Associtiion of Selected Food Habit and Familial Tendency with Goiter: A case-Control Study

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The current case-control study aimed at finding out association of occurrence of goiter with familial tendency and eating of the vegetable 'Lafa shak' *(Malva verticillata),* a common green leafy vegetable of the study area, three selected villages of Dinajpur, a northern district of Bangladesh, where goiter is highly prevalent. Seventy-two goiter patients and eighty-two controls matched for age, sex and other socio-demographic conditions were interviewed through a pre--tested Banlga questionnaire. Data were analyzed using descriptive measures and logistic regression. Among goiter patients 48.6% had blood relatives with goiter in contrast to only 8.5% among controls (p<0.001, OR=6.006, 95% CL 2.188-16.488). The blood relatives developed goiter in spite of residing in different localities. This supports 'familial predisposition' as a causative factor for goiter. The respondents who consumed 'Lafa shak' suffered from goiter more frequently. Out of 72 cases 47(65.3%) consumed Lafa shak as against 11 (13.4%) in the control group of 82 (p<.000, OR=8.697, 95% CL 3.684-20.534). Rate of use of iodized salt was found higher, 45.8% in goitrous respondents than in non-goitrous respondents 24.4 %. This finding appears to be in contrast to the accepted role of iodized salt in prevention of goiter. The findings indicate that familial predisposition and dietary habit of eating 'Lafa shak' are strongly associated with the causation of goiter in the study area.

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Introduction

Goiter, the enlargement of thyroid gland, is locally called as 'Ghag', 'Gologonda', 'Gola-Fola' etc. in Bangladesh. Goiter affects all ages and both sexes although it is more frequent in peri-pubertal age, particularly in adolescent girls and in pregnant women. Goiter is so common in our society, particularly in young women that mild goiter in peri-pubertal girls are socially accepted as symbol of beauty, sometimes aptly named as goose-neck ('Hash-gola'), though large goiter is thought to be disgraceful.

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The first records of goiter and cretinism date back to ancient civilizations - the Chinese, the Indian, the Greek and the Roman.[1]

Goiter is mostly due to deficiency of the trace element, 'iodine'. Iodine is essential, in very little amount, for normal growth, development and well being of all human. In a 60 year's life span an individual requires only 60 gm- a teaspoonful of iodine.[2] Iodine is essential for synthesis of thyroid hormones which are synthesized by combination of iodine with an amino acid - tyrosine. When iodine deficiency reaches critical level thyroid hormone synthesis cannot occur. The gland undergoes compensatory enlargement and give rise to goiter. Although goiter may occur due to a number of other pathophysiologic mechanisms, it is most commonly due to deficiency of iodine in food.

As a general rule iodine deficiency in food is the primary cause of endemic goiter.[3] Deficiency of iodine in food is due to Environmental Iodine Deficiency (EID). Bangladesh is the largest delta in the world. Major river system- the Ganges/ Padma, the Brahmaputra, the Tista, the Jamuna and the Meghna form this huge delta, situated in Monsoon zone in Asia. As a result of these hill rivers, heavy rainfall, frequent floods Bangladesh has become one of the most badly affected endemic iodine deficient countries of the world.[4]

In Bangladesh out of 120 million, 11 million people are suffering from IDD while another 23.2 million are at risk.[5] In a survey jointly conducted by Dhaka University, International council to control Iodine Deficiency Disorders (ICCDD), and UNICEF in 1993 47.1% of the population of Bangladesh has been estimated to be suffering from goiter.[6] Goiter is said to be endemic when prevalence of visible or easily palpable goiter is 5% or more in pre & peri pubertal individuals or that of only palpable goiter is 30% or more among adults in a region.[3]

Prevalence of goiter varies greatly in different districts of Bangladesh. A national survey in 1981-82 by the Institute of Public Health Nutrition (IPHN), Dhaka revealed an average prevalence of 10.5% of visible goiter rate (VGR). Higher prevalence of up to 30% was found in some districts with some pockets showing Endemicity as high as 50-70%.[4] Among 20 greater districts highest prevalence rate was found in Jamalpur (29.16%) followed by Rangpur (27.48%) and Dinajpur (17.69%).[4]

In Bangladesh short term and long term intervention program to reduce iodine deficiency in the country was proposed in 1984 in a national seminar on IDD: a long term intervention program in the form of Universal Salt Iodization (USI) for the whole country and a short term intervention program using iodine in oil (Lipiodol) injection in hyper endemic areas.[4]

Two evaluation surveys of USI program in Bangladesh were successfully conducted in November 1996 and January 1999. In both the surveys it was found that almost 99% of edible salts available in the market and households were iodized. However level of iodine in the salt was not maintained as per law.[7]

1st Follow up survey of IDD in Bangladesh was conducted in the last half of 1999. The overall total goiter prevalence was 17.8% - (in the hilly areas - 19.8%, in flood prone area - 13.7% and in plain land - 20.4%).[7] Though iodine prophylaxis is the main recommendation for decreasing IDD, like some other countries iodine prophylaxis has not been wholly successful, implying that factors other than iodine deficiency may play role in causation of goiter.

USI program was started in Bangladesh in 1993 and by 1999 it has attained a remarkable success - 99% of all edible salt found iodized at market and households by the time.[7] But reduction of goiter is not that remarkable in spite of so high rate of iodine prophylaxis. The reason behind this is not clearly understood and it is yet to be explored in Bangladesh.

So, the present study is designed to find out association of familial tendency and selected food habit with occurrence of goiter in Dinajpur district.

This study attempts to determine association of selected locally consumed leafy vegetable called 'Lafa shak' and familial tendency with goiter and cause of failure to decrease the goiter prevalence significantly in spite of great achievement of USI program in Bangladesh.

Method

The present case-control study done in March 2002 to June 2002 was designed to find out any association between occurrence of goiter and habit of eating a green leafy vegetable locally called 'Lafa Shak', commonly consumed by people of study area – Dinajpur, a northern district of Bangladesh, which is highly goiter endemic. The study also tried to find out whether there is any family tendency in occurrence of goiter. The authors also attempted to see role of iodized salt in reduction of incidence of goiter in study population.

Data were collected from '72 cases' of goiter patients from three villages, '82 non-goitrous controls' from one adjacent village of Dinajpur. 'Cases' and 'controls' were matched for age, sex and other socio-economic factors.

The respondents were interviewed after taking their informed consent, through pre-tested Bangla questionnaires. Collected data were analyzed using descriptive measures and logistic regression. Results were presented in table and charts according to specific objectives.

Results

A total of 154 individuals (72 cases and 82 controls) were interviewed on some selected variables of study population. Data were organized into different groups of variables. Appropriate descriptive and analytic statistics were attempted. All the findings obtained were organized and presented in deferent tables and charts according to objectives of study.

Table I shows that age distribution was almost similar among cases and controls. Mean age of cases were 42.19 years while mean age of controls was 39.65 (p=0.281). Most of the cases (51.40%) and controls (52.40%) were from age group 26-45 yrs.

Table I: Mean age of the cases and controls

Respondents	Age of the respondents in years			p
	Number	Mean	Std. Deviation	
Case	72	42.19	15.12	0.28
Control	82	39.65	14.10	

Table II shows that Among 154 respondents 139 were female and the proportion was high both among the cases (91.7%) and controls (89%)

Out of 72 cases, the proportion of female (91.7%) was higher than the males (8.3%). Distribution of the sex in control group was almost similar female 89%, male 11%. But this was not statistically significant (p=.581) Table II.

Table II: Distribution of the cases and controls by sex

Sex	Case (n=72) Number (%)	Control (n=82) Number (%)	Total (n=154) Number (%)	p
Male	6(8.3)	9(11)	15(9.7)	0.58
Female	66(91.7)	73(73)	139(90.3)	

Table III shows that mean monthly income of cases was 2180.56 and control was 2359.76 Tk. (p= .546).

Table III: Mean monthly family income of case and control

Subject	Monthly Income of the respondents (in Taka)			p
	Number	Mean	Std. Deviation	
Case	72	2180.56	1792.60	0.546
Control	82	2359.76	1866.33	

Regarding other socio demographic parameters like religion, marital status, occupation etc were found to be well matched between 'cases' and 'controls' respondents, while educational level was a little higher in control group.

Duration of Goiter

Duration of goiter in study cases was from 2 yrs to 45 yrs. Maximum cases (75.0%) were suffering from goiter less than 15 years, 22.2% for 16-30 years. The mean duration of goiter was 12.13 with ± 10.78 years.

Table IV: Duration of Goiter

Duration of Goiter (In Years)	Case	
	Frequency	%
<16	54	75
16-30	16	22.2
>30	2	2.8
Total	72	100

Goiter and Family History

Most of the respondents (72.7%) had no history of goiter in the family members. Out of the 154 respondents only 42 (27.3%) gave history of goiter among their family members (blood relations). Among those who gave positive family history 35 (83.3%) were in case, 7 (16.7%) were in control group. Family history of goiter was positive in 48.6% of goiter patients in contrast to only 8.5% of control group.

Chi-square test suggested that there was positive association between family history and goiter. The risk of having goiter more than '10' times higher among those who had positive family history than those who didn't have (p=.000) OR was 10.135 with 95% CL 4.1 − 25.0.

Table V: Distribution of the respondents according to family history of goiter

Family History of goiter	Case		Control		Total		Statistics
	Number	%	Number	%	Number	%	
Yes	35	83.3 48.6	7	16.7 8.5	42	100 27.3	p=0.000 OR= 10.135
No	37	33.0 51.4	75	67.0 91.5	112	100 72.7	at 95% CL
Total	72	46.8 100	82	53.2 100	154	100 100	4.112- 24.978

N.B. Upper and lower percentage indicates row and column percentage respectively

Food habit and Goiter

Habit of taking leafy vegetables by the respondents. Out of 72 cases 65.3% were used to consume Lafa shak and rest 34.7% consumed other shak. Where as in the control group of 82 subjects only 11 (13.4%) consumed Lafa shak. Other vegetables such as lal shak and kochu shak were taken more frequently by this group. And chi-square test suggested that there is a strong positive association between goiter and eating of Lafa shak (p=.000)

Table VI: Distribution of cases and controls by their habit of eating leafy vegetables

Food habit of goiter cases	Case		Control		Total		p
	Number	%	Number	%	Number	%	
Lal shak	9	12.5	41	50	50	32.5	0.000
Kochu shak	9	12.5	29	35.4	38	24.7	
Lafa shak	47	65.3	11	13.4	54	37.7	
Other shak	7	9.7	1	1.2	8	5.2	
Total	72	100	82	100	154	100	

Association of shak eating habit of with goiter

In order to examine the association of 'Lafa Shak' eating with goiter table VI was collapsed into a 2x2 table (table VII) of 'Lafa' eater and ‘other shak' eater among cases and controls. A very high value of chi-square was found indicating a very highly significant results imply very strong association of Lafa shak eating with goiter (p=0.0005).

Finding suggested that the risk of developing goiter 12 times higher among those who took Lafa mostly than other shak eaters (OR=12.135).

Figure 1. Lafa Shak (Scientific name: *Malva verticillata*)

Table VII: Habit of eating Lafa shak and other shak among the cases and controls

Habit of taking leafy vegetables	Case		Control		Total		p
	Number	%	Number	%	Number	%	
Lafa shak	47	65.3	11	13.4	58	37.7	0.000
Other shak	25	34.7	71	86.6	96	62.3	
Total	72	100	82	100	154	100	

Difference in duration of taking Lafa shak among cases and controls
The mean duration of taking 'Lafa Shak' by cases and controls (who ate Lafa shak daily) were 22.77 ± 12.35 yrs. and 12.18 ± 5.51 yrs. respectively, 't' test suggested significant correlation between goiter and duration of taking Lafa shak(p=0.000)(t=4.319).

Table VIII: Mean duration of taking Lafa shak.

Subject	Duration of Lafa shak intake in years			p
	Years	Mean	Std. Deviation	
Case	47	22.77	12.35	0.000
Control	11	12.18	5.51	

Relationship between duration of goiter and duration of intake of Lafa Shak
The mean duration of goiter and Lafa shak intake were 12.13+ 10.78 years and 22.77 ± 12.35 years respectively.

The duration of eating Lafa shak (in yrs) was significantly linearly correlated with the duration of goiter in years. (r=0.631, p= .000, t=6.805).The coefficient of determination r^2=.40. Which means 40% of variation in duration of goiter in years was explained by the duration of intake of Lafa shak in years.

Distribution of respondents by type of edible salt
Among 72 cases, 33 (45.8%) used iodized salt 21 (29.2%) non iodized, 18 (25%) mixed salt. Conversely only 20 (24.4%) of control used iodized salt, 39 (47.6%) used mixed salt. This difference in salt-use by goitrous and non goitrous respondents was statistically significant (p=0. 005), implying that those who have goiter use iodized salt more frequently.

Table IX: Distribution of the respondents by type of edible salt

Type of edible salt	Case		Control		Total		p
	Number	%	Number	%	Number	%	
Packet Salt (Iodized)	31	45.8	20	24.4	53	34.4	
Loose Salt (Non-iodized)	21	29.2	23	28	44	28.6	
Loose & Packet Salt (Mixed)	18	25		47.6	57	37	0.000
Total	72	100	39	100	154	100	

Logistic regression analysis for identification of contribution of 'Lafa shak', 'family history' and 'iodized salt' as factors of goiter

Logistic regression analysis was conducted to clarify the association between goiter and Lafa shak consumption, family history of goiter and use of iodized salt and to assess the likelihood of these risk factors of being positive for causation of goiter. Those who consumed lafa shak were found more than 8 times prone to develop goiter than those who did not consumed. Family history of goiter poses 6 times more risk of developing goiter. Iodized salt was found to be protective [EXP (B)-.430].

