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Prevalence and Factors Associated with Goiter Among Women of Reproductive Age Group in Adiyo Woreda, Kaffa Zone, South-West Ethiopia

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Abstract: *Background*: Goiter (enlargement of the thyroid gland) is the term used to describe the negative outcome of iodine deficiency. Iodine deficiency is a public health problem and the most preventable cause of brain damage and mental retardation in the world, and also a public health problem in Ethiopia. *Objective:* The objective of this study was to assess the prevalence and factors associated with goiter among women of reproductive age group in Adiyo Woreda, Kaffa Zone, Southwest Ethiopia. *Methods:* A community-based cross-sectional study was conducted from August 21/2019 to September 21/2019 in Adiyo Woreda Kaffa Zone South West Ethiopia. A multistage sampling technique was employed. A total of 675 women of the reproductive age group were included in the study. Data was collected by a pre-tested questionnaire and checklist for clinical findings. Study participants were clinically examined for goiter by palpation methods using criteria set by World Health Organization. Data were entered into Epi info Verssion7 and then exported to SPSS version 21 for analysis. Descriptive statistics analysis was employed. Variables that had a p-value of less than 0.25 during bivariate analysis were entered in the multivariate logistic regressions. Finally, a p-value less than 0.05 and an odds ratio with 95% confidence intervals were used to decide statistically significant variables. *Result*: -Prevalence of goiter was found to be 61 (23.9%) where 25 (18.5%) were palpable and 36 (5.3%) were visible. Family history of goiter (AOR= 2.24, 95%CI= (1.27-3.96)), cabbage consumption (AOR=2.39, 95%CI= (1.11-5.11)), using salt for < 2months once purchased (AOR=0.52, 95%CI= (0.34-0.79)), Adding time of salt into food (AOR=0.61, 95%CI (0.39-0.95)), Poor knowledge about iodized salt and IDD (AOR=2.8, 95%CI= (1.58-4.89)) showed statistical difference at p-value less than 5%. *Conclusions:* Goiter prevalence was found to be moderate (23.9%) among women of the reproductive age group in the study settings. The health programmers and implementers have to address improving knowledge of Iodized salt proper utilization and, IDD to goiter. Thus ensuring the consumption of iodized salt and promoting iodine-rich food items among the community in the study setting is recommended. Wide-scope exploration is suggested.

Keywords: Prevalence, Goiter, Reproductive Age, Women, Ethiopia

1. Introduction

Goiter is a condition defined when each of the lateral lobes of the thyroid gland is larger than the terminal phalanges of the thumb of the person examined and it's used as an indicator of chronic iodine deficiency [1-3]. There are different environmental and person-specific features that are

well-thought-out for the etiology of goiter. However, iodine deficiency is incriminated to be a cause for 90% of goiter and it happens in areas anywhere food is produced on soils short in iodine content [3-6].

Iodine is a trace element found in the soil and it is a vital component of the thyroid hormones. It is involved in regulating the body's metabolic processes related to normal metabolism, growth, and development of the brain [4, 5, 7]. In most cases 90% of the total iodine dietary intake is provided from the food, the rest returning from water [3, 6]. Iodine is one of the basic micronutrients not manufactured by our bodies. Moreover, it cannot be stowed inside the body for a long amount of time. Therefore a daily intake of iodine is significant to improve the risk of iodine deficiency goiter [1, 3, 5]. The daily recommended amount of dietary iodine for healthy adults and adolescents beyond twelve years of age is 50µg/d while the requirement is increased to 200µg/d, for pregnant and breastfeeding women. The requirement is 20µg/d for children 6-12 years of age, and 90µg/d for children 0-59 months of age [2, 4, 8].

Globally more than 2 billion people are estimated to be at risk of Iodine Deficiency Disorders (IDD) and the overall prevalence of goiter in a general population is estimated to be 5.8%. The risk is 4.7% in America but as high as 28.3 in Africa [2, 4]. The iodine nutrition status of women in the reproductive age group including pregnant women in African countries including Ethiopia, Kenya, South Africa, and Nigeria ranges from four to 22%. This shows in those countries endemic goiter burden is higher [9]. For example in Ethiopia, 52% of women could not identify any cause of goiter [10]. Deficient iodine intake in women before during pregnancy might end up into congenital irreversible brain damages, abortion, stillbirth, cretinism, mental retardation, infant death and reduces school performance in children, and goiter [1, 2, 9].

Fortification and diversification of foods with iodine is an effective means of long-term prevention and control of strategies for goiters [8, 1]. Iodized salt is the most effective, affordable cost, sustainable solution to iodine deficiency disorder [12, 3]. Endemic goiter is measured through indicators including Urinary Iodine Concentration (UIC), total goiter prevalence (TGP), and through the rates of coverage of adequately iodized salt (>15ppm) in households [14].

Iodine deficiency disorder is the major nutritional and intergenerational public health problem all over the world affecting millions of people. Moreover, the prevalence is very high in less developed countries [2, 5]. It is one of the public health problems of pregnant women and young women in any part of the world hindering learning capacity and productivity [16]. An endemic goiter results from increased thyroid stimulation by Thyroid-Stimulating Hormone (TSH) to maximize the utilization of available iodine and thus represent maladaptation to iodine deficiency [2, 7]. However, the most damaging disorder induced by iodine deficiency is irreversible mental retardation, cretinism, stillbirth, abortion, increases perinatal mortality, retarded physical development, increases morbidity and mortality of infants and neonates. If iodine deficiency occurs during the most critical period of brain development (from the fetal stage up to the third month after birth) [2, 8], the resulting thyroid flier will lead to irreversible alteration in brain function [19].

Globally 2.2 billion people are at risk of iodine deficiency disorder. From these people 30 to 70% have goiter and -10% have cretinism [20]. Ethiopia is implementing a universal salt iodization program to eliminate iodine deficiency disorders however it is ranked six among the global high IDD burden countries, 59% of women are iodine deficient, goiter prevalence reaches up to 35%, moreover the prevalence is as high as 71% in the southern part of the country, this demonstrates that more than 6 million women were affected by goiter [2, 9, 21]. The lowest coverage of adequately iodized salt was observed in the South region which was 3.7%. Recently a 43%, goiter prevalence was reported from Demba Goffa Woreda southern Ethiopia, this indicates that different socio-economic, cultural, and environmental characteristics are risk factors for goiter within the region [20, 22].

Several predictors are incriminated to the prevalence of goiter in most parts of Ethiopia. Some of the reasons influencing goiter occurrence are, poor utilization of iodized salt, different sociodemographic factors, knowledge, and practice towards utilization of iodized salt, eroded soil lacking iodine, lack of food rich in iodine, type of water used, family history of goiter, feeding cassava and/or cabbage are among the factors linked to goiter [22-27].

The majority of women of the reproductive age group lack knowledge about iodine deficiency disorders which is taken as one of the risk factors for goiter prevalence among women of reproductive age group [20, 23, 28]. It is a significant public health problem though has been neglected by health service providers and decision-makers [7]. Studies were conducted in different parts of Ethiopia. But there is still limited information about the prevalence of goiter and its associated factors among women of the reproductive age group in this very remote study area, therefore this study aimed to assess the prevalence of goiter and associated factors among women of the reproductive age group in Adiyo Woreda, Kaffa Zone, South West Ethiopia, 2019.

2. Methods and Materials

Study Area: Adiyo Woreda is one of the 3 woredas in the Kaffa Zone in SNNPR with an altitude of 450-2900 meters above sea level. The woreda is located at a distance of 512 Km Southwest of Addis Ababa and 64 Km from the zonal capital town Bonga. The woreda has 28 kebeles. The capital town of Adiyo Woreda is Kaka. Adiyo Woreda has three agro-climatic zones: highland altitude (Dega) (71.5%), mid-altitude (Woinadega) (3.5%), and lowland altitude (kola) (25%). Very steep hills and mountains characterize the topography of the area which is suitable for erosion and flooding. The population estimation of Adiyo Woreda is

46210 of which 74567 (50.99) is female. The reproductive age group women population is 34067. The mean annual rainfall of the woreda is 800 mm with low variability. The rainfall is bimodal in which the short rains are from February to March and the long rainy season lasts from June to September. The people predominantly earn their living by farming land along with cattle raising. The woreda is bordered by konta special woreda in the North, Gimbo Woreda in the South, Jima zone's Dedo Woreda in the East, and Kaffa Zone's Telo Woreda in the West. Commonly cultivated and produced food are cereals including barley, wheat, Maize, and Teff. There are also vegetables like enset [Kocho], Godere, Cabbage. Even though other crops are produced in the area Cabbage with Kocho (enset) is the most important staple food of the community [5].

Study Design: A community-based cross-sectional study was conducted in Adiyo Woreda Kaffa Zone South West Ethiopia from August 21 to September 21, 2019.

Population: All women of childbearing age (15-49 years) in Adiyo Woreda were the source population while all women of childbearing age (15-49 years) who were living in the selected Kebels were the study population. Households having reproductive age group women were taken as the sampling unit and individual Woman of the reproductive age group who was living in the selected household and was selected to be interviewed was a study unit. All women in the reproductive age group who lived at least six months in the study area before the data collection time were included in the study. Women in the reproductive age group who were severely ill during the study period were excluded from the study. Women of the reproductive age group who were absent from their household during the second visit of data collection were recorded as none response.

Sample Size Determination: The sample size was calculated using a single population proportion formula by taking a previous study conducted on the prevalence of goiter in the reproductive age group which was 28% (p) [24] and by considering 95% confidence level and 5% precision (d). Accordingly $n= [(Z\ \alpha\ /2)^2\ P\ (1-P)]/d^2$, where $Z\ \alpha/2 = .96$, d= 0.05, p=0.28, design effect= 2. The result was 614 women. After adding a 0% non-response rate, the total sample size was 675 women.

Sampling procedure: A multistage sampling technique was employed. Adiyo Woreda was purposively selected among 3 woredas of Kaffa Zone because of its landscape, agro-ecology, and erosion status as well as a cost consideration. Twenty-eight (28) smallest administrative units (kebeles) found in the woreda were registered first and classified based on their residence and agro-ecological settings as urban (1 Keble), rural (27 kebeles), highland (20 kebeles), lowland (07 kebeles), and midland (01 Keble) respectively. A total of nine kebeles (30%) were included in the study. First, from highlands six namely Chareguta, Boka, Gindacha, Kochiyo, Medwuta, Chega, secondly from lowland two namely Angiyo kola and Yecha, and from midland one kebele namely Kaka were randomly selected to be part of the study. Following this, the sample was proportionally allocated to each selected kebele according to the number of women in the reproductive age group. Then systematic sampling technique was employed to reach individual HouseHolds (HHs) using kebele registration book list as a frame. The scheme to locate HHs after the initial HH was indicated using the ratio of the total HHs in the kebeles to the sample size (N/n=16). The first HH in each kebele was identified from the central place which was Keble administrative office. The rest were every 6^{th} HH until the total sample size was achieved. Eligible participants were selected by lottery method from the selected HH if there is more than one eligible group. In case there was no eligible identified in the selected HH, the data collectors go to the next HH until they got an eligible woman. The absentee was labeled with no response after a third visit.

Variables of the study: Dependent variable was identified as "goiter" while the independent variables include Socio-Demographic characteristics (age, religion, income, family size, educational status of females and their husband and occupation of women's and their husband, ethnicity, marital status), Utilization of inadequately iodized salt, Exposure to goitrogenic food, Family history of goiters, Soil erosion, How long the salt used once purchased, Salt sun expose, Place of salt kept, Type of salt used, Adding time of salt into food, Type of water used, Pregnancy status, Breastfeeding status, Knowledge and practice towards iodized salt and IDD.

Operational definitions: Goiter -Thyroid gland which has lateral lobes with a volume greater than the terminal phalanges. Good Knowledge towards iodized salt and IDD:-Answers 60% and above of knowledge questions about iodized salt and IDD. Good practice towards iodized salt and IDD:-Answers 60% and above of practice questions about iodized salt and IDD. Poor knowledge towards iodized salt and IDD:-Answer less than 60 % of knowledge questions. Poor Practice towards iodized salt and IDD:- Answer less than 60 % of Practice questions. Grade 0 goiter:- No palpable or visible enlargement in the neck indicating the absence of goiter during physical examination.

Grade goiter:- Palpable but not visible enlargement in the neck when the neck is in the normal position during physical examination. Grade 2 goiters:-A swelling in the neck that is visible when the neck is in a normal position and is consistent with an enlarged thyroid when the neck is palpated. Total Goiter Prevalence (TGP):- Sum of goiter grades and 2 [1, 2].

Data Collection Tools: Data were collected by the pretested structured questioner. The questioner was adapted from previously performed research in Ethiopia [24] and some items included in the questionnaire were taken from the Ethiopian Health and Demographic Survey (EDHS) and were adapted to suit the study context [5]. It was prepared in English Language version and translated to Amharic and Kaffinono local languages and then re-translated back to English to maintain conceptual consistency. The consistency in the context of translation was checked and maintained by both the principal investigator and two experienced Language experts before use. Questionnaires were grouped

and arranged according to the objective of the study. The socio-demographic characteristic of the respondent quarries to assess contributing factors to goiter, quarries to assess knowledge and practice of respondents towards utilization of iodized salt and IDD prevention methods.

Three BSc health officers (first-degree graduate clinicians) and three non-health professional government workers who had a diploma and speak the local language were recruited. The health officers were trained for a day on the objective of the study and on how they do a physical examination on assessing thyroid size or goiter by a medical doctor. The clinicians examined all the respondents for any enlargement of the thyroid (goiter) following the interview. To minimize inter-individual variability during inspection and palpation of the goiter the grading was conducted by using the WHO/UNICEF/ICCIDD classification scheme. Accordingly, Grade 0: no goiter (neither visible nor palpable), Grade1: (thyroid palpable but not visible), Grade 2: (thyroid visible with a neck in normal position), Total Goiter Rate (TGR) is the sum of goiter grade and grade 2 [1, 2].

The recruited non-health professionals were trained on the aim of the study, on tools and procedures of data collection, how to interview the respondents by the principal investigator for one day to minimize inter-individual variation during information collection, and then they interviewed the study participants. A pretest was carried out on 34 (5%) of the sample on Gimbo Woreda. The input from the pretest was incorporated into the study tool for the final version. Two supervisors, senior health officers, and the investigator have supervised the data collection processes.

Data quality assurance: Quality assurance procedures were implemented in all stages of the study starting from questionnaire designing, training, data collection, and data entry. The questionnaire was objective-based, logically sequenced, and pre-tested. The data collector and supervisor were trained on the objective of the study and on areas like goiter examination to reduce inter-individual unpredictability, the standardization step (procedure) continued until inter-observer variation was insignificant. The collected data were checked by the principal investigator on daily basis for any incompleteness and possible corrections were conducted. Data entry was led by the principal investigator to minimize errors during data entry.

Data processing and analysis: Data were checked, cleaned, and entered into Epi info version7 statistical computer software, then exported into Statistical Package for Social Science (SPSS) version 21 for analysis. Descriptive statistics, frequency tables, mean, standard deviation and percentage were used to describe the study population with relevant variables. To identify factors in multivariate analysis only variables that showed p-value<0.25 on the bivariate analysis were entered into the multivariate logistic regression models to control the possible effect of a confounder. Odds Ratios (OR) and their 95% confidence intervals were computed to assess the strength of association and variables with a p-value less than 0.05 in multivariate analysis were considered as statistically significant.

Ethical Consideration: Ethical approval of the research was obtained from the Institutional Review Board of Health Science College, Arsi University (project proposal No. A/CHS/RC/18/2019, on 20/12/2011). Before data collection, we also obtained permission from the Kaffa Zone health department and Adiyo Woreda health office. Written consent to participation was taken from each participant. The consent for that age group of fewer than 8 years was taken from adult relatives/spouses. During data collection, the objective of the study was explained to the study participants. Privacy and confidentiality of information were maintained by excluding personal identifiers and interviewing privately. Measures were taken to ensure the respect, dignity, and freedom of each individual participating in the study.

3. Results

Socio-demographic characteristics of the study participants

A total of 675 respondents were expected to participate in the study all of 675 study participants were interviewed making a response rate of 00%. The mean age of study participants was (31.03+6.4) years and about 377 (55.85%) of the study participants' age were between 25-34 years. Five hundred thirty-one (78.67%) of the respondents were Kaffa by ethnicity, 513 (76%) were orthodox by religion, 276 (40.89%) respondents were without formal education and 634 (94.07%) were married. Out of 634 married study participants, 221 (34.8%) and 512 (80.6%) of their husbands were without formal education and farmers respectively. The 577 (85.5%) women were housewives [Table1].

Table 1. *Sociodemographic characteristics of study participants among women of the reproductive age group of Adiyo Woreda Kaffa Zone South West Ethiopia, 2019. (n=675).*

Variable		Frequency	Percent
Age in years			
	15-24Years	109	16.15
	25-34years	377	55.85
	>35years	189	28.00
	Mean (+SD)	675	31.03 (6.4)
Ethnicity			
	Kaffa	531	78.67
	Konta	62	9.19
	Amhara	51	7.56
	Oromo	24	3.55
	Gurage	7	1.03
Religion			
	Protestant	128	18.96
	Orthodox	513	76.00
	Muslim	34	5.04
Marital Status			
	Single	30	4.40
	Married	635	94.07
	Divorced	10	1.50
Educational status of Husband			
	Without formal education	276	40.89
	Read and write	89	13.19
	Elementary school	171	25.33
	High school	88	13.03
	Collage/University	51	7.56
Occupation of respondents			

Variable		Frequency	Percent
	Housewife	577	85.5
	Government Employee	54	7.9
	Self-Employee	41	6.1
	Student	4	0.6
Educational status of the respondent			
	Cannot read and write	261	38.67
	Read and Write	103	15.26
	Elementary school	74	10.96
	High school	178	26.37
	Collage/University	59	8.74
Occupational status of husband			
	Farmer	512	80.6
	Government Employee	44	6.4
	Merchant	72	10.7
	Self-Employee	7	1.1
Family size			
	<=5	234	34.67
	>5	441	65.33
Average monthly family income (birr)			
	<500	316	46.81
	500-999	197	29.19
	>999	162	24.00

3.1. Dietary Characteristics of the Study Participants

Regarding fish/milk/meat consumption, only 34 (19.85%) of the participants eat fish/milk meat weakly bases, from those 23 (91.8%) eat <3 times per week. Almost all of the respondents 672 (99.56%) did not consume cassava but 605 (89.62%) consume cabbage 15 (19.01%) consume cabbage >3times per week. Six hundred two (89.19%) of the respondents have no familiar history of goiter. Among respondents, 45 (21.48%) have a history of drinking alcohol. During the time of survey 670 (99.26%) of the study, respondents were used coarse/ none packed salt and 5 (0.74%) of study respondents were used packed iodized salt [Table 2].

Table 2. *Dietary characteristics of the study participants among women of the reproductive age group of Adiyo Woreda Kaffa Zone South West Ethiopia, 2019. (n=675).*

Variables	Category	Frequency	Percent
Eating fish meat/milk			
	Yes	134	19.85
	No	541	80.15
Eating fish meat/milk frequency (n=134)			
	<3 times / weeks	123	91.80
	>3 times/ weeks	11	8.20
Eating cassava			
	Yes	3	0.44
	No	672	99.56
Eating cabbage			
	Yes	605	89.62
	No	70	10.38
Cabbage consumption frequency (n=605)			
	<3times / weeks	490	80.99
	>3times / weeks	115	19.01
Family history of goiter			
	Yes	73	10.81
	No	602	89.19
History of Drinking alcohol			
	Yes	145	21.48
	No	530	78.52
Type of salt used			
	Packed salt	5	0.74
	Coarse/not Packed salt	670	99.26

3.2. Maternal and Environmental Characteristics of the Study Participants

Six hundred seventy-three (99.7%) of the study participants do not have a history of cigarette smoking. Regarding the type of water used, 472 (69.92%) were used for protected springs and pipes and 203 (30.08%) were from the river for their daily activity. Around three fourth of the respondents, 476 (70.52%) were living in an area affected by erosion, and the majority of the respondents 615 (91.11%) were living in high land areas. Only 76 (11.26%), 2 (1.78%) respondents were pregnant, and children who have breastfed respectively [Table 3].

Table 3. *Maternal and environmental characteristics of study Participants among women of the reproductive age group of Adiyo Woreda Kaffa Zone South West Ethiopia, 2019. (n=675).*

Variables	Frequency	Percent
History of cigarette smoking		
Yes	2	0.30
No	673	99.70
Type of water used		
Protected Spring/pipe water	472	69.92
River	203	30.08
Soil erosion status of living area		
Yes	476	70.52
No	199	29.48
The altitude of the living area		
High Land	615	91.11
Mid land	60	8.89
Pregnancy status of respondents		
Yes	76	11.26
No	599	88.74
Breast Feeding condition of the respondents		
Yes	11	1.63
No	664	98.37

3.3. Physical Examination of Participants to Detect Goiter and Grading

The total prevalence was 61/675 (23.09). Among the women who had palpable 25/161 (77.64%), and 36/161 (22.36%) had a visible goiter. The goiter proportions were 20/161 (12.42%) and 41/514 (27.43%) among pregnant and non-pregnant respectively [Table 4].

Table 4. *Goiter and its grade on physical examination among participants of the study, Adiyo, Ethiopia. 2019 (N=675).*

Variable	Category	Frequency	%
Goiter			
	Yes	161	23.9
	No	514	76.1
Grade of goiter on examination (n=161)			
	Visible	36	22.36
	Palpable	125	77.64
Goiter among Pregnant (n=76)*			
	Yes	20	26.32
	No	56	73.68

* Chi-square tests of goiter among pregnant mothers -sided p was 0.22.

3.4. The Practice of the Study Participants Towards Iodized Salt

Of the total participants, 525 (77.78%) and 516 (76.44%) of the participant had information about iodized salt and goiter respectively. Two hundred twenty-six (43.05%) of the study participants their sours of information about iodized salt were health professionals and 446 (66.07%) of respondents couldn't know about the problem of keeping salt in moist areas. Only 50 (22.22%) and 86 (27.56%) of the respondents know about iodine as causes and prevention methods of goiter respectively. During the time of the survey, 429 (63.56%) of women keep the salt in the near-fire and moist area and 246 (36.44%) in a dry area. Only 66 (9.8%) of the respondents expose salt to the sun when the salt becomes humid, 340 (50.37%) of the respondents put the salt in a container having a cover. Among 675 study participants, 338 (50.07%) added salt at the end when cooking their food. Among those who used coarse/non-packed salt half 348 (51.56%) of the respondents have used the salt for < 2 months once purchased [Table 5].

Table 5. *Knowledge, Practice about iodized salt, and IDD of study Participants among women of the reproductive age group of Adiyo Woreda Kaffa Zone South West Ethiopia, 2019. (n=675).*

Variable	Category	Frequency	Percent
Information about goiter			
	Yes	516	76.44
	No	159	23.56
Source of information about iodized salt (n=525)			
	Health professionals	226	43.05
	Radio	299	56.95
Is goiter preventable			
	Yes	238	35.26
	No	437	64.74
Causes of goiter			
	Evil	43	6.37
	Nutrition problems	308	45.63
	Drinking contaminated water	174	25.78
	Not consuming iodized salt	150	22.22
Information about iodized salt			
	Yes	525	77.78
	No	150	22.22
Type of container used to keep salt			
	Covered	340	50.37
	Open	335	49.63
Place of kept iodized salt			
	Dray Area	246	36.44
	Moist area and near fir	429	63.56
The problem of keeping salt in a moist area			
	No change and increases	446	66.07
	Decrease	229	33.93
The problem of keeping salt in an open container			
	No change and increases	457	67.70
	Decrease	218	32.30
Whether the respondent expose salt to the sun			
	Yes	66	9.78
	No	609	90.22
The problem of exposing salt to the sun (n=66)			
	No change and increases	61	92.42
	Decrease	5	7.58
How long the salt used once purchased			
	<2month	348	51.56
	>2month	327	48.44
Time of adding salt during cooking food			
	At the end	338	50.07
	While cooking	337	49.93
Did you know iodized salt prevents goiter			
	Yes	186	27.56
	No	489	72.44
Knowledge about iodized salt and IDD			
	Poor	454	67.26
	Good	221	32.74

3.5. Bivariate and Multivariate Logistic Regression Analysis

Participants who consume cabbage were 2.2 times more likely to have goiter as compared to those who did not consume cabbage (AOR=2.39, 95%CI (1.11-5.12)). Family history of goiter also found a significant association with goiter, respondents who had family history goiter were 3.4 times more likely to had goiter as compared with those who did not have a family history of goiter (AOR=2.24, 95% CI (1.27-3.96)). Participants who did not know about iodized salt and IDD were 2.8 (AOR=2.8, 95%CI (1.58-4.89)) times more likely to have goiter than their counterparts. Those who added iodized salt at the end were 0.6 less likely to have goiter compared to those who do it in the middle (AOR=0.6, 95%CI (0.39, 0.95%)) [Table 6].

Table 6. *Bivariate and multivariate logistic regression analysis of Goiter and determinants among women of the reproductive age group in Adiyo Woreda Kaffa Zone South West Ethiopia, 2019.*

Variable (N=675)	Goiter status		COR (95%CI)	AOR(95%CI)	P
	Yes (%)	No (%)			
Educational status of husband (n=635)					
Not able to read and write	63 (41.45)	158 (32.71)	2.96 (1.28-6.87)*	2.25 (0.91,5.55)	0.08
Able to write and read	28 (18.42)	75 (15.53)	2.77 (1.13-6.83)*	2.26 (0.86,5.95)	0.1
Elementary (1-8)	14 (9.21)	60 (12.42)	1.73 (0.65- 4.62)	1.83 (0.65,5.17)	0.26
Secondary (9-12)	40 (26.32)	138 (28.57)	2.15 (0.91- 5.11)	2.28 (0.92,5.69)	0.08
Collage/university	7 (4.6)	52 (10.77)	1.00	1.00	
Cabbage Consumption					
Yes	151 (93.79)	454 (88.33)	1.99 (1.00-3.99)*	2.39 (1.11-5.12)**	0.001
No	10 (6.21)	60 (11.67)	1.00	1.00	
Family history of goiter					
Yes	32 (19.88)	41 (7.98)	2.86 (1.2-3.56)*	2.24 (1.27-3.96)**	0.001
No	129 (80.12)	473 (92.02)	1.00	1.00	
Where do you keep salt?					
Dry area	41 (25.47)	205 (39.88)	0.52 (0.35-0.77)*	0.68 (68,0.43,1.09)	0.11
Moist area and near fir	120 (74.53)	309 (60.12)	1.00	1.00	
The problem of keeping salt in a moist area					
Increases	124 (77.02)	322 (62.65)	0.5 (0.33-0.73)*	73 (0.39,1.36)	0.33
Decreases	37 (22.98)	192 (37.35)	1.00	1.00	
How the salt container kept					
Covered	60 (37.27)	280 (54.47)	1.00	0.97 (0.61,1.54)	0.88
Open	101 (62.73)	234 (45.53)	2.01 (1.4,2.90)*	1.00	
The problem of keeping salt in an open container					
Increases	123 (76.4)	334 (64.98)	1.74 (1.16,2.62)*	0.73 (0.38,1.39)	0.34
Decreases	38 (23.6)	180 (35.02)	1.00	1.00	
Do you expose salt to the sun					
Yes	28 (17.39)	38 (7.39)	2.64 (1.56-4.46)*	1.66 (0.87,3.16)	0.12
No	133 (82.61)	476 (92.61)	1.00	1.00	
Salt wash before use					
Yes	38 (23.6)	85 (16.54)	1.56 (1.01,4.24)*	1.26 (0.74,2.12)	0.39
No	123 (76.4)	429 (83.46)	1.00	1.00	
How long the salt used once purchased					
<2month	53 (32.9)	295 (57.39)	0.36 (0.25,0.53)*	0.5 (0.34,0.79)**	
>2month	108 (67.08)	219 (42.61)	1.00	1.00	0.002
Adding time of salt to food during cooking					
At the end	52 (32.3)	286 (55.64)	0.38 (0.26,0.55)*	0.6 (0.39,0.95)**	0.03
While cooking	109 (67.7)	228 (44.36)	1.00	1.00	
Knowledge about iodized salt and IDD					
Poor	140 (86.96)	314 (61.09)	4.25 (2.60,6.94)*	2.8 (1.58,4.89)**	0.001
Good	21 (13.04)	200 (38.91)	1.00	1.00	

*= Significant at P-Value of 0.25, **=Significant at P-value of 0.05

4. Discussion

The overall prevalence of goiter in this study was 61/675 (23.9%). From those which have a goiter (125/161 (18.5%) were palpable and 36/161 (5.4%) were visible) which revealed that goiter is a moderate public health problem in the study area according to the recommendation of the WHO [2] and the prevalence was higher among women's of 25-34 years of age. Family history of goiter, a time of adding salt to food, cabbage consumption, knowing goiter preventability, how long the salt used once purchased, knowledge about iodized salt and IDD, and knowing iodized salt prevents goiter were significantly associated factors with goiter. According to our finding Only 5 (0.74%) of study participants used packed iodized salt, this may be one of the

reasons for the high prevalence of goiter in the study area.

The total goiter prevalence was 23.9% (18.5% palpable and 5.4% visible) and it was in line with, a study conducted among pregnant women in Adda Woreda in the Oromia region, 20.2 % (grade 2), and in India, 4.2% [14, 29]. But the TGP in our study was higher than a study done nationally in Ethiopia which was 0.8% [24], a study conducted on rural women of the Sidama TGP of 5.9% where .5% visible and 4.4% palpable [30]. The current rise of prevalence might be due to dietary characteristics and knowledge and practice about iodized salt in the community. The difference might be due to the difference in sampling. The sampling of the study in the Sidama zone excluded pregnant women. The effect of pregnancy on the thyroid gland can contribute to the difference. The second assumption is the current study is done in more remote areas concerning the different distances from Hawasa the capital city of the region. The remoteness is considered to be one of the reasons as the number of access and quality of information and services decrease.

The prevalence of goiter identified by the current study was lower than a study conducted at the national level, 35.8% [28]. There are other local studies with higher findings including in Gojam 30.1 % [31], Northwest Ethiopia 37.6% [32], Arsi zone Chole Woreda 36.6% [33], and South Region, Demba Goffa Woreda 43% [22]. The difference might be due to the difference in the geographic area, food produce, and culture in feeding.

Comparing the prevalence of goiter among the age groups of the participants a higher magnitude (13.6%) was found in the 25-34 age group, it was in line with a study conducted in Northwest Ethiopia [32], and Demba Goffa Woreda revalued that prevalence of goiter is higher within the age group of 24-34 [22], however, the study done in Pakistan shows the highest prevalence was found in younger age group and as age increases the prevalence of goiter decreases [34]. The difference to Pakistan's could be from the study design used and the effect of population sociodemographic and socio-cultural differences. The similarity between our result and that of Damba Goffa Woreda could be from the fact that physical proximity of the area, sociocultural similarity, and the study sample (women of reproductive age in both studies) were the reasons.

Among proximate factors, shorter (< months) storage time of salt at household once purchased (AOR=0.5, 95%CI (0.34, 0.79)) decrease prevent goiter by 50%. This is the fact that when the salt is stored for a longer time; as iodine is an easily volatile element, the iodine found in the salt is easily lot, and finally, the salt becomes inadequately iodized and as a result, this may result in iodine deficiency goiter [35]. The current finding is similar to the report of a study conducted at Maychew Woreda in Ethiopia which shows when the period of stay of salt at household once purchased increases the adequacy of iodine in the salt decreases [35]. Our result was also in agreement with a study conducted in the south region Demba Goffa Woreda Gamo Goffa Zone which indicates that keeping salt for a long time (>2months) is significantly associated with goiter [22]. Another study which was done in Canada also strengthens this idea, the salt loses 28-51%, 35-52% of its iodine content after three months, and six months respectively [36].

Another important proximate factor identified as predicting factors of goiter was Cabbage consumption ((AOR=2.39, 95%CI (1.11, 5.11)). Women who consume cabbage were more likely to have goiter as compared to their counterparts who didn't consume cabbage. This finding is in line with, Study conducted in Chole Woreda Arsi Zone Oromia Region [33], a study conducted in kutaber Woreda south Wollo Zone [2], similarly study conducted in Harramaya Woreda showed that women who eat cabbage three times /month are prone to goiter [37]. Also, it is in line with a recent study done in Demba Goffa Woreda Gamo Goffa Zone that shows cabbage consumption is a risk factor for goiter [22]. Moreover, this finding is in agreement with a study conducted in Jima Zone Shebe senbo Woreda southwest Ethiopia [38]. This is maybe due to cabbage one of the goitrogenic food which contains thiocyanate and is thiocyanate that restrains iodine transport into the body [33].

A family history of goiter was found (AOR=2.24, 95%CI (1.27, 3.96)) significantly associated with goiter. Respondents who had a family history of goiter were more than double more likely to hah goiter than those who had no family history of goiter. This may be due to respondents having a family history of goiter and their families were living together and having a similar dietary habit, another reason may be due to iodine deficiency is an inter-generational, which means the deficiency pass through generation [33]. This finding was consistent with a Study conducted in Adda Woreda in Oromia Region [3] and Demba Goffa Woreda Gamo zone south region [22].

Knowledge about iodized salt and IDD (AOR=2.8, 95%CI= (1.58, 4.89)) were significantly associated with goiter. This finding is in line with a study conducted in a rural area in India which shows knowledge of women significantly associated with goiter [15], also National study conducted in Ethiopia revealed that more than 90% of childbearing age women didn't know the causes of iodine deficiency disorders and the importance of iodized salt [28], study conducted in south region Dembe Goffa Woreda Gamo Goffa Zone also shows knowledge about iodized salt and iodine deficiency disorder was poor and significantly associated with goiter [22]. Similarly, a study done in Gondar shows knowledge about iodized salt was significantly associated with the availability of iodized salt at the household level and goiter [39]. Moreover, a study conducted in southwest Ethiopia indicated that the knowledge of parents about prevention methods of iodine deficiency disorders was significantly associated with goiter [26].

The time of adding salt into food during cooking (AOR=0.61, 95%CI (0.39, 0.95)) was found significantly associated with goiter. It revealed adding at the end prevents 61% goiter than adding the iodized salt earlier during cooking food. This finding is in line with a study conducted in SNNPR Leku town that shows that time of adding salt to food during cooking was significantly associated with goiter [40]. It is also in line with a study conducted in the kutaber Woreda south Wollo Zone [41].

Data were collected by a senior health officer who has

experience in clinical examination of goiter at the health center level and the response rate of participants was a hundred percent. We like giving questions about limitations also. The limitation of this study was the use of TGP alone without including the other two indicators (UIC and rate of coverage of iodized salt at HH) to measure the level of endemic goiter. TGP as an indicator likewise might be weaker than the determination of the goiter status of the respondents using ultrasound due to inter-observer variation which our study lacks. In addition, the design (cross-sectional) cannot measure the cause and effect relationship. Hence users of this study need to be cautious about the results.

5. Conclusion and Recommendation

Goiter prevalence was found to be 23.9% among women of the reproductive age group in the study settings. Presence of family history of goiter, cabbage consumption, using iodized salt for a long period (>2month) once purchased, knowing about the relation of iodized salt and IDD, time of adding iodized salt to food during cooking were significantly related to the presence of goiter.

We recommend more emphasis on prevention and control of iodine deficiency disorders like sustainable universal salt iodization programs shall be strengthened. Improving knowledge and practice about iodized salt and IDD. The authors recommended conducting a further study using wider scope and biomarkers to enhance a better understanding of predictors and appropriate response of goiter and other iodine deficiency disorders in the study area.

Abbreviations

AOR: Adjusted Odds Ratio;
CI: Confidence Interval;
COR: Crude Odds Ratio;
EDHS: Ethiopian Demographic Health Survey;
EPHI: Ethiopian Public Health Institute;
HH: House Hold;
HEW: Health Extension Worker;
ICCIDD: International Council for the Control of Iodine Deficiency Disorder;
ID: Iodine Deficiency;
IDD: Iodine Deficiency Disorder;
IUCD: Intra-Uterine Contraceptive Device;
IS: Iodized Salt;
PPM: Parts Per Million;
SNNPRS: South Nation Nationalities People Regional State;
TGR/P: Total Goiter Rate/Prevalence;
TSH: Thyroid Stimulation Hormone;
UIC: Urinary Iodine Concentration;
UNICEF: United Nation International Children's Emergency Fund;
USI: Universal salt Iodization;
VAD: Vitamin A Deficiency;
VAS: Vitamin A Supplementation;
WHO: World Health Organization

Declarations

Data

Data is available and can be accessed from the correspondent at reasonable request.

Conflict of Interest

Authors declare there is no conflict of interest.

Consent to Publish

Not applicable.

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Authors' Contribution

GHT made the conception. GHT, LTW, IKS and BLT involved in designing the study, data acquisition, availing resources, data management. LTW wrote the manuscript. All the authors read and approved the manuscript.

References

[1] Allen L, Benoist B, Dary O, Hurrell R. Guidelines on food fortification with micronutrients. 2014; (1): 376.

[2] Benoist B, Anderson M, Egli I, Takkouche B, Allen H. Iodine status Worldwide. WHO Global IDD database on iodine Deficiency, WHO Geneva. 2004.

[3] Rasmussen LB, Christiansen E. Urinary iodine concentrations for determining iodine status in populations. Vitamin and Mineral Nutrition Information System Geneva: 2013: 5.

[4] Yibrie A, Yifru S, Tigabu D, Tefera Y, Teklu T, et al. Iodine Deficiency Disorders. Ethiopian Public health Institute. 2007; 58.

[5] Agency ECS. Ethiopian Demographic Health Survey Report. Central Statistics Agency. 2016: 32-551.

[6] Thilly D. The Control of endemic goiter Books. World Health Organization. 979; 92 (4): 89.

[7] Emiru S, Urga K, Kebede A. Iodine Deficiency in School-aged Children7-17 years and associated Factors in Akaki-Kaliti sub-city of Addis Abeba, Ethiopia. Center for food science and Nutrition. 2016; 95.

[8] EMOH. Nutrition Intervention in Ethiopia. Maternal Health and Nutrition. 2017; 4 (161): 28.

[9] Harika R, Faber M, Samuel F, Kimiywe J, Mulugeta A, Eilander A. Micronutrient Status and Dietary Intake of Iron, Vitamin A, Iodine, Folate and Zinc women of Reproductive Age and pregnant women in Ethiopia, Kenya, Nigeria, and South Africa: A Systematic Review of Data from 2005 to 2015. MDPI. 2017; 9 (1096): 23.

[10] Hailu A. Remarkable progress against iodine deficiency in Ethiopia. IDD Newsletter. 2017: 2.

[11] Haidar J. Common micronutrient deficiencies among food aid beneficiaries: Evidence from refugees in Ethiopia. Ethiopian Journal of Health Dev, 2015. 25 (3): 223-239.

[12] Chilima B, Chirwa I, Phiri F, Kuweluza HC, Gondwe J, Kanyuka M, et al. Malawi Micronutrient Surve Report. National Statistical Office Zomba, Malawi. 2017: 2-123.

[13] Ahmed J, Seyuom E, Mengistu G, Bogale T, Tamene W, Kassa D, et al. Ethiopian Demographic and health survey. Central Statistical Agency. 2011; 3 (1): 452.

[14] Fereja M, Gebremedhin S, Gebreegziabher T, Girma M, Stoecker BJ. Prevalence of Iodine Deficiency and Associated Factors among Pregnant Women in Adda Woreda, Oromia Region, Ethiopia, Cross-Sectional Study. BMC Pregnancy and childbirth. 2018; 0 (12): 2-8.

[15] Roy R, Chaturvedi M, Agarawal D, Ali H. Household use of iodized salt in rural areas, Gautam Budh Nagar, India. Journal of Family Medicine and Primary Care. 2016; 4 (2): 6. DOI: 0.4103/2249-4863.184628.

[16] Chuot CC, Galukande M, Ibingira C, Kisa N, Fualal JO. Iodine deficiency among goiter patients in rural South Sudan. Research Notes. 2014; 7 (751): 6.

[17] Herrador, Z., Sordo, L., Gadisa, E., Buño, A., Gómez-Rioja, R., Iturzaeta, J. M., de Armas, L. F., Benito, A., Aseffa, A., Moreno, J., Cañavate, C., & Custodio, E. (2014). Micronutrient deficiencies and related factors in school-aged children in Ethiopia: a cross-sectional study in Libo Kemkem and Fogera Woredas, Amhara Regional State, Ethiopia. *PloS one*, *9* (12), e112858. https://doi.org/10.1371/journal.pone.0112858

[18] Assey VD, Brundtland GH. controlling iodine deficiency disorders through salt iodization in Tanzania. Tanzania Food and Nutrition Centre. 2009; 5-102.

[19] Muktar M, Roba KT, Mengistie B, Gebremichael B. Iodine Deficiency and its associated factors among primary school children in Anchara Woreda Eastern Ethiopia. Pediatric Health, Medicine, and Therapeutics. 2008; 9: 89-95.

[20] Zerfu D, Belay A, W/Yohannes M, Ayana G, Abera A, Tesfaye B, et al. Ethiopian National Micronutrient Survey Report Ministry of Health. 2016; 8-126.

[21] Troen TM. Progress and challenges in eliminating iodine deficiency in Ethiopia: a systematic review. BMC Nutrition. 2016; 2 (12): 2-12.

[22] Zekarias B, Mengistie B. Prevalence of Goiter and Associated Factors Among Women Of Reproductive Age Group In Demba Goffa Woreda, Gamo Goffa Zone, South West Ethiopia. Ethiopian Journal of Health Dev. 2016; 3-70.

[23] Mirmiran P, Nazeri P, Amiri P, Mehran L, Shakeri N, Azizi F. Iodine Nutrition Status and Knowledge, Attitude, and Behavior in Tehranian Women Following 2 Decades Without Public Education. Journal of Nutrition Education and Behavior. 2013; 45 (5): 8.

[24] Ayana G, Belay A, W/Yohaness M, Zeru T, Tefera H, Legesse A, et al. Goiter prevalence and median urinary iodine concentration in Ethiopian reproductive age women and school-age children. Ethiopian Journal of Public Health and Nutrition. 2017; 35 (5): 05-109.

[25] Tigabu E, Bekele KB, Dachew BA. Prevalence of goiter and associated factors among schoolchildren in northeast Ethiopia. Epidemiology and Health. 2017; 39 (20): 5.

[26] Kebede DL, Adinew YM. Predictors of Goiter among School Children in Southwest Ethiopia: Case-Control study. Journal of Nutrition & Food Sciences. 2015; 0 (5): 3.

[27] Worku A, Kifle H. Prevalence of Goitre among School-age Children in Jimma Town, South West Ethiopia. Addis Continental Institute of Public Health.1.

[28] Abuye C, Berhane Y. The goiter rate, its association with reproductive failure, and the knowledge of iodine deficiency disorders (IDD) among women in Ethiopia: Cross-section community-based study. BMC Public Health. 2007; 7 (10): 7.

[29] Vijay J, Sharma S, Kapil U, Bhadoria AS. Prevalence of goiter and associated factors among pregnant mothers residing in a district with poor socioeconomic status in Rajasthan state, India. Journal of Family Medicine and Primary Care. 2019; 7 (6): 334-1340.

[30] Gebreegziabher T, Teyike N, Mulugeta A, Abebe Y, Hambidge KM, Stoecker B. Lack of Dietary Sources of Iodine and the prevalence of Iodine deficiency in rural women from Sidam Zone, Southern Ethiopia. African Journal of Food, Agriculture, Nutrition, and Development. 2013; 3 (5): 8401-8414.

[31] Aweke KA, Adamu BT, Girmay AM, Yohannes T, Abuye AZC. Iodine Deficiency Disorders (IDD) in Burie and Womberma Woredas, West Gojam, Ethiopia. African Food, Agriculture, Nutrition, and Development. 2014; 4 (4).

[32] Mesele M, Degu G, Gebrehiwot H. prevalence and associated factors of goiter among rural children aged 6-12 years old in Northwest Ethiopia, cross-sectional study. BMC Public Health. 2014; 4 (130): 8.

[33] Bekele A, Adilo TM. Prevalence of Goiter and its Associated Factors among primary school children in Chole Woreda Arsi Zone, Ethiopia Cross-sectional study. BMCNutrition. 2019; 0 (40): 10.

[34] Qamar MF, Abbas S. Prevalence, and case reports of Goiter at Districts Bahawalpur, Pakistan. SciInt (Lahore). 2012; 24 (1): 33-37.

[35] Gidey B, Alemu K, Atnafu A, Kifle M, Tefera Y, et al. (2015) Availability of Adequate Iodized Salt at Household Level and Associated Factors in Rural Communities of Laelay Maychew Woreda, Northern Ethiopia: A Cross-Sectional Study. J Nutr Health Sci 2 (1): 03. doi: 0.15744/2393-9060.1.403.

[36] Diosoday LL, Manner JO, Venkatesh-Manner MG, Stone TG. Stability of iodine in iodine salt used for the correction of iodine deficiency disorders. II, Canada. Food and Nutrition Bulletin. 998; 8 (4): 388-396. DOI: 0.1177/156482659701800409.

[37] Kedir H, Berhane Y, Worku A. Subclinical Iodine Deficiency among Pregnant Women in Haramaya Woreda, Eastern Ethiopia: A Community-Based Study. Journal of Nutrition and Metabolism. 2014; 0 (8).

[38] Mezgebu Y, Mossie A, Rajesh P, Beyene G. Prevalence and severity of iodine deficiency disorder among children 6-12 years of age in Shebe Senbo Woreda, Jimma zone, southwest Ethiopia. Ethiop J Health Sci. 2012; 22 (3): 96-204. PMID: 23209354; PMCID: PMC3511898.

[39] Gebremariam HG, Yesuf ME, Koye DN. Availability of Adequately Iodized Salt at Household Level and Associated Factors in Gondar Town, Northwest Ethiopia. ISRN PublicHealth. 2013; 70 (20): 70-75.

[40] Hibstu DT, Tesfaye DJ. Epidemiology of goiter and its predictors among school-age children in Leku town, Southern Ethiopia. Curr Pediatr Res. 2017; 21 (4): 620-626.

[41] Ahmed A, Menkir S, Lemma F. Risk Factors of Iodine Deficiency Disorder and Prevalence among Primary School Children in Kutaber Woreda, South Wollo Zone, Ethiopia. Advances in Biological Research. 2017; 1 (5).