Original Research Article

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Prevalence of iodine deficiency among multinodular goiter patients: a South Indian study

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ABSTRACT

Background: Mass iodization of table salt was introduced by the Government of India to treat as well as prevent iodine deficiency problems including goitres. However, even after so many years of introduction of iodized salt, the number of patients reporting with multi nodular goiter to the hospitals in Kerala seems to be high. The coastal districts of Trivandrum and Kollam report especially high prevalence of goitres and subsequently thyroidectomies. The aim of this study was to find the prevalence of iodine deficiency among patients with multi nodular goiter in South Kerala.

Methods: This was a cross sectional study of 300 patients admitted with multinodular goitre in the general surgical wards of Government Medical College Trivandrum, Kerala, India. From June 2013 to June 2014, these patients were evaluated clinically and with the investigatory facilities available at this institution. Their urine spot iodine excretion levels were measured at the laboratory of state iodine deficiency control cell, Trivandrum, Kerala, India.

Results: Out of the 300 cases, 6 patients were found to have mild iodine deficiency. Mean iodine level was normal at 170 microgram per decilitre. The prevalence of iodine deficiency in multinodular goiter cases studied was found to be 2%.

Conclusions: The high prevalence of multinodular goiter cases in Kerala cannot be sited per se as due to iodine deficiency as only 2% of the total number of cases studied had low urine iodine levels. This raises a question whether the salt iodization programme needs to be re-analyzed and possibly re-structured for the state of Kerala.

Keywords: Iodized salt, Iodine deficiency, Multinodular goiter, Urine iodine

INTRODUCTION

Iodine is a micronutrient required for lots of biological activities in human body, most important of which is in the production of thyroid hormones. The most important sources of iodine apart from iodised salt are, sea foods, milk, vegetables, bread and also from drinking water. Deficiency of iodine produces a wide spectrum of diseases usually termed as iodine deficiency disorders. The most evident form of IDD (iodine deficiency disorders) is goitre. Goitre is defined as any enlargement of thyroid gland. There are many causes for goitre most common of which is iodine deficiency.

Goitres were described very early in history, even before the discovery of thyroid gland itself. It was later that goitres were found have relation to iodine deficiency. Though there is documentation of the Chinese treating goitres with sea weed, but it is to be doubted whether this was mere trial and error. Iodine supplementation was introduced as an effective method of both treating already developed goitres in early stages and as a prophylaxis to prevent the development of goitres.

Iodine deficiency disorders (IDD) form a major public health problem in India. The results of sample surveys conducted by different agencies across the country have

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identified 235 districts as endemic for IDD.^{1,2} Since the historical times of the non-violent Salt March of Dandi in 1930, India has come a long way in the area of salt production, now providing for millions of its people, salt fortified with iodine under the universal salt iodization (USI) program. Universal salt iodization (USI) and iodine supplementation are highly effective strategies for preventing and controlling iodine deficiency. USI is now implemented in nearly all countries worldwide and two thirds of the world's population is actually covered by iodized salt.³

However, just as low dietary intake can result in a number of thyroid related problems, so can excess intake. Excess iodine intake has been found to be associated with iodine induced hyperthyroidism (IIH) and autoimmune thyroiditis, due to the stimulation of proliferation of thyroid follicular cells and thereby increasing the chance of mutations.⁴

There are only few data available regarding the actual prevalence of iodine deficiency in Kerala. Government medical college, Trivandrum, Kerala, India is an institution which gets drainage of patients from most of the southern regions of Kerala, mostly from the districts of Trivandrum and Kollam. Even after so many years of iodine supplementation and better access to health care facility still the number of patients seeking treatment with goitres is found to be high, or even showing a minimal rising trend. This study intends to find the level of iodine in patients who present with goiter by means of urine iodine estimation and hence to assess if iodine deficiency is actually the cause for the goiters here.

