ORIGINAL ARTICLE

Prevalence of goitre and its associated factors in a coastal district of Karnataka

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Abstract

Context: Iodine deficiency Disorders (IDDs) are a major public health problem globally. In India more than 200 million are at risk for this disorder. It affects people of all ages and both sexes. The mental impairment caused by IDD especially in children is an important consequence of IDD. **Aim:** To find the prevalence of IDDs and the associated factors with it. **Settings and Design:** A school based cross – sectional study. **Methods and Material**: The study was done in Udupi district of Karnataka using a pretested, semistructured questionnaire. The villages of the three talukas (Udupi, Kundapur and Karkala) of Udupi district were sampled according to Probability Proportionate to Size (PPS).One school was chosen for the study from each of the 30 selected villages. Minimum of 90 students were selected from each school. Salt and urine samples were collected for Iodine estimation from a sub sample. Goitre was graded according to WHO/UNICEF/ICCIDD criteria. **Results:** A total of 3023 children were examined (M = 49.1%, F = 50.9%). The prevalence of goitre in Udupi district was 19.8%. The prevalence of goitre was found to be more amongst females compared to males (p = 0.021) and also was found to be increasing with the increasing age (p = 0.003). Of the 539 salt samples analyzed 23.7 % were inadequately iodized. Education of the father, fish consumption and occupation of the mother were found to be significant predictors of goitre. **Conclusions:** Goitre is a public health problem in Udupi district of Karnataka. The adequately Iodized salt coverage which should have been more than 90 % is not fulfilled. More awareness is required amongst the people about IDDs and its predictors.

Key Words

Goitre, salt Iodine content, children, urine Iodine estimation.

Introduction

Iodine deficiency Disorders (IDDs) are a major public health problem globally. About half of the Iodine in the diet absorbed is used for thyroid hormone synthesis which has a major role in the metabolism in the body. Low levels of these hormones lead to retarded growth, stunting, poor development, paralysis of muscles.(1) IDD affects people of all ages, both sexes and those belonging to different socio-economic classes. However, of far greater importance is the mental impairment caused by IDD that reduces intellectual capacity especially in children. Though easily preventable, Iodine deficiency is the world's most prevalent cause of brain damage.

Globally more than 1.5 billion people are at risk of this disorder. More than 71 million people are affected by IDD in India while more than 200 million people are at risk. Not even a single state / Union Territory in India is free of this disorder. Of the 325 districts surveyed in India so far, 263 districts are

IDD-endemic, i.e. the prevalence of IDD is above 10 per cent in the population.(2)

The most effective and inexpensive way to prevent IDD is by consuming iodated salt daily. For this the Government of India launched the National Goitre Control Programme in the year 1962, which was renamed as National Iodine Deficiency Disorder Control Programme in 1992.(3)

In the past goitre was considered to be a disease of hilly region and was not expected to be found in the coastal areas but many studies done have reported otherwise. Many new areas beyond the hilly terrain were found to be endemic with goitre. Although the government of India made Iodization of salt mandatory however in many parts of the country Iodized salt is not available and some even if available people choose to use un-iodized salt. This study was undertaken with the objective to find the prevalence of goitre in a coastal district of Karnataka and find the factors associated with it.

Aims & Objectives

This study was undertaken to find the prevalence of goitre in a coastal district of Karnataka and its associated factors.

Material and Methods

Approval for the study was obtained from the Institutional Ethics Committee and from the Deputy Director of public instructions (DDPI), Udupi District. The survey was conducted during the months of February and March, 2014. A total of 3023 children were recruited for the study. Selection of students was done as per the government guidelines for assessing IDDs.(4)

The list of all the villages of the district with the latest population census (2011) was obtained from the District Health Office. A sample of 30 villages was selected from the entire district by PPS (Probability proportionate to size). Of the 30 villages selected, 15 were from Udupi, (11) from Kundapur and 4 were from Karkala. One school was then randomly selected from each of the 30 villages. The non enrollment and dropout rate in the villages was found to be 0.5%. Hence the school dropouts were not included and a house to house survey was not needed.

Inclusion criteria: Students in the classes 1st to 7th standard from the selected schools were enrolled in the study.

Exclusion criteria: A village was excluded when all the schools put together in that village had a strength less than 90 children. Also a school with strength less than 30 was excluded from the sampling frame.

Selection of the children: The selected schools were visited twice. During the first visit, the list of children from the 1st to 7th standard was obtained from the school register and 12-14 students were selected randomly from each class ensuring equal gender distribution to reach a minimum 90 students. The team went to each classroom and briefed the class about the study. The subject information sheet and the consent forms were handed over to the children and were requested to show it to their parents and get their signature if they agree to their child's participation in the study. Of the students selected, 20 students from each class were given air tight plastic containers and asked to get approximately 2 tablespoons of salt used for cooking at home the next day. A few extra students were also selected in case of absenteeism on the day of data collection.

During the second visit the next day, all the selected students were subjected to clinical examination. Of the 20 children picked for salt samples, every alternate child was requested to provide 5ml urine sample in an air tight plastic container for Urinary Iodine testing.

Goitre was assessed clinically by physical examination and graded as per the recommended criteria of WHO/UNICEF/ICCIDD:

No goitre: No palpable thyroid

Grade 1: Thyroid palpable but not visible.

Grade 2: Thyroid visible with the neck in normal position.

Results

A total of 3023 children were examined in the survey of which 1483 (49.1%) were males and 1540 (50.9%) were females in the age group of 6 to 12 years. The overall prevalence of goitre in Udupi district was found to be 19.8%.

Table 1 illustrates the age and gender distribution of the children based on goitre grading. The prevalence of goitre was found to be consistently higher amongst the females compared to the males. The difference was found to be statistically significant ($\chi 2 = 5.362$, $p = 0.021$). Also the prevalence of goitre was increasing with the growing age. The difference was found to be statistically significant ($\chi 2 = 13.901$, $p = 0.003$).

A total of 569 salt samples were collected from the students and analyzed for the Iodine content. Of the salt samples analyzed 135 (23.7%) samples had Iodine content less than the recommended (< 15 ppm) and 433 (76.1%) salt samples had adequate amount of salt Iodine content (> 15 ppm).

The median urinary Iodine excretion (UIE) values according to age groups are shown in Figure 1. Urinary iodine estimation was done for 343 urine samples and median value was 109.3 mcg/dl. The median Urinary Iodine excretion for boys and girls was 102.47mcg/dl and 113.66 mcg/dl respectively.

On univariate analysis poverty, type of diet, fish consumption, salt storage in a open container or a close container, mother's and father's literacy along with occupation of mother were identified to be significantly associated with goitre ($p<0.2$) (Table 2). Distance of the salt from the cooking area, type of cooking salt- rock salt or powdered salt, history of goitre in family member, fathers occupation, type of family and religion were not found to be associated with goitre.

In Multivariate analysis, education of the father, fish consumption and occupation of the mother were found to be significantly associated with goitre ($p<0.05$) (Table 3). Approximately 0.4% children had missing data for one or the other variables.

Discussion

IDD has been declared as a public health problem since the 1950s in India. After the study done in Kangra Valley region, Himachal Pradesh, it was accepted that salt Iodisation is a cost effective intervention for reducing the prevalence of goitre. Following it, the Government of India launched the National Goitre Control Programme in 1962.3 Many studies have been done to assess the prevalence of goitre post introduction of iodisation in the country. Kamath R *et al* during 2006 assessed the prevalence of goitre as 16.6 % amongst the general population in Belgaum district.(5) A study done in Chamrajnagar, Karnataka, amongst 6 to 12 year school children in 2013 showed the prevalence of goitre to be 7.74 %. (6) Similar to the previous result the present study assessed the prevalence as 19.8 % in Udupi district making it an endemic district and a public health problem in accordance with the WHO guidelines (Iodine deficiency a public health problem if the prevalence is more than 10%). (7)

Zama *et al*. assessed the prevalence in Chamrajnagar in 2013 and found increasing prevalence of goitre with increasing age with a dip in students of class II.6 Rao *et al*. did the study in a coastal district of Karnataka and found that the prevalence of goitre amongst female children was higher (31.2%) compared to the male children (28%).8 A study in Chandigarh in 2011 showed that the prevalence of Goitre was more amongst girls (17.2 %) than in boys (13.8%).9 The present study is in conformity with the above results. The prevalence of goitre was more in females in each age group ($p = 0.021$). Also the prevalence of the goitre was found to be increasing with increasing age except for a dip in the age group of 8 to 9 years ($p = 0.003$).

Iodine in our body is required for synthesis of Thyroid hormone. Iodine from the Gastro Intestinal Tract is absorbed and utilized for the synthesis of the thyroid hormone and the remaining is excreted out in the urine. Estimation of this Iodine in the urine is a good measurement of iodine uptake. According to the WHO guidelines, iodine deficiency is a public health problem if the median UIE is less than 100 mcg/dl. (7) In our study the median UIE was 109 mcg/dl. The median UIE according to the different age group (Figure 1) showed that Iodine excretion level were low in the age group of 8 to 9 and 12 years. The prevalence of goitre is high even though the urinary Iodine excretion is sufficient. This could be probably due to the presence of goitrogenic substances in the diet or due to manifestation of physiological goitre during puberty. A study done in Jamnagar district in 2009 amongst children of 6 to 12 years of age had a median urinary Iodine excretion of 80 mcg/dl indicating Iodine deficiency. (10) A study done by Kapil *et al*. had shown that 86 % districts in India had UIE more than 100 mcg/dl. (11)

Since the 1950s Iodine deficiency disorder has been a recognized public health problem for the world and the country. Many steps have been taken to curb down the problem. Government of India (GOI) advocated Iodised salt since 1983. By 1997 the sale of non – iodized salt was prohibited under the Food Adulteration Act, 1954. (2) The recommended level Iodine in the salt is > 15 ppm at the consumer level.7 Many studies have been done to estimate the number of households using adequately iodised salt. The target of supplying adequately iodised salt is to >90% of the population. In our study 23.7 % of the

population were using less than recommended Iodine content salt. Similar results were seen in recently done studies in Chamrajnagar district and Belgaum district which found inadequately iodised salt being used by 28.42% and 50 % of the families respectively. (5,6) Also in Bhubaneshwar 49% of the households were consuming salt with Iodine <15 ppm. (12) Another study done in Eastern UP showed that 16.6 % of the population were not using adequately Iodised salt. (13) According to the study done by Pandav *et al*. 71 % of the population are utilizing adequately Iodized salt. (2) All these results show that there is a need for a targeted approach for better reach of adequately iodized salt to the population, strict action against the use of non iodized salt, and more collaboration between various departments to reach out to the problem.

Amongst the various risk factors, literacy of the father was found to be statistically associated. Goitre was 1.3 times more likely to be associated with a child of less literate (illiterate or education less than middle school) father compared to a child of an educated father. This could be due to more awareness about the importance of iodised salt in the educated father. The other reason could be more education means better job opportunities, better buying capacity and better goitre control although the socio economic factors according to the APL status or BPL status was not found to be significant. Occupation of mother was also found to be significantly associated with goitre. Children with working mother had a 0.23 times less likelihood of having goitre compared to children whose mother was a housewife. This could be attributed to a better knowledge and a better buying capacity of the mother to buy iodized salt.

Children not eating fish had a 0.27 times less likelihood of having goitre compared to children consuming fish. The result is in contrast to the previously published results which showed fish to be having a protective effect on goitre. (14,15) It is known that both excess and deficient Iodine consumption is associated with an increase risk of the disease in the population. (16) The other dietary factors which could have been associated with goitre or interfered with Iodine utilization by the thyroid gland were not collected and was a limitation of our study. More research in this area could be taken up in the future.

Conclusion

Iodine deficiency disorder is a public health problem in Udupi district. Adequately Iodised salt is still not being used by >20 % of the population. The literacy status of the parents and socio economic status had a bearing on the goitre status of the children.

Recommendation

Awareness regarding proper storage of salt to retain the iodine content needs to be imparted to the people. The dietary pattern and environmental effects which could interfere with Iodine absorption or proper utilization of Iodine by the body needs to be assessed.

Limitation of the study

Being a school based study, there were certain factors like a detailed dietary history and household salt storage, that could not be quantified and which could have had a bearing on iodine deficiency.

Relevance of the study

Even though goitre continues to be a public health problem yet the various factors which interferes with managing the problem still remain obscured. This study was an attempt to find what further steps could be taken to tackle the problem besides Iodisation of salt. Although the government has made sale of Iodised salt mandatory, the ignorance of the community regarding proper storage and utilization of the Iodised salt still continues. This needs to be corrected.

Authors Contribution

The work is an intellectual contribution of the entire team. Veena Kamath and George Jacob have been instrumental in working out the methodology and report writing, Asha Kamath has worked on the statistical aspects and data analysis of the study, Ayushi Agrawal has contributed towards data collection and report writing, Revathi Shenoy has been responsible for biochemical analysis of salt and the urine samples.

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Tables

TABLE 1 AGE AND GENDER DISTRIBUTION OF GOITRE

Age group	Gender	Grade 0		Grade 1		Grade 2		Total goitre	
6-7	Female	260	78.5%	64	19.3%	7	2.1%	71	21.5%
	Male	261	82.3 %	48	15.1 %	8	2.5%	56	17.7%
8-9	Female	305	82.9%	59	16.0%	4	1.1%	63	17.1%
	Male	300	83.3%	52	14.4%	8	2.2%	60	16.7%
10-11	Female	388	77.3%	92	18.3%	22	4.4%	114	22.7%
	Male	388	83.4%	62	13.3%	15	3.2%	77	16.6%
12	Female	232	74.1%	67	21.4%	14	4.5%	81	25.9%
	Male	231	76.0%	64	21.1%	9	3.0%	73	24.0%
Total	Female	1204	78.4%	282	18.5%	47	3.1%	329	21.9%
	Male	1210	81.8%	226	15.5%	40	2.7%	266	18.0%

TABLE 2 UNIVARIATE ANALYSIS: SIGNIFICANT CORRELATES FOR GOITRE ON UNIVARIATE ANALYSIS

Variable	Total	Goitre n (%)	Crude OR	95% CI
Poverty				
APL	873	149 (17.06%)	1	1.063 - 1.061
BPL	2126	450 (21.26%)	1.305	
Type of diet				

Mixed	2692	551 (20.46%)	1	0.977 - 1.831
Vegetarian	316	51 (16.13%)	1.337	
Fish consumption				
Yes	2637	545 (20.66%)	1	0.512 - 0.933
No	367	56 (15.25%)	0.691	
Salt storage				
Closed container	2754	527 (19.13%)	1	1.246 - 2.219
Open container	255	72 (28.23%)	1.663	
Mother's education				
Educated	1329	232 (17.45%)	1	1.107 - 1.596
Illiterate	1668	366 (21.94%)	1.329	
Father's education				
Educated	1500	338 (22.76%)	1	1.184 - 1.700
Illiterate	1485	258 (17.37%)	1.419	
Occupation of mother				
Housewife	2573	493 (19.16%)	1	0.568 - 0.917
Working	433	107 (24.71%)	0.722	

TABLE 3 SIGNIFICANT CORRELATES FOR GOITRE ON MULTIVARIATE ANALYSIS

Variable	Total	Goitre n (%)	Adjusted OR	95% CI
Father's education				
Educated	1500	338 (22.76%)	1	1.147- 1.657
Illiterate	1485	258 (17.37%)	1.379	
Fish consumption				
Yes	2637	545 (20.66%)	1	0.533 – 0.980
No	367	56 (15.25%)	0.723	
Occupation of mother				
Housewife	433	107 (24.71%)	1	0.604 - 0.984
Working	2573	493 (19.16%)	0.771	

Figures

FIGURE 1 BOX PLOT - MEDIAN URINARY EXCRETION ACCORDING TO AGE GROUP