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Prevalence, risk factors and family pedigree studies of endemic goitre in Lalmonirhat, Bangladesh

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Abstract: With an aim to assess the prevalence, risk factors and family pedigree of endemic goitre in Durgapur Union under Aditmari Upozilla, Lalmonirhat district, Bangladesh, a total of 10,000 people were surveyed at random. Fifty nine persons were detected to have goitres of either one of the three principal patterns, thus suggesting an incidence of 0.59% goitrous people in the study area. The incidence of uni-nodular goitre was the highest (45.80%) in comparison with the diffuse (39.90%) and multi-nodular (15.30%) goitres. The probable risk factors included sex, where 84.72% females were affected compared to only 15.30% males. Age group of 21-25 years was found to have the highest goitre frequency (20.30%) while the 41-above age group had the lowest (5.10%). Housewives were found to have the highest frequency of goitres (42.40%) in comparison with the teachers who had the lowest frequency (1.70%). In relation to the regions of living, the frequency of the goitrous people was higher (62.70%) among those who lived beside the river, compared to those who resided in plan lands (37.30%). Goitrogenic vegetables such as cabbage had the highest frequency of 67.80%, while cauliflower had a moderate (18.60%) and peanut had the lowest (13.60%) frequency. Among 59 affected persons, only 10 (16.90%) used to take iodized salt, 43 (72.90%) non-iodized salt, and the remaining 6 (10.20%) used to take both iodized and non-iodized salts. Intake of edible oils was also found to have some effects on the incidence of goitre in the area under study. Goitrous people who used to take mustard oil in a regular basis were much more affected (52.50%) than those who used soybean oil (47.50%). It is obvious from the present survey that goitre is not a hereditary disease because goitrous fathers and mothers did not inherit the defects into their offspring.

Key words: Goitre, prevalence, risk factors, pedigree study, thyroid glands.

Introduction

Goitre (L. *gutteria*) is a swelling in the neck resulting from an enlarged thyroid gland. The thyroid gland is located in the anterior throat. It is a butterfly-shaped organ and is composed of two cone-like lobes or wings, *lobus dexter* (right lobe) and *lobus sinister* (left lobe) connected *via* the isthmus. Each lobe is about 5 cm long, 3 cm wide and 2 cm thick. Occasionally a third lobe called the pyramidal lobe is attached to the thyroid gland (Hedzec, 1973). The goitre is conical shaped and extends from the upper part of the isthmus, across the thyroid cartilage to the hyoid bone. The pyramidal lobe is a remnant of the foetal thyroid stalk or thyroglossal duct, which is also known as Lalouette's pyramid (Elnour *et al*., 2000).

Having goitre does not necessarily mean that thyroid gland is not working normally. Even when it is enlarged, thyroid may produce normal amount of hormones. A number of factors can cause thyroid gland to enlarge. Among the most common are: iodine deficiency, over-active thyroid (hyper-thyroidism), under-active thyroid (hypothyroidism), pregnancy and inflammation from infection or tumours (Bahn *et al.*, 2011). Apart from these, however, goitre may result from other conditions such as Grave's disease (Burch & Cooper, 2015) and Hashimoto's disease (Shoenfeld *et al*., 2010; Moore & Wilkinson, 2009).

Regarding morphology, goitres may be classified either as the growth of the nodule or as the size of the palpation (Frilling *et al,2004 & Gandolfi et al,2004)*. According to the growth of the nodule, uni-nodular (single nodule), multi-nodular (multiple nodules) or diffuse (whole goitre appearing to be enlarged) goitres are recognized in goitrous patients. Depending on the size of the palpation, Class I (goitre not seen in normal posture), Class II (palpable goitre is seen easily) and Class III (goitre is very large and retrosternal, meaning that pressure results in compression marks) goitres can be identified. In addition, INFS (Institute of Nutrition and Food Science) programmed categorizes goitres into Grade 0 (normal), Grade 1 (goitre visible when the neck is extended), Grade 2 (goitre visible when the neck is in normal position) and Grade 3 (goitre

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is visible from a considerable distance).

Goitre is one of the important health problems in Bangladesh as revealed from three major surveys: (1) East Pakistan Nutrition Survey of 1962-64, (2) National Goitre Prevalence Study of 1981-82, and (3) National Iodine Deficiency Disorders Survey in Bangladesh, 1993. The prevalence of goitre in the country was recorded to the extent of 20%, 10.5% and 47.1% respectively from the above surveys (Yusuf *et al*, 1994). Gradually, the number of goitre patients increased to 73.5% in the country (Alam & Moslem, 1998). In two Unions of Dewanganj thana under Jamalpur district, the prevalence of endemic goitre was related to the knowledge, attitude and practice regarding iodized salt among the population (Chowdury *et al*., 2002).

A survey was conducted by Yusuf *et al*. (2008) to monitor the current status of iodine deficiency disorders in children aged 6-12 years and women aged 15-44 years in Bangladesh as measured by goitre prevalence and urinary iodine excretion. Further reports suggest that certain Northern districts, particularly Rangpur, Gaibandha, Nilphamari, and Dinajpur in Bangladesh are considered as goiter-prone areas, where about 11 percent of the population is affected by visible goitre, the prevalence being much higher in females (Banglapedia, 2014). Recently, Badaruddin *et al*. (2015) reported the goitre situation in some villages in Sirajgonj, Bangladesh.

Apart from Bangladesh, Zimmermann & Anderson (2012) assessed the global and regional iodine status where 32 countries were found iodine deficient and globally 29.8% of school-age children (246 million) were estimated to have insufficient iodine intake. In Pakistan, however, Subhan *et al*. (2014) investigated the prevalence of goitre and iodine status among school children in Kohat district, where the palpation method was used to measure goitre grade. The present survey was aimed at estimating the prevalence, risk factors and family pedigree of goitre in Lalmonirhat district of Bangladesh, Durgapur Union under Aditmari Upozilla in particular.

Materials and Methods

The present survey was conducted to estimate the prevalence, risk factors and family pedigree analysis of the endemic goitre in the study area as follows:

Prevalence: The study area comprised Lalmonirhat district in the Northern part of Bangladesh, mainly at Durgapur Union under Aditmari Upozilla. For the survey, 10,000 people were selected at random. The sampling area was divided into 10 blocks, each consisted 1000 persons. The purpose of the study was explained to the subjects who were instructed to keep their heads erect during observations. The presence or absence of the goitre was confirmed by observing the enlargement of thyroid glands in front of the throat and also by noting the upward movement of the enlarged thyroid glands on deglutition. The observed data were recorded for estimating the prevalence of the goitre in the study area, where the subjects were categorized into uni-nodular, multi-nodular or diffuse goitres.

Risk factors: To estimate the probable risk factors for goitre in the study area, the subjects were classified into sex (males and females), eight age groups (from 5 to 45 years, with an interval of 5 years), regions of living (riverside and plain land), six occupations (farmers, teachers, businessmen, housewives, students and workers), intake of vegetables (cabbage, peanut and cauliflower), iodized or non-iodized salts and oils (mustard or soybean).

Family pedigree: To estimate whether the presence or absence of goitre had any relevance to the family members, goitrous fathers, mothers and children were recorded to analyze the family pedigree of the affected persons.

Results

The observed results of the survey have been elaborated in the following paragraphs.

Prevalence: A total of 59 persons were detected to have goitres of either one of the three different patterns. Thus, an incidence of 0.59% goitrous people was recorded in the study area(Table-1). The incidence of uni-nodular goitre was recorded to be the highest (45.80%) in comparison with the diffuse (39.90%) and multi-nodular (15.30%) goitres (Plate-1).

Risk factors: The probable risk factors included sex, where 50 females were affected (84.72%) compared to only 9 males (15.30%), age groups, in which 21-25 years age group was found to have the highest frequency (20.30%) and 41-above age group had the lowest (5.10%)(Table-2), and occupation, where housewives were found to have the highest frequency of goitres (42.40%), in

Table 1 Prevalence of endemic goitre patterns in the survey area according to gender and residence

Gender	Frequency	Residence		Goitre patterns		
		Riverside	Plain land	UN	MN	DF
Males	9	3	6	3	2	4
Females	50	34	16	24	7	19
Total	59	37	22	27	9	23

UN= uni-nodular, MN= multi-nodular; DF= diffuse

Table 2 Prevalence of endemic goitre patterns in the survey area according to age groups

Gender	Frequency	Age groups (yrs)								
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
Males	9	1	1	2	1	0	3	1	0	0
Females	50	3	2	3	4	21	6	8	2	1
Total	59	4	3	5	5	21	9	9	2	1

Table 3 Prevalence of endemic goitre in the survey area according to occupation

Gender	Frequency	Occupation					
		Farmers	Teachers	Business	Housewives	Students	Workers
Males	9	3	1	7	0	2	3
Females	50	2	0	1	25	5	10
Total	59	5	1	8	25	7	13

Plate-1: Uni-nodular (a-b), multi-nodular (c-d) and diffuse (e-f) goiter patterns recorded from Lalmonirhat district, Bangladesh.

comparison with the teachers who had the lowest frequency (1.70%)(Table-3). In relation to the regions of living, the frequency of the goitrous people was higher (62.70%) among those who were found to live beside the river, compared to those who resided in plain lands (37.30%) (Table-1).

Goitrogenic vegetables such as cabbage had the highest frequency of 67.80%, while cauliflower had a moderate (18.60%) and peanut had the lowest (13.60%) frequencies. Among 59 affected persons, only 10 (16.90%) used to take iodized salt, 43 (72.90%) non-iodized salt, and the remaining 6 (10.20%) used to take both iodized and non-iodized salts. Intake of edible oils was also found to have some effects on the incidence of goitre in the area under study. Goitrous people who used to take mustard oil in a regular basis were much more affected (52.50%) than those who used soybean oil (47.50%) (Fig-1).

Family pedigree analysis: It is apparent from the present survey that goitre is not a hereditary disease, because only one goitrous father (n=1) and mother (n=1) did inherit the defects into their son (n=1) (Fig-2).

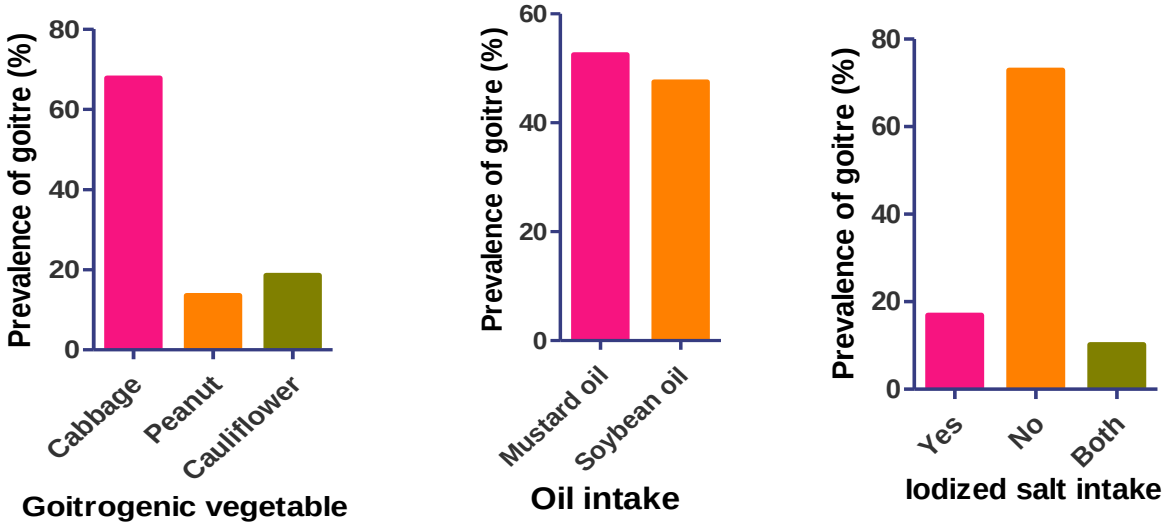

Fig. 1 Effects of intake of vegetables, edible oils and salts on the frequency of endemic goitre in Lalmonirhat, Bangladesh

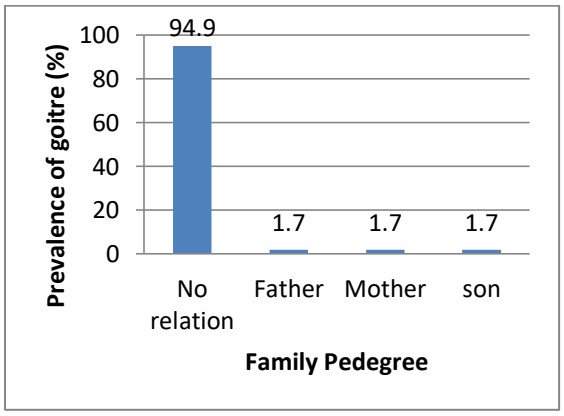

Figure 2 Prevalence of endemic goitre in the survey area according to family pedegree

Discussion

The present results clearly demonstrated that the gender, age groups, occupation, regions of living, intakes of goitrogenic vegetables and edible oils might have positive impacts on the incidence of goitre in the country. In an earlier study, Chowdury *et al*. (2002) reported 375 goitre cases (35.70%) out of 1050 people. Goitre prevalence was more in 41 to 50 years age group .The females (56.8%) were more sufferers than the males. Regarding occupation, majority was housewives (47.47%) and cultivators were in the second position (20%). Majority of the respondents was illiterate. Most of the respondents took iodized salt. Among the goitre cases who did not take iodized salt 19% could not take iodized salt because of high cost and only 2% due to ignorance. These findings mostly corroborate with those of the present results.

Yusuf *et al.* (2008) examined a total of 7233 children and 6408 women for goitre incidence in Bangladesh. In children, the total goitre rate was 6.2%, compared to 49.9% in 1993 and in women it was 11.7%, while in 1993 it was 55.6%. Prevalence of iodine deficiency was 33.8% in children and 38.6% in women (compared to 71.0% and 70.2%, respectively in 1993). Iodine nutrition status in urban areas was considerably better than in rural areas.

These findings revealed that Bangladesh has achieved a commendable progress in reducing goitre rates and iodine deficiency among children and women ever since the universal salt iodization programme was instituted 10 years ago. However, physiological iodine deficiency still persists among more than one-third of children and women, which points to the need for all stakeholders to redouble their efforts in achieving universal salt iodization.

Study by Zimmermann & Anderson (2012) revealed that approximately 70% of households worldwide had access to iodized salt. The study emphasized that the iodized salt programmes need to be strengthened and extended to reach nearly one-third of the global population that still has inadequate iodine intakes. A survey in Kohat, Pakistan by Subhan *et al*. (2014) showed an overall prevalence of 35% goitre, 37.16% in boys and 33% in girls. The results however differ from those reported here.

Badaruddin *et al*. (2014) found that the prevalence of goitre 11.63% at Dinajpur town in Bangladesh of which grade 1 was 11.24% and grade 2 was 0.39%. In our study females were more suffering than male, the ratio was

1: 5.6. Most of the patients were in the 41-50 years of age group which is similar to the study of Rahman *et al.* (2014) where out of 50 patients 41 were females and 9 were males, the ratio was 1: 4.5. Most of them were in the 31-50 years of age group. These findings are very similar to the present results.

A total of 551 subjects were studied, 363 males and 188 females to unravel the relation of goitre to intake of iodized-salt, mustard oil and cabbage in the villages of Sirajgonj (Badaruddin *et al*., 2015). The prevalence of goitre was 28.13%, in which the goitre of grade 1 and grade 2 was 21.96% and 6.17% respectively. In contrast to the present finding, males were suffering more than the females. Goitre prevalence in those taking iodized salt was 28.57% and in those taking non-iodized salt was 28.05% which were also different from those of the present study. Goitre prevalence in those taking mustard oil was 28.6% and in those taking non-mustard oil was 24.14%. Goitre prevalence was much more in those who took mustard oil than those who took non-mustard oil. In this study goitre prevalence in those taking cabbage was 28.12% and in those taking non-cabbage was 28.21%. The apparent discrepancies with the present findings might be due to the location of the study area.

There are some reasonable explanations for this wide variation in goitre prevalence in different regions of Bangladesh (Banglapedia, 2014). There are several factors which might affect the endemicity of goitre in Lalmonirhat district. The fact that the present study area is located far from the sea, further suggesting that the iodine content must contribute to the etiology of goitre in a country like Bangladesh, bearing in mind that the sea is a rich source of iodine. Factors other than nutritional iodine deficiency, goitrogens, sex, occupation, vegetables as principal foods, and age groups affect the utilization of iodine by the thyroid gland, are of extreme importance. The present report provides an update on the goitre incidence and associated risk factors in the Northern part of Bangladesh.

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