METHODS

The study setting was the general surgery wards of Government Medical College, Trivandrum, Kerala, India as well as the State Nutritional Bureau, Trivandrum. The research design was that of cros s sectional survey. Study period was twelve months: from June 2013 to June 2014. The research subjects included patients with multi nodular goiter cases coming to the general surgery department of Government Medical College Trivandrum, Kerala, India.

Multinodular goiter patients with age between 12 and 80 were included in the study.

Any patient with deranged renal function, any proven malignancy were excluded in the study.

The actual study was preceded by a pilot study conducted in December 2012 to assess the load of multinodular goitres getting treated at the institution. In the pilot study the number of patients undergoing elective surgery under department of general surgery in a time span of 30 days was defined as sample population, out of which the prevalence of multinodular goitre was calculated. This data was used to estimate the sample size for the present

study. Based on a prevalence of 25.77% for multinodular goiters, the sample size was found. Sample size calculation for prevalence study was with the formula 4pq/12, where

p = prevalence; q = 100 - p; l = p/5

Substituting the values to the above formula, sample size was found to be 288 and subsequently rounded off to 300. No random sampling techniques were used. Every consecutive patient eligible for the study was included.

The study was vetted by the Institutional review board and approved by the Ethics Committee of Government Medical College Trivandrum, Kerala, India. All cases were analyzed for geographic, dietary and familial risk factors of iodine deficiency. They were also investigated for features of hypothyroidism and nature of thyroid swelling. All the patients were subjected to spot urine iodine estimation to find the body iodine level. The patients underwent clinical examination and investigations after obtaining informed consent.

Data collection tools consisted of a structured questionnaire which included the following variables: Patient details : with geographic data; details of presenting complaints: with duration of swelling; Past history: hypothyroidism, miscarriages in females, congenital anomalies; personal history: dietary habit, intake of iodized salt, intake of brassica family vegetables, source of drinking water; menstrual, marital and obstetric history: parity, abortion, congenital anomalies, menarche, nature of cycle, age of attainment of menopause; family history: goiters , thyroid malignancy, hypothyroidism. Other details incorporated in the questionnaire included clinical examination: body mass index, pulse rate, size, and nature of thyroid swelling; investigation reports: thyroid function test, renal function test and ultrasound neck.

Urine spot iodine level was measured by wet digestion method (sandell-kolthoff) using percholic acid. The iodine level was assessed with a single spot urine sample iodine estimation, which was done at State Iodine Deficiency Control Laboratory free of cost. Data collected using proforma and details was entered into Microsoft excel 2013 and analysed with statistical package for social sciences software programme (SPSS) ver 18. Qualitative variables were described by percentage. A p-value less than 0.05 was considered significant.

RESULTS

All the 300 subjects included in the study consumed iodised salt. Except 5 who were strict vegetarians, all the other subjects had access to sea food on a regular basis. 90% of the subjects consumed some of the known goitrogens at least once a week as part of their staple diet.

Out of 300 subjects studied the ratio of males:females was around 1:9.

Only 1% of the patients were below 20 years, 16% were between 21 - 30 years, 23% were between 31 - 40 years, 33% between 41-50 years, 16.3% between 51 - 60 and 10.6% of the patients were above 60 years (Figure 1).

The urine iodine estimation showed that 6 subjects out of 300 subjects analysed has iodine deficiency that is urine iodine below 100 microgram per decilitre, making a prevalence of 2%. On the other hand, 78 subjects had iodine excretion value more that 200mcg, which is considered as more than adequate, making a prevalence of 26% (Figure 2). The mean value of urine iodine excretion was 170 microgram per decilitre.

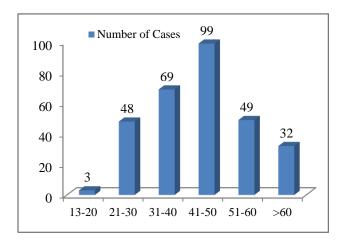


Figure 1: Age group distribution of patients.

