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Prevalence of goiter and its associated factors among primary school age children aged 6–12 years old in Debre tabor town, northwest Ethiopia

Abstract

Background: There are many reasons for children to underperform at school such as nutritional status, socio cultural, environmental and other factors. Iodine deficiency disorder is the major cause of preventable brain damage in children resulting in academic underperformance.

Objectives: To assess prevalence of goiter and its associated factors among school age children at Gafat governmental primary school in Debre Tabor Town, 2017.

Methods: Cross sectional study design with mixed data collection method was conducted, from April 1 to 30/2017. A total of 294 school age children were participated in this study. Participants selected using systematic random sampling technique. Quantitative and qualitative data were collected from clients and key informants using structured questionnaires and in-depth interview guide respectively. Data were entered into Epi data and exported into SPSS version 20.0 for analysis. Descriptive statistics, bivariate and multivariate binary logistic analyses were carried out. Qualitative data were analyzed based on thematic frameworks to triangulate quantitative findings.

Results: The prevalence of goiter was 28.37%. Females were more likely affected by goiter than males between ages 6-12 years. Feminine sex, educational status of mothers, occupation of father, perception of mothers on prevention of goiter, participation of children in playing activities and failure of recalling events were associated with the prevalence of goiter among school age children.

Conclusion: The prevalence of goiter was almost similar to the Regional prevalence of goiter but lower than National prevalence. Surprisingly utilization of iodized salt had no effect on the existence of goiter. Knowledge, skill and practice gaps were clearly observed on mothers of school age children on iodized salt utilization. Author recommended FMOH should create awareness on iodized salt utilization in collaboration with the federal ministry of education.

Keywords: goiter, prevalence, associated factors, school age children

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Abbreviations: AAU, addis ababa university; AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; EHNRI, Ethiopian health and nutrition and research center institute; EPDRF, Ethiopian people's democratic republic front; EPI-INFO, epidemiological information; ICCIDD, international council for the control iodine deficiency disorder; ID, identification number; IDD, iodine deficiency disorder; KM, kilo meter; MOH, ministry of health; SPSS, statistical packages of social sciences; TGR, total goiter rate; TSH, thyroid stimulating hormone; UNICEF, united nation international children's economic fund; USI, universal salt iodization; WHO, world health organization.

Background

Iodine is an important micronutrient required for structural development and optimal functional activity of the thyroid gland and central nervous system. Iodine deficiency is one of the most prevalent micronutrient deficiencies globally and is the main cause of potentially preventable cognitive disability in childhood.[1] Globally, Iodine deficiency disorder (IDD) results in more than 18 million babies being born mentally impaired in each year. IDD hinders brain development during infancy and childhood. In Ethiopia, it is estimated that over 35 million people are at risk of IDD and over 20 million people suffer from goiters (TGR of 26%). The total percentage of goiter among school children varies across regions (39.9% nationally). Furthermore, endemics have been described in many areas caused by Goitrogens in drinking water that may contain various chemical compounds interfering with thyroid hormone synthesis.[2] Globally, the total goiter rate is estimated to be 15.8% and nearly two billion people are at risk of ID, while one-third lives in areas where natural sources of iodine is low. Regarding the school children, about 32% are suffering from ID and related consequences.[3,4]

There is clear evidence that the major damage caused by malnutrition takes place in the womb and during the first 2 years of life.[5–7] This damage is irreversible and is linked to lower intelligence and reduced physical capacity, which in turn diminishes productivity, slows economic growth, and perpetuates poverty. Moreover, malnutrition passes from generation to generation because stunted mothers are more likely to have underweight children.[2]

Goiter is a public health problem. When community's awareness towards associating factors is high, the solution to iodine deficiency disorder is relatively simple and inexpensive. Adding iodine to salt provides protection from brain damage due to iodine deficiency

for the whole population, helping people and country reach their full potential. The impacts pass through generation to generation.[8] The damage is irreversible and is linked to lower intelligence and reduced physical capacity, which in turn diminishes productivity, slows economic growth, and perpetuates poverty. On the other hand,[9,10] thyroid swellings on school age children are common in the mountainous areas including Ethiopia, where the altitude ranges are 1,500-2,000 meters or more above sea level.[11] In Ethiopia, it is estimated that over 35 million people are at risk of IDD and over 20 million people suffer from total goiter rate (TGR of 26%). Nationally, the total percentage of goiter among school- children is 39.9%, which is the highest one among any other age groups while 36% is among biological mothers of school children. The prevalence varies across regions and people living in mountainous areas and war places suffer from iodine deficiency disorders than other places.[12] Determining the prevalence of goiter and its associated factors helps policy makers and administrators for early detection, timely intervention and prevention of further complications. Since there are few studies done in Ethiopia and no researches were found in Debre Tabor town, this study is used as a baseline for health professionals to focus on the prevention aspects of public health problems in community and school health nursing. The objective of this study was to determine the prevalence of goiter and identify associated factors among school age children at Gafat governmental primary School, Debre Tabor town, Northern Ethiopia.

Methods and materials

Study area and period

The study was conducted in Debre Tabor town, capital city of South Gondar. The town is located 666 km away from Addis Ababa and 101km from Bahir Dar-the capital of Amhara Regional State. According to south Gondar administrative health office report of 2017, the total population of the town is 78739 of whom 35627 were females. The town has one Zonal Hospital, two Health centers, three private clinics. The town has six governmental schools. Currently, the total number of students in the town is 8415. The town has primary education, coverage of 92.2% in all six governmental primary schools. Gafat, the selected primary school, is found in Northern west direction from the center of the town. The school has 1932 students, of whom 1020 were females. The study was conducted from April 1 to 30/2017.

Study design and period

Facility based cross sectional study design using quantitative and qualitative data collection methods was employed.

Source population

All students attending in Gafat school during data collection period in Debre Tabor Town.

Key Informants from students for focused group discussion.

Study population

All sampled students in Gafat governmental primary school in Debre Tabor town during data collection period.

Eligibility criteria

All students from grade one to six were selected. Students who lived with their parents for at least six months in the study area. Students who were critically ill were excluded.

Sample size determination

Sample size for quantitative approach was determined using single population proportion formula $n = (Z\alpha/_2)^2 p(1-p)/d^2$. Where n is sample size, Z the standard normal deviation, set at 1.96 (for 95% confidence interval), D is the margin of error (0.05 was taken). P is Prevalence of goiter among school age children in Amhara region(29%).[5] Correction formula were used to calculated final sample size and considering 5% non-response, the sample size were 294. For qualitative approach: 24 students were selected for focused group Discussion.

Data collection methods and procedure

Two health officers were recruited to collect the data. Systematic random sampling technique was used to select study participants. For quantitative study, structured questionnaire was used. The questionnaire was initially prepared in English and translated into Amharic and retranslated back into English to check consistencies of concepts. For qualitative data, FGD was conducted with selected key informants using guide and tape recorder after appropriate time selection. Each FGD had eight selected students. Before conducting discussion, explanation and elaboration of the need for discussion was explained to them. Each FGD was took 1½ to 2hours. The qualitative data were used for triangulating quantitative data.

Data quality assurance

Data collectors and supervisors were trained in one day with the objective of the study, contents, consistence and logical order of the questionnaire and how to maintain confidentiality and privacy of the participants. The collected data were checked by supervisors and Investigators on a daily basis. For qualitative data, the principal investigator was forming focus group discussions (FGDs). Each FGD had a total of eight selected students with one group leader, one note taker and one-time keeper. FGD were conducted until the data has been saturated.

Operational definitions

I. **Goiter:** Thyroid gland enlargement which has lateral lobes with a volume greater than the terminal phalanges of the thumb of the person.

II. **Prevalence of goiter:** Both old and new cases of goiter among school age children.

III. **Endemic goiter:** The prevalence of goiter greater than 5% among school age children.

IV. **Governmental primary school**: Governmentally financed and managed by an educational institution which provides education from grade 1 up to 8.

Data quality control and management

One day training was given for data collectors and supervisors. The questionnaires were pretested on 5% of sample size at Debre Tabor School. The questionnaire was translated into local language for common understanding among study participants. In addition, continuous supervision of the data collection process was carried out. The collected data were checked for incompleteness and inconsistency of data. The principal investigator entered the data into the computer and data cleaning was made for each variable. For qualitative data, Guideline for FGD was revised by experts before conducting the discussion, and all collected data were written down in Amharic for discussion and back to English for description. The recorded data were

Data processing and analysis

Each questionnaires were coded and checked for completeness and consistency. Then, the data were entered inti Epi data version 3.1 and exported to SPSS version 20 for further analysis. The data were cross checked by each investigators before analysis. For descriptive statistics, results were expressed in terms of percentages and were presented using tables and graphs according to the types of tool used. Descriptive and bivariate analysis was computed to see the frequency distribution and to test whether there is an association between dependent variables and selected independent variables respectively. In bivariate analysis variables with p-value of 0.20 and less were taken to multivariable analysis and the model was built with backward stepwise elimination (backward LR). Finally, the p-values 0.05 and less were considered statistically significant. For qualitative data, all reported data were written down and organized on notebooks for each warm FGD. The data were also first transcribed into text format and translated into English version. Then, it was analyzed manually using thematic analysis technique descriptively. Initially, data were read several times to identify major themes. After Coding, data's were compared and organized into themes. Finally, Quantitative results were presented in texts, tables and graphs as appropriate and qualitative results were used to support the quantitative results.

Ethical considerations

Ethical clearance was obtained from Addis Ababa University health Science College Ethical Review Board. Official letter was written to Jimma Town Health Office. Participants' confidentiality and anonymity was kept. Informed verbal and written consent were also taken individually, and any respondents who were not assured given a full right to refuse to participate in the study without any negative connotation on their future service.

Results

Socio–demographic distribution of participants

Out of 332 children, 289 students were participated in the study with a response rate of 87.05%. Among all study subjects**,** 219 (75.8%) school age children mothers were married and only 13 mothers (4.5%) were single**.** Regarding to religious status, the majority of them were Orthodox (69.9%); regarding educational status, 27.0% were completed primary level of education. The distribution of the mothers by occupational status showed that 46.7% were housewives, followed by 25.3% mothers who engaged in a particular business generating job (Table 1).

Status of goiter among school age children

The present study showed that 82 (28.37%) children had goiter among the total of 289 study subjects. About 67.2% males and 32.8% females had grade 1 goiter respectively. On the other hand, among children who had grade 2 goiter, 61.1% and 38.9% are females and males respectively (Table 2). From 289 children, 52.7% whose ages were 11-12 years did not have goiter while 47.3% whose ages were 6-10 years did not also have goiter. Thirty-seven (57.8%) whose ages were 11 and 12 years had grade 1 level of goiter. On the other hand, 27 children (42.2%) whose ages were 6-10 years have had grade 1 level of goiter. Ten children (55.6%) whose ages were 11-12 years and 8 children (44.4%) whose ages were 6-10 years have had grade 2 goiter status respectively (Table 3).

Table 1 Distribution of school age children parents by socio-demographic characteristics at Gafat governmental primary school, Debre Tabor town, Northern Ethiopia, March 01/2014 - May 30/ 2014

Characteristics	Frequency	Percent (%)
Current age of the mother/caretaker		
<20	13	4.5
20-34	219	75.8
>34	30	10.4
	27	9.3
Marital status		
Single		
Married		
Divorced		
Widowed		
Religion		
Orthodox	202	69.9
Muslim	49	17
Protestant	21	7.3
Catholic	12	4.2
Others	5	1.7
Educational status of mothers		
Illiterate	51	17.6
Read and Write	38	13.1
Primary education	78	27
High school	73	25.3
Above high school	49	17
Educational status of fathers		
Illiterate	20	6.9
Read and Write	14	4.8
Primary education	39	13.5
High school	108	37.4
Above high school	108	37.4
Occupational status of mothers		
Gov. employee	49	17
Non.gov. employee	14	4.8
Self-work	73	25.3
House wife	135	46.7
Others	18	6.2
Occupational status of fathers		

Table Continued

Characteristics	Frequency	Percent (%)
Government employee	124	42.9
Non-government employee	19	6.6
Self-employee	68	23.5
Merchant	69	23.9
Other	9	3.1
Family size		
1-3	17	5.9
4-6	196	67.8
>7	76	26.3

Table 2 Distribution of goiter status among school age children by sex in Gafat governmental primary school, Debre Tabor town, Northern Ethiopia, March 01/2014 - May 30/ 2014

Characteristics	Frequency	Percent (%)
Absent (Grade 0)		
Male	114	55.1
Female	93	44.9
Total	207	100
Grade 1		
Male	21	32.8
Female	43	67.2
Total	64	100
Grade 2		
Male	7	38.9
Female	11	61.1
Total	18	100
Present		
Male	28	34.15
Female	54	65.85
(Male+Female)	82	28.37

Factors associated with prevalence of goiter

Binary and multiple logistic regression model was performed to identify the factors associated with goiter. Variables which were identified to have significance association at p value less than 0.05 with goiter in the bivariate regression model were entered into multiple logistic regression model. In multivariate logistic regression model, females school aged children (AOR=2.34; 95% CI= 1.10, 4.97), mothers completed primary level of education (AOR= 0.21;95% CI = 0.06, 0.74), children who had been screened for early detection of goiter (AOR=0.03; 95% CI= 0.01, 0.17), children whose mothers did not knows about preventability of goiter (AOR=5.93; 95% CI=2.07, 16.98) were significantly associated with goiter (Tables 4 & 5).

Table 3 Distribution of goiter status among school age children by age in Gafat primary school, Debre Tabor town, Northern Ethiopia, March 01/2014 - May 30/ 2014

Characteristics	Frequency	Percent (%)
Absent (Grade 0)		
6-10	98	47.3
11-12	109	52.7
Total	207	100
Grade 1		
6-10	27	42.2
11-12	37	57.8
Total	64	100
Grade 2		
6-10	8	44.4
11-12	10	55.6
Total	18	100
Present (Grade 1 and 2)		
6-10	35	12.11
11-12	47	16.26
6-12	82	28.37

Table 4 Distribution of associated factors for the prevalence of goiter among school age children in Gafat governmental primary school, Debre Tabor town, Northern Ethiopia, March 01/2014 - May 30/ 2014

Characteristics	Frequency	Percent (%)
Ever heard about goiter		
Yes	124	42.9
No	165	57.1
Ever heard about Iodized salt		
Yes	98	33.9
No	191	66.1
Source of information about goiter		
Health professionals	14	4.8
Mass media	46	15.9
Books/magazines	275	95.2
Husband	273	94.5
Friends/relatives	257	88.9
Others	285	98.6
Previous screening for existence of goiter		
Yes	12	4.2

Table Continued

No	277	95.8
Characteristics	**Frequency**	**Percent (%)**
Perception for detection of goiter		
Visible on neck	212	73.4
Has pain	7	2.4
Thru examination	44	15.2
No idea	26	9
Perception on treatment of goiter		
Yes	211	73
No	24	8.3
I don't Know	54	18.7
Know factors for goiter and other problems		
Yes	43	14.9
No	17	5.9
I don't know	229	79.2
Actions to be taken for goiter treatment		
Use traditional treatment	25	8.7
Visit health institution	212	73.4
Go to religious places	13	4.5
Nothing	39	13.5
Said that goiter is preventable*		
Yes	120	41.5
No	51	17.6
I don't know	118	40.8
Currently used salt		
Non-iodized salt	219	75.8
Iodized salt	20	6.9
Mixed	50	17.3
Participation of children*		
Likes to play	247	85.5
Dislikes to play	20	6.9
I don't know	11	3.8
Others	11	3.8

Qualitative results

Four Focus Group Discussion were taken. Each FGD contains eight members and warmed discussions were carried out freely. Saturation and redundancy of data occurred at the end of the fourth group discussion. Data were analyzed manually after reading several times. Five major themes were made after FGD. The themes were discussed in details as follow.

Table 5 Independent association of variables that entered in multiple logistic regressions with goiter status of school age children in Gafat governmental primary school, Debre Tabor town, Northern Ethiopia, March 01/2014 - May 30/ 2014

Characteristics	COR (95% CI)	AOR (95 %CI)
Sex		
Male	1	1
Female	2.36(1.39,4.03)	2. 34(1.10, 4.97)
Educational status of mothers		
Illiterate	1.75(0.76, 4.03)	1.12(0.31, 4.02)
Read and write	1.63(0.66, 4.00)	1.57(0.39, 6.35)
Primary completed	0.29(0.11, 0.75)	0.21(0.06, 0.74)
High school completed	1.22(0.56, 2.70)	0.98(0.31, 3.07)
Above high school	1	1
Previously screened for existence of goiter		
No	1	1
Yes	0.12(0.03, 0.45)	0.03(0.01, 0.17)
Goiter is preventable		
Yes	1	1
No	3.38(1.67, 6.83)	5.93(2.07, 16.98)
I don't know	1.48(.81, 2.68)	1.98(0.85, 4.61)

Availability of iodized salt affect utilization

Most women did not identify what iodized salt mean, but the availability was expressed as ''powder and packed salt'' for iodized salt while non-iodized salt was named as ''common non powder salt'' for non-iodized salt for common language and understanding. Almost all said that even if we preferred to use iodized salt with diet, its availability in the town is inadequate. Because of this we all use common non iodized salt. ''I believe that the inaccessibility of iodized salt in the town might be due to the cost of iodized salt is not affordable unlike the common non iodized salt. Women are interested in paying for in a low cost'' said a 35 years married woman from FGD 1.

Perception and cultural beliefs on benefits of iodine

Participants described poor perception towards taking iodized salt is one factor for understanding the benefit adding iodine in the diet. They perceived that goiter is a natural problem that passes from one family to another family. Most participants do not know the function of iodine in our body. Some believed that taking iodine in our diet will prevent the occurrence of goiter in their children after mass-media promotion by FMOH. But we have been culturally influenced to use non iodized salt. This is because goiter is a commonly family related problem. "I know a mother and a daughter who has had goiter and live nearby my house. Unlike us they commonly use packed iodized salt with watt but both a mother and a daughter develop goiter. From this, I point out that goiter cannot be prevented through iodine'', said a 25 years' lady from FGD4.

Times of iodized salt utilization

On the other hand, all participants behaved that adding iodized salt is crucial at the begging of watt preparation. This is due to malpractice of adding non iodized salt in our diet. This is scientifically approved that the function of iodine will be lost due to heat. Because of this, iodine should be added at the end of watt preparation. The entire participants explained as they do not know the right time of adding salt in watt and coffee. This confirms that there is clear knowledge and skill gap on utilization of iodized salt in the study area.

''I would prefer to add salt at the begging of watt preparation than at the end. It might have a negative impact on all my family and neighbors'', said a 39-year-old widowed woman from FGD 3.

Surprisingly, some women preferred to use iodized salt for ultimate use because of its powder form will help them maximize salt taste if the amount of the previous non iodized salt is inadequate. In addition, only a few mothers said that iodized salt is added at the end of vegetable preparation. Since its form is a powder, we can easily distribute over ready-made vegetables. This might be essential to maintain the function of iodine**.**

Controlling the quality of iodized salt

Cooking problem is another major reason for the failure of control of iodine-deficiency disorders by iodized salt. Since recipes and cooking procedures vary from one household to another, it is difficult to know the overall iodine loss during cooking. During discussion, participants said that there is very little or no information is available. These might be due to lack of knowledge of the public health significance of iodine-deficiency disorders and the importance of iodized salt for its control among parents' of school age children. A 42 years old woman said from FGD 3, the quality of iodized salt is expressed when a small amount of salt has the ability to maximize watt taste during food cooking.

Effect of family size on iodized salt utilization

Majority of the study subjects had 4-6 numbers of children. Having large numbers of families in a single house might be one reason to prefer non iodized salt. They mentioned non iodized salt is affordable and used for a long period of time as compared with iodized salt in such families than those who have small family size. A 46 years' mother in FGD 2 and whose family size is 8 said, "even if I have heard about the advantages of iodized salt in Ethiopian Television program, it is very difficult to pay 5 Ethiopian Birr for only one pack of iodized salt. We use more than one pack of iodized salt per week. But the common non iodized salt may serve for at least three weeks with the same cost.[13–17]

Discussions

The present study showed that 28.37% children have had goiter. This result was almost similar to the regional prevalence of goiter among school age children and lowered as compared to national prevalence (39.9%).[4] Totally 67.2%) males and 32.8% females have had grade 1 goiter respectively and 61.1% females and 38.9 males have had grade 2 level of goiter. Females were more likely affected by goiter than males between ages 6-12 years. This might be the trapping system of mammary glands for iodine is similar to that of thyroid gland. The breasts effectively compete with thyroid gland for ingested iodine. This distribution of iodine to both breast and thyroid gland in pubertal girls explains why goiter is more common in girls than pubertal boys. The development of a goiter in young girls indicates the deficient distribution of iodine to both breast and thyroid tissue. Treating such a patient with thyroid hormone is not sensible and appears to increase the risk of breast cancer.[1,12,22] In addition, the present study revealed that the prevalence became high when the ages were increased. 57.8% whose ages were 11-12 years and 42.2% whose ages were 6-10 years have had grade 1 level of goiter. Similarly, 55.6% whose ages were 11-12 years and 44.4% whose ages were 6-10 years have had grade 2 goiter. This result was consistent with other previous studies.[12,18,20]

In the present study, being female was associated with the existence of goiter among school age children in multivariate analysis (AOR= 2.34; 95% CI = 1.10, 4.97). Many studies found that feminine sex was significantly associated with goiter prevalence.[12,18–20,21] The result of this study was in line with other studies and reported that the prevalence of goiter was higher in females aged above ten years of age than males of the same age. Educational status of mothers had associated with the existence of goiter in bivariate analysis and also appeared in multivariate analysis (AOR=0.21; 95% CI=0.06, 0.74). Likely educational status of fathers had an association in bivariate analysis, but it disappeared in multivariate analysis. This means that the effect of father education disappeared when the effect of another variable was controlled. Occupation of fathers had also association in bivariate analysis while it disappeared in multivariate analysis. Children who were previously examined/screened for goiter existence had association in both bivariate and multivariate analysis (AOR= 0.03; 95% CI=0.01, 0.17). It means, the effect of this variable appeared if the effect of other variables were controlled. Perception of mothers on prevention of goiter was associated with the prevalence of goiter among school age children in bivariate analysis and the effect was also appeared in multivariate analysis (AOR=5.93; 95% CI=2.07, 16.98). Participation of children in playing activities was dependently associated with other variables, but had no independent association with goiter prevalence. Failure of recalling events was associated with the prevalence of goiter among school age children in bivariate analyses. The association appeared independently when the effect of other variables was adjusted. Most mothers did not understand the benefits of taking iodized salt with watt as daily requirement, presence of iodine in salt and whether it associates with goiter or not. Some were used when the amount of non-iodized salt was inadequate for the purpose of maximizing its taste.[22] Only few mothers did understand the benefit of its use after mass media promotion of FMOH but the problem laid on ways of practicing. They added on watt at the beginning of food cooking. On the other hand, the majority of the study subjects has had inadequate information regarding to the prevention of goiter, functions of iodized salt and its utilization. They mentioned as goiter is a family related problem and some said that goiter is common in geographically iodine deficient areas**.**

Conclusion

Prevalence of goiter is found to be high and iodine deficiency disorder is a severe public health problem. In this study being female and mothers lack of knowledge on preventability of goiter increases the risk of goiter. Mother's completion of primary education and early detection of goiter were protective for goiter. Ensuring the consumption of iodized salt, promotion of education and early detection of goiter at the household level are highly recommended.

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Availability of data and material

The datasets generated during the current study are available from the corresponding author on reasonable request.

Consent for publication

Consent for publication is available and can be send to the editors on request.

Ethics approval and consent to participate

This study was approved by the Addis Ababa University, Health Sciences College, School of Nursing and Midwifery ethics committee, and written informed consent was obtained from all study subjects.

Conflicts of interest

The author declares there are no conflicts of interest.

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