Original article

Endemic goiter in School Children in Southwestern Ethiopia

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Abstract

Background: Iodine deficiency disorder (IDD) is a serious threat to the health and well being of people residing in goiter endemic areas.

Objective: To determine the prevalence of iodine deficiency disorders among school children.

Methods: A school-based cross sectional survey was conducted in Kafa Zone, Southwestern Ethiopia in January 2003. A total of 1044 students, aged 6 - 15 years, drawn from three Elementary Schools were selected by though the systematic random sampling method. Data on sociodemographic characteristics were collected using a pretested structured questionnaire. Physical examination was conducted to identify the presence or absence of goiter. Data were analyzed using SPSS version 11.0.

Results: The prevalence of goiter among the study population was found to be 27.4% {95% CI = (24.7, 30.1)}. The faminine sex was found to be significantly associated with incidence of goiter (P< 0.001). The prevalence of goiter in the three schools was 146 (42.0 %) {95% CI = (36.8, 47.2)} in Shomba kuri, 82 (23.6%) {95% CI = (19.1, 28.1)} in Mera and 58 (16.7%) {95% CI = (12.8, 20.6)} in Abera Yuda primary schools. The prevalence of goiter in Shomba kuri, located at a lower altitude, was significantly higher than that of the other schools (P<0.001).

Conclusion: This study showed that IDD is a public health problem in the zone. Goiter was more prevalent among females than males. Continuous, concerted efforts should be exeted to strengthen information, education and communication (IEC) activities in order to create awareness about the detrimental effects of IDD prevention, and encourage iodated salt consumption. [*Ethiop.J.Health Dev.* 2004; 18(3):175-178]

Introduction

Nutritional deficiencies which are good indicators of the health status of the general population of a nation have become more prevalent in developing countries. Next to Protein Energy Malnutrition (PEM), deficiencies of iodine, vitamin A and nutritional anemia are the commonest nutritional problems in these countries (1).

Iodine deficiency in childhood and adolescence is characteristically associated with endemic goiter (2). Globally about 740 million people are affected by goiter and more than two billion (or over 38% of the population living in 130 countries) are estimated to be at risk of IDD. Many countries including China and India have come to regard their entire population as at risk of IDD (3).

According to a situational analysis carried out by Ministry of Health (MOH)and the /United Nations Children's Fund (UNICEF) in 1993, 42 million people (78%) of the total population of Ethiopia are exposed to iodine deficiency, 35 million (62%) are iodine deficient, 14 million (26%) have goiter and at least one in 1000 people is cretin; with about 50,000 prenatal deaths. This report claims that many health problems in the country are attributable to iodine deficiency (4). Another study conducted in Kobo village and 8 schools in central Ethiopia revealed a goiter prevalence of 63.3% in the village and 93.4%, 81.1% and 29.3 % in the schools in Kobo, Kembatana - Hadya province and Gubre, respectively (5). A similar study conducted on elementary school children in the district neighboring to the present study area also reported 64.1% prevalence of goiter (6).

Even though inadequate intake of iodine is the principal cause of IDD, other goitrogens like cassava, millet, soya bean, bamboo shoot, turnip, kale which interfere with the metabolism of iodine and the formation of the hormone are also implicated (1, 7-9). Contamination of drinking water by different microbes, and other associated nutritional deficiencies as Vitamin A, protein energy malnutrition (PEM) and iron deficiency anemia (IDA) are among the environmental and nutritional factors which contribute to the occurrence of IDD (4).

The cost effective long term strategy to control iodine deficiency disorder is iodizing salt. There are however, other short term methods like iodized oil capsules (Lipid oils), iodized water, Lugols iodine etc. depending on the urgency of correction of the deficiency and accessibility of severely affected areas. Ethiopia as a member of WHO has accepted iodating all the salt produced in the country for human consumption (4).

Kafa Zone however lacks adequate information about this important public health problem. The main objective of this study is thus, to determine the prevalence of

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iodine deficiency disorder among school children in Kafa Zone.

Methods

A cross sectional study was conducted in Kafa Zone, Southwestern Ethiopia to determine the prevalence of iodine deficiency disorders in January 2003. Its approximate location is 35.3° - 36.48°E and 6.48 - 8.50°N- and covers an area of 13,199 sq. Km and it has ten weredas (districts). The population is 758,971 (as projected from 1994 census) and the average household size is 4.4. The predominant religion and language are Orthodox Christianity and kafinonnoo (Kafigna), respectively. The livelihood of the people is based on agriculture and their main products are maize, beans, barley, teff, wheat, peas, fruits, pineapple and livestock (10).

Three out of the ten districts were selected by the non probability convenience sampling method. Three elementary schools (one from each district) were identified to represent different altitudes, i.e., high (dega), medium (woinadega) and low (kolla) altitudes. Shombakuri School is located in Gimbo district which is 85 and 25 kms away from Jimma and Bonga towns respectively and has an altitude of 1,409 meters above sea level. Mera School is located in Menjiwo district 15 kms away from the Zonal center and has an altitude of 2,103 meters above sea level. The third school, Abera Yuda, is in Chena district, 54 kms away from Bonga town with an altitude of 1,765 meters above sea level. Written consent was obtained from Zonal and Woreda Capacity Building Department and school authorities. Finally permission was secured from the study subjects following a brief discussion with teachers and students about the purpose of the study and public health importance of the IDD.

The total number of students enrolled in the three schools during the study period was 3,915 (Mera 698, Shombakuri 962 and Abera Yuda 2,255). Taking the prevalence of goiter to be 50%, with 95% confidence interval, and a margin of error of 5%, the sample size that was taken from each school was 348.

First, the attendance list was checked and systematic random sampling was considered. The first individual was identified by the lottery method and every 2nd, 3rd and 6th student was picked by systematic random sampling from Mera, Shomba Kuri and Abera Yuda schools, respectively. A student absent on the date of data collection was substituted by the next student from the same class room. Students who were less than 6 years of age and above 15 years of age were excluded from the study. The younger the child (below 6 years) the more difficult it becomes to palpate the thyroid gland and such children are categorized in the preschool age group (11, 12).

Data on sociodemographic characteristics (age, sex, ethnicity, religion, education and occupation), and signs and symptoms of thyroid enlargement (goitre), were collected using a pretested questionnaire prepared for the purpose. Data were collected by three health officers and nine nurses after a one day training on how to fill the questionnaires and how to do physical examination. The physical examination was carried out by the health officers and an enlarged thyroid was graded according to techniques recommended by WHO (11). When grading was in doubt, the lower grades were considered. Continuous supervision of the data collection process was carried out. Five percent of the data collected daily was randomly rechecked to ensure completeness and consistency of the data.

Data were cleaned, edited and analyzed using SPSS (PC) version 11.0. Descriptive statistics were used for frequency distribution and Chi-square statistical tests were used where necessary to test the association between factors and IDD. The extent of IDD in the community was estimated from the prevalence of goiter in school children using epidemiological model (6, 13). The formula used was g=pigs, where g= total goiter prevalence in the population Pi= multiplier for gs, gs = goiter in school children.

$$Cg = \frac{EXP\ (bo+big+biig^2)}{[\ 1+EXP\ (bo+big+biig^2)]}, \text{ where}$$

Cg=prevalence of goiter cretinism estimated from g, bo=9.3939. Bi=15.796, bii=9.8026.
Rates of reproductive losses was estimated with Ln = mmCg,
Where mn= multiplier for Cg,
Li= Rate of neonatal deaths (mi = 0.602)
Lii= Rate of still births (mii = 0.656)
Liii = Rate of abortions (miii = 0.883) (13).
Mild developmental handicaps were estimated by multiplying the cretinism prevalence (Cg) by 3 (13).

The following operational definitions are used. Goiter: Thyroid gland which has lateral lobes with a volume greater than the terminal phalanges of the thumb of a person (14). Endemic goiter: goiter prevalence greater than 5% (11), Iodine deficiency endemia: Indicates the severity of IDD problems based on prevalence of total goitre rate (TGR) in school age children. The prevalence of goiter is said to be mild, moderate, and severe if TGR is 5 - 19.9%, 20 - 29.9%, and greater or equal to 30% respectively. Total Goiter Rate (TGR):- Goiter grades 1 and 2 (11).

Results

A total of 1044 students were interviewed and examined, making the response rate 100%. A greater proportion (554) (52.1%) of the study subjects were in the age group 6-10 years. Mean age of the study subjects was 10.5 years. Orthodox Christianity was the predominant

religion which accounted for 990 (94.8%). The majority, 808 (77.4%) of the study subjects were found to be from Kafa ethnic group, followed by Amhara, 208(19.9%). Most of the heads of the households of the study subjects were farmers, 938(89.8%) followed by merchants, 69(6.6%)- A majority of the mothers were illiterate, 676(64.8%) followed by those who had elementary education, 235 (22.5%)- Out of 1040 fathers, 420 (40.2%) were illiterate and 356 (34.1%) had elementary education (Table 1).

Table 1: **Socio demographic characteristics of the students and their parents, Kafa zone, Jan. 2003 (n=1044)**

Characteristic	Number	%
Age in years		
6-10	544	(52.1)
11-15	500	(47.9)
Sex		
Male	518	(49.6)
Female	526	(50.4)
Religion		
Orthodox	990	(94.8)
Moslem	25	(2.4)
Protestant	17	(1.6)
Catholic	12	(1.1)
Ethnicity		
Kafa	808	(77.4)
Amhara	208	(19.9)
Oromo	23	(2.2)
Other	5	(0.5)
Occupation of Head of household		
Farmer	938	(89.8)
Trader	69	(6.6)
Employee	30	(2.9)
Other	7	(0.7)
Literacy status of the mother		
Illiterate	676	(64.8)
Read & write	56	(5.4)
Primary	235	(22.5)
Secondary	70	(6.7)
Secondary+	7	(0.7)
Literacy status of father		
*Illiterate	420	(40.2)
Read & write	65	(6.2)
Primary	356	(34.1)
Secondary	175	(16.5)
Secondary+	24	(2.3)

* Total in this category is only 1040 (Literacy status was not known for four fathers).

The gross goiter prevalence among the study subjects measured by palpation was 27.4% {95% CI = (24.7, 30.1)}. The prevalence of goiter in the three schools were 146 (42.0 %) {95% CI = (36.8, 47.2)} in Shomba kuri, 82 (23.6%) {95% CI = (19.1, 28.1)} in Mera and 58 (16.7%) {95% CI = 12.8, 20.6)} in Abera Yuda primary schools. The prevalence of goiter in Shomba kuri was significantly higher than that of the other schools (P< 0.001) (Table 2).

Using the epidemiological model described earlier the prevalence of goiter in the community was calculated and found to be 16.7%. The rate of cretinism and other milder disorders of IDD were estimated to be one and three out of 1000 persons respectively. The annual toll of reproductive losses attributable to iodine deficiency was estimated from the cretinism prevalence as neonatal deaths of 0.6, still births of 0.7 and miscarriages 0.9 out of 1000 live births in the community.

The prevalence of goiter was higher in females, 184 (35.0%) {95% CI = (30.9, 39.1)} than in males 102 (19.7%) {95 % CI = (16.3, 23.1)} making the male to female ratio for total prevalence of goiter to be 1:1.8. This difference is statistically significant (P < 0.001).

Table 2: **Prevalence of goiter prevalence by study site, Kafa Zone, January 2003**

Name of school	(%) of cases	95%CI
Mera (n=348)	23.6	19.1, 28.1
Abera Yuda (n=348)	16.7	12.8, 20.6
Shomba duri (n=348)	42.0	36.8, 47.2
Total	27.4	24.7, 30.1

Altitude is in meters above sea level

Discussion

The prevalence of goiter in this study is 27.4% which is lower compared to the studies in Ethiopia and elsewhere (1,6,13,15). However, the present finding is almost equivalent to that of the Chebona Gurage (29.3%) and higher than that of Selale (16.4%) (1). Using the epidemiological model mentioned earlier the prevalence of goiter in the community is estimated to be 16.7% which is nearer to the prevalence in the household members reported in the nationwide survey (18.7%) (1) but lower than that of Tanzania (22%) and Ecuador (30%) (13).

Among the socio demographic variables the female sex was found to be highly associated with goiter this is consistent with other studies (1, 15).

The rate of cretinism as estimated from the prevalence of goiter in the community was found to be 1/1000 persons which is low compared to the Seka Chekorsa district (10/1000 persons) (6) and reports from Tanzania, Ecuador and Zaire with the rates of 6.6, 7 and 6.2 per 1000 persons respectively (13). However, it is similar to the national value which is 1.03/1000 persons. Rate of cretinoid (mild to moderate IDD) estimated from rate of cretinism was 3/1000 persons. This is consistent with the national figure (1), but low compared to that of Seka Chekorsa (6).

The nnual toll of reproductive losses estimated from the rate of cretinism was 0.9 miscarriages, 0.7 stillbirths and 0.6 neonatal deaths out of 1000 live births. The finding was low compared to 9 miscarriages, 7 still births and 6 neonatal deaths of the Seka Chekorsa district (6) and 3.2

miscarriages, 2.8 still births and 2.6 neonatal deaths of the nation (1).

The prevalence of goiter was found to be significantly different in the schools studied. Different studies documented that IDD is more prevalent at higher altitudes than lower ones (1). This study however showed the prevalence of IDD to be higher at lower altitudes. Although goitrogens (1, 7- 9), nutritional deficiencies and environmental factors (4) are also implicated to contribute to the development of IDD, it is beyond the scope of this study to discuss on the influencing factors.

Some children might have not been enrolled or might have dropped out of school due to social stigma created by goitre and its sequellae. This might have underestimated the prevalence and could be taken as a limitation of this study.

In conclusion this study showed that IDD is a major public health problem in this community. Goiter was significantly higher among females than males. Moreover, goiter was found to be more prevalent at lower altitude in this study. Therefore further study should be conducted using larger sample to verify factors influencing IDD in this part of the country. Continuous concerted efforts should also be made to strengthen information education and communication (IEC) activities need to be undertaken in order to create awareness about the detrimental effects and prevention of IDD, and encourage iodated salt consumption.

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