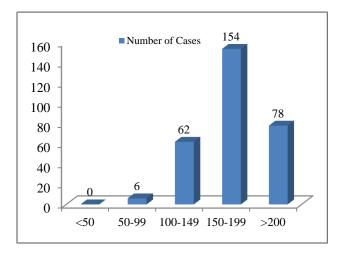


Figure 2: Urine iodine excretion among the patients with multinodular goiter.

DISCUSSION

The present study was based on the analysis of all multinodular goitre cases admitted under, Department of General Surgery, Government Medical College, Trivandrum, Kerala, India during the study period of

twelve months. The prime objective of this study was to find out if the multinodular goitre is due to iodine deficiency. The 300 cases were evaluated clinically and with ultrasound of the neck as a part of routine work up, for the presence of multinodular goitre. The iodine level was assessed with single spot urine sample iodine estimation.

As per the results of the study, all patients consumed iodized salt and majority had adequate intake of seafood on a regular basis. The study revealed that multinodular goitre has preponderance in female sex, which corresponds with existing studies. A substantial proportion of the patients had excess iodine excretion while only a minimal proportion had iodine deficiency. Hence iodine deficiency can be eliminated as an etiological factor. In fact, the question is whether iodine excess is contributing to the development of goiters in these patients.

According to WHO/ UNICEF/ ICCIDD, if more than 5% of school age children (aged 6 - 12 years) have goitre then the area should be classified as endemic for iodine deficiency. WHO/ UNICEF/ ICCIDD have also recommended that no iodine deficiency is indicated in a population when the median urine iodine elimination (UIE) level is 10 $\mu g/dL$, that is, when more than 50% of the urine samples have UIE levels of 10 $\mu g/dL$, and not more than 20% of samples have UIE levels of 5 $\mu g/dL.6$ The median UIE level in the present study was found to be 17 $\mu g/dL$ indicating adequate iodine nutritional status of the population.

Among a sample of 1872 children between the age of 6-12 years from the Kottayam district of Kerala, results showed the total prevalence of goitre as 7.05%. The findings of that study suggested that the population is in a transitional phase from iodine deficient, as revealed by total goitre rate, to iodine sufficient nutrition, as revealed by the median urinary iodine excretion level of $17.5~\mu g/dL$.

A cross sectional population survey was conducted in two phases among the residents of urban coastal area of central Kerala.⁸ The initial phase included a house to house survey of 3069 adults, selected by cluster sampling method. From the surveyed population, 986 subjects underwent further physical examination as well as biochemical evaluation for thyroid function, thyroid autoimmunity status and iodine status. The total prevalence of goitre was 12.2% while median urine iodine excretion was 211.4 mcg/dl, indicating iodine sufficiency. Thyroid function abnormalities were present in 19.6% of subjects. The authors reported that significant proportion of iodine sufficient adult population had thyroid disorders.

Some other researchers have done studies to find that patients had elevated urinary iodine suggesting excess iodine intake and absence of iodine deficiency.⁹

Complications known to be associated with excess iodine, that is, benign goiter (35%), iodine induced hyperthyroidism or thyrotoxicosis (34%), thyroiditis (16%) and cancer of thyroid (15%) were been observed in this study. They recommended that continued supplementation of edible salt fortified with iodine should be monitored carefully, and supplementation programs should be tailored to the particular region.

In the study by Chandra et al, on school children in the age group of 615 years, a total goiter rate of 21.63% was observed in the absence of iodine deficiency. In a similar study among 961 school children in North East India, a total goiter rate of 34.96% was identified even though there was no biochemical iodine deficiency.

Two independent studies from the All India Institute of Medical Sciences, New Delhi, describe the association of residual goiter and autoimmunity with an excess iodine status. Hashimoto's thyroiditis as well as focal lymphocytic thyroiditis were reported among healthy young girls with goiter who consumed adequate iodine and also among school children respectively. In both the studies, the role of other goitrogens was suggested to be involved in the development of goiter and autoimmunity. ^{12,13}

However, some other researchers have reported a high prevalence of iodine deficiency in as high as 11 districts of Kerala, ranging between 9.3 and 44.5%. ¹⁴ One another South Indian study was carried out to determine the prevalence, