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Environmental Iodine Deficiency and Goiter Prevalence in A Block Area of The North Eastern Region: A Retrospective Analysis

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INTRODUCTION

Endemic Goiter, the best known and easily recognizable form of iodine deficiency, have been recognized for centuries. India is one of the major Endemia of goiter in the world. Reports published in 1996 stated that about 167 million persons were at risk of IDD in India including the 54 million with goiter, 2.2 million with cretinism and 6.6 million with mild neurological deficits. No state in the country was believed to be free from Iodine Deficiency Disorders (ICMR Bulletin, Vol.26, June,1996). Though considerable progress has been achieved in minimising the ravage caused by Iodine Deficiency Disorders through implementation of National IDD Control Programme yet Goiter remains as an enigma to the Public Health Scientist.

The Northeastern region of India is famous for its diverse ecology and distinct culture and lifestyle specific to different ethnic groups. Newly emergent foci of iodine deficiency disorders was encountered in different places reported from increasing number of outpatient attending cases of goiter in various Primary Health Centres of this region specifically in Assam (Patowary 1985). But no systematic study was undertaken to explore the iodine deficiency disorder status of this region. It was therefore decided to carry out a survey in a selected area to determine the magnitude of the problem of endemic goiter and other associated forms of IDD together with some aetiological factors potentially responsible for the goiter in this region.

MATERIAL AND METHOD

Study Area: The area selected for the study is a Community Development block situated at a distance of 45 Km from Guwahati city in Assam. It is a valley between the offshoots of the Chilarai Hills and is traversed by the river Puthimari, a Northern tributary of the river Brahmaputra along with other rivulets. The average rainfall of the area is 2312 mm annually.

Study Sample: The percent sample of the villages was drawn at random and thus 8 villages were selected for the present study. Every 4th family of each village was surveyed and all the family members were interviewed and clinically examined using pretested questionnaire. Total population examined in the study was 1424 distributed in 170 families, which constituted more than 1% of the total. Grading of goiter was done as per Criteria laid down by WHO 1979 and PAHO 1984 (Dunn et al., 1984).

Study Duration: The duration of the study was two years and was completed in the end of 1991.

Grading of Goiter

• Grade	O:	No goiter
• Grade	Ia:	Goiter detectable only by palpation and not visible when neck fully extended.
• Grade	Ib:	Goiter visible when neck fully extended and palpable.
• Grade	II:	Goiter visible when neck in natural position
• Grade	III:	Very large goiter visible from a considerable distance.
• Grade	IV:	Monstrous goiter.

Modification of Goiter grading in 1992 stated that a) Grade 0: Thyroid neither palpable nor visible. b). Grade 1: Thyroid palpable but not visible with neck in normal position c). Grade 2: Thyroid palpable and visible with neck in normal position (document WHO/NUT/94.6, WHO 1994).

Estimation of Laboratory Parameters: 3 c.c. each clotted blood was collected from twenty persons of the studied population at random for estimation of circulating T_3 and T_4 hormone. After separation of serum as per procedure specimen was transferred to RIA Laboratory BARC, Dibrugarh. Estimation was done by Radio Immu-ne Assay technique. Twenty numbers of casual urine samples at random were collected and transferred to Regional Medical Research Centre, NE Region (ICMR), Dibrugarh for estimation of urinary excretion of Iodine. Estimation was done by the

method prescribed by ICMR (Project Manual, ICMR, 1983-1985). Sixty samples of water from various drinking water source was collected and also carried to Regional Medical Research Centre, NE Region(ICMR), Dibrugarh for estimation of Iodine in water which was done by the method prescribed by ICMR. Forty-eight samples of Soil from different samples were collected as per procedure and was carried to RMRC for estimation of Iodine in soil. Estimation was done at National Institute of Nutrition, Hyderabad by the Iodine-Kinetic Method after Alkali extraction.

RESULTS

Of the 1424 individuals interviewed and examined there were 746 males and 678 females. 64.82% were unmarried. Agriculture is the main occupation (48.68%) of the target population. Overall prevalence of goiter (TGR=Total goiter rate) was 33.8% of which visible goiter rate (VGR) was 5.82%. 19.8% of the goiter cases were of Grade Ib and 8.21% were of Grade Ia goiter. Out of the visible goiter's 5.12% were of Grade II, 0.63% of Grade III and only 0.07% were found to be in Grade IV Goiter. The highest prevalence of goiter was seen in the age group of 14-19 years with female preponderance (Fig. 1 and 2). Nodularity was detected in 12 goiter cases of grade II, Grade III and Grade IV out of which three were multinodular goiter one in each of Grade II, Grade III and Grade IV Goiter cases. One case each of Cretinism, hypothyroidism and hyperthyroidism was detected in the study population.

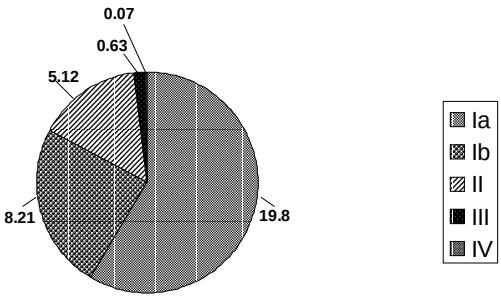

Fig. 1. Gradewise prevalence of goitre in the Study population

Results of Urinary Iodine Excretion Level and Hormone Estimation

The mean urinary iodine excretion level was 48.03 microgram/g of Creatinine in the sampled population.

Serum hormone level had shown euthyroid status of thyroid gland except in three cases. In one Grade Ib 15 years male goiter case the T_3 and T_4 levels were below normal (T_3=0.8mg/ml, T_4=4.7mg/% and in another case of 23 years female with Grade II goiter both the hormone levels were subnormal (T_3=0.44mg/ml and T_4=1.3mg/%). Clinically these two cases showed signs of Cretinism and hypothyroidism. In one 52 years female having Grade IV goiter hormone levels were above normal limit (T_3=2.40mg/ml and T_4=15.0 mg/%). This case was clinically detected as hyperthyroidism.

Awareness of Goiter: Knowledge of goiter was present in all the studied families. Water as the

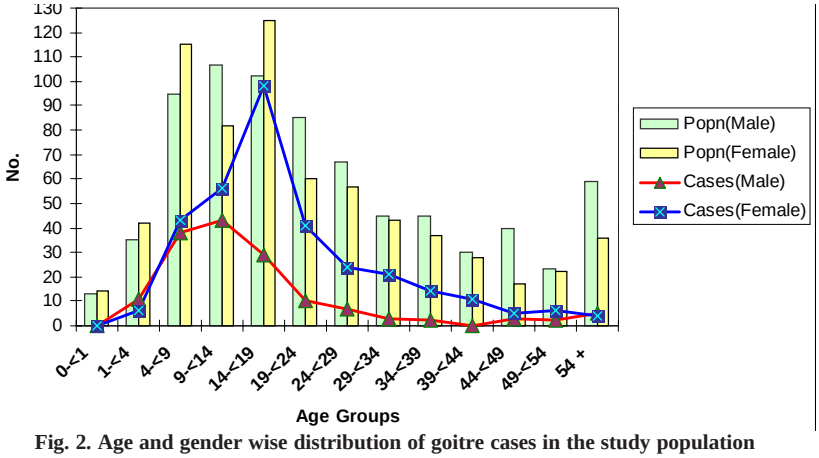

Fig. 2. Age and gender wise distribution of goitre cases in the study population

cause of goiter was perceived by 85.64% of the families, 9.57% families thought it was due to germs while another 4.79% thought food as the cause of goiter. Majority (91.49%) of the head of the families did not consider goiter as a health problem. 97.3% of the head of the families had no knowledge about iodisation of salt during the study period. Only 28.21% of the goiter cases were aware of their presence of swelling.

Environmental Iodine Status: Average iodine content in water in the study villages was 0.745 microgram/Ltr. A very weak association was noticed between water iodine level and prevalence of goiter ($p \leq .05$). Average iodine content in soil in the study villages was 1ppm. Weak association was observed in between soil iodine and prevalence of goiter in the study area ($p \leq .05$).

DISCUSSION

Endemicity of Goiter denotes prevalence in a defined population exceeding ten percent and the excess is about invariably demonstrably due to iodine deficiency (Stanbury 1987). Endemicity of goiter in the study area was evident from the prevalence rate of 33.8% which was much higher than the WHO Criteria (SEARO Regional Health Papers No.10 WHO, 1985). Age and gender distribution of goiter was similar to other contemporary surveys conducted by different investigators in the Sub Himalayan region (Ramalingaswami, 1973; Sengupta et al., 1968; Dudani et al., 1978). The high prevalence of goiter in the age group of 14-19 years female was attributed to the increase physiological demand at puberty and pregnancy. Thily et al. (1972) in their study reported that goiter prevalence increases in both sexes in the same way from birth to adolescence when it reaches a model peak. In the goitrous region prevalence attained 80% in men and 90% in women in the age group of 15-29 years (Thilly et al., 1972). Presence of nodules in the higher grades of goiter was due to reduced iodine intake for prolonged period. Nodularity detected in the study in 12 goiter cases belonged to Grade II, III and Grade IV of which three were multinodular goiter's. Similar findings were observed in Ghodegaon, Maharashtra where thirteen cases of goiter with solitary nodule and five multinodular cases among 960 goiter cases were detected (Dudani et al., 1978). Low urinary iodine excretion level not only reinforces the clinical criteria of endemicity of goiter but also shows the characteristic features of Endemic goiter due to iodine deficiency. Our observation in urinary iodine excretion of 48.03 mcg/g of Creatinine reflected the endemicity of goiter in that region. Ramalingaswami et al. (1961) in their study amongst the school children of Sub-Himalayan region observed low excretion of iodine i.e. below 40 mcg/g Creatinine where the prevalence of goiter was between 55-100% (Ramalingaswami et al., 1961). In another study at Andhra Pradesh urinary iodine excretion value was estimated as 50 mcg/g Creatinine in a group of children aged 0-12 years where the prevalence rate varied from 8.2%-52% (Desai et al., 1987). Serum thyroid hormone level showed euthyroid status of thyroid gland except in three cases in the study. Out of these 3 cases in one Grade Ib male goiter case both T_3 and T_4 hormone levels were lower than normal. In another Grade II female goiter case T_3 and T_4 values were subnormal. In the only Grade IV case hormone levels were above the normal limit. Chopra and Hershman et al from their study in some regions of New Guinea indicated that Serum T_4 may be low in subjects from endemic goitrous region but Serum T_3 was maintained within range or even it may be higher than the range of values observed in non goitrous region (Chopra et al., 1975). Usually in an endemic area preferential secretion of Triodothyronine(T_3) is more whereas Thyroxine (T_4) secretion may be normal or reduced. The usual picture of an endemic area was not visualized in this study from the hormone levels probably due to low sample size estimation of thyroid hormones.

Iodine deficiency in an area is mainly judged from iodine content of soil, level of iodine in drinking water source and iodine content of food grown in that soil. Average iodine level in drinking water in the study area was 0.745 mcg/L where the total goiter prevalence was 33.84%. Ramalingaswami et al. (1961) in their study in Sub Himalayan region observed extremely low value of iodine in drinking water. No value was higher than 3 mcg/L (Ramalingaswami et al., 1961). Dudani and Natu reported iodine content of water ranging from 1.6-1.8mcg/L where goiter prevalence was 0.83% to 32.50% (Dudani et al., 1978). In a study conducted in Gangetic belt authors reported a range of 1.52±0.38 mcg/L iodine level in drinking water where the prevalence of goiter was 25.5% (Agarwal et al., 1987). Mean soil iodine level in the area was 1ppm.

Agarwal et al. (1987) in their study at Ramanna village in the Gangetic belt found soil iodine level of 1.46±0.93ppm where goiter prevalence was 25.5% (Agarwal et al., 1987). Though a deficiency was observed regarding knowledge of salt iodisation and health problems related to goiter yet the people of the area had better knowledge of presence of swelling in their neck. While 28.21% of the goiter cases had knowledge of swelling in their neck in this study, only persons with Grade III goiter were aware of neck swelling in a study conducted by Sathe and Dandre (1975).

CONCLUSION

Environmental iodine deficiency was the mainstay of high goiter prevalence in the study area. Frequent flooding and change of river course attributed to the major causes of iodine depletion in the soil of the region. Though embankments over both banks of river Puthimari was constructed long back yet there was inundation of many villages by the yearly flood due to either breach of embankment or backflow from the confluence of the tributary and the main river. Drinking water source of the population in the study was tube-wells. It was observed that in the villages nearest to the river Puthimari tube wells were like artesian wells with automatic flow of water all the year round. Pollution of drinking water is also related to intensity of goiter. Mc Carrison from his extensive study in Gilgit area and Ramalingaswami et al from their studies in Sub Himalayan region proved that the existence of Endemic goiter in these regions were though due to Environmental iodine deficiency yet they did not disclaim the role of polluted drinking water in the causation of goiter (Mc Carrison, 1906; Ramalingaswami, et al., 1961). Kelly and Sneeden in their study on prevalence of endemic goiter mentioned bacteriological impurity in drinking water acting as goitrogenic agent and raising the bodily demand of iodine (Kelly et al., 1960). The study area might be prone to the affects of contamination and hardness of water playing important role in Thyroid Enlargement. Consumption of goitrogeneous foodstuffs acting as an aetiological agent for goiter in the area could not be ignored. Hence an extensive study including food iodine estimation was the need of that hour.

Assessment of current iodine nutrition status with a resurvey of the area will be necessary to know the effective implementation of universal salt iodisation and its impact on the people of that area.

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KEYWORDS Environmental Iodine Deficiency. Goiter. Iodine Nutrition Status

ABSTRACT A study was conducted in a Community Development Block area, a valley between the offshoots of the Chilarai Hills, situated at a distance of 45 Km from Guwahati city. Eight villages were selected in the block for the study and family members of every 4th family of each village was interviewed and clinically examined for goiter. Total numbers of individuals examined were 1424. Overall goiter prevalence (TGR=Total goiter rate) was 33.84% of which visible goiter rate was 5.82% (WHO 1979 and PAHO 1984 classification). Age prevalence of the goiter was highest in 14-<19years with female preponderance. Single case each of Cretinism, Hypothyroidism and Hyperthyroidism showing correlation with the results of circulatory thyroid hormone was detected in the target population. 97.3% of the head of the families were not aware of salt iodisation. Majority (91.49%) of the head of the families did not consider goiter as a health problem. Mean urinary iodine excretion level was 48.03 microgram/g of Creatinine in the sampled population. Average water iodine level in the study area was 0.745 microgram/L of drinking water. Mean iodine content of soil in the study area was 1 ppm. Assessment of current iodine nutrition status of the population is essential to know the effective implementation of salt iodisation in the locality.

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