Table X: Logistic regression analysis showing risks of selected factors

Outcome of respondents	Risk factors	Beta Coefficient	Chi-square (Wald stat)	Significance	EXP(B)	95% CL for EXP(B)	
						Upper	Lower
Goiter	Family History of Goiter	1.793	12.104	P=0.001	6.006	2.188	16.488
	Lafa shak Consumption	2.163	24.352	P=0.000	8.697	3.684	20.534
	Use of Iodized salt	-.845	3.770	P=0.052	-.430	.183	1.008

Discussion

Present case control study with 72 cases and 82 controls was carried out to find out the association of selected food habit and familial tendency with goiter.

The cases and controls were homogeneous in respect of their socio-demographic characteristics e.g. age, sex, marital status, occupation, income. Education-wise the control group was better off than the cases suggesting that goiter is more common among illiterates. However, logistic regression analysis showed non-significant effect of education as a contributory factor of goiter. Thus we can say that the cases and controls possessed homogenous socio-demographic characteristics which are a prerequisite for a case-control study.

As most of the respondents both in case and control group were adult female and as the female suffers more from goiter, number of housewife both in case and control group was expected to be higher than other occupation. In another study by Sarker-Fazlul Haque also found that most of the respondents were housewife.[8] Goitrous relatives of 28 (80%) cases lived in different residence than cases while goitrous relatives of only 7 (20%) cases lived in the same residence of cases.

Out of 154 respondents, 42 (27.3%) gave history of goiter among their family members

(Blood relations). Among those who gave positive family history 83.3% were in case group. The familial tendency of goiter patients and their family members (blood relatives) showed strong positive association ($p<.001$).
The odds ratio also indicated that the risk of having goiter more than 6 times higher among those who had positive family history than those who did not have. This finding is similar to that of study by C. ABUYE et al. which found strong association between the respondent with goiter and goiter in their parents.[9]

Development of goiter in the relatives of goiter patient in spite of living in separate residence, eating in different cooking - may indicate their familial predisposition to goiter. This was in agreement with other investigators who have reported that heredity is one of the contributing factors for the enlargement of the thyroid gland.[10]

Different types of leafy vegetable (shak) are commonly eaten vegetable as curry with rice in the study area. Options of leafy vegetables are different in different seasons according to their availability and choice of the respondents but common ones are lal-shak, kochu-shak, 'Napa-shak', locally pronounced as Lafa shak. Lafa shak *(Malva verticillata)* is a green leafy vegetable' commonly available in study area in winter season. Results showed that those who took 'Lafa shak' regularly were more prone to develop goiter. Occurrence of goiter was directly related with the longer duration of taking Lafa the more was probability of developing goiter.

Odds ratio also indicated that those who consumed of Lafa shak was about 9 times more likely to have goiter than those who did not take Lafa shak.
When the effects of the other factors were removed, the risk increased tremendously more than 28 times. This indicates goitrogenous effect of Lafa shak.

In Ethiopia a similar study by ABUYE C. has shown that a locally consumed green leafy vegetable "Halleko" has significant association with goiter.[9] Similar association of unprocessed "Sayaben" with goiter has been detected in west Africa.[11]
Intake of Lafa shak by respondents was also considered against the socio-demographic variables. Lafa shak was consumed more frequently by poorer, illiterate section of them but no statistically significant association was found.

Distribution of respondents by type of edible salt use shows that usage of iodized salt is more in goiter (45.8%) cases than in control group (24.4%) meaning that iodized salt increased the occurrence of goiter but mean age duration of goiter (12.13 ± 10.78 years) and mean duration of using iodized salt (6.30 ± 2.17 years in cases and 5.90 ± 2.49 years in controls) should be considered along with this. The relation of use of iodized salt with more occurrence of goiter may be due to fact that patients suffering from goiter for long duration had started to use iodized salt after they had developed goiter with the hope of reducing their disfigurement by goiter and with a hope of cure of goiter.

Controls used mixed salt (iodized and non-iodized salt) more frequently because they might believe that as they did not have goiter, so they did not need to use iodized salt.
Among the respondent only 34.4% used iodized salt. This is not consistent with the finding of evaluation survey of USI program which found 99% of edible salt in market and households to be iodized. However this survey also commented that level of iodization was not maintained as per law.[7]

One study by Sarkar. Md. Fazlul Haque in Nilphamari found that 58.06% of respondents used iodized salt.[8] This variation may be due to difference of knowledge and awareness about iodized salt in these two areas.

Conclusion

The present case control study found that there is a strong association between occurrence of goiter with family history of goiter (blood relatives with goiter) and habit of eating a green leafy vegetable locally called "Lafa Shak". Family history of goiter poses about six times and habit of eating "Lafa Shak" poses eight times more risk of having goiter. Use of iodized salt was found more in goiter-patents than in controls. The reason for this may be that the goiter patents think that iodized salt may help in curing their goiter. Authors recommend more extensive study regarding hereditary factors in causation of goiter and to find and establish any chemical in "Lafa Shak" which is goitrogenic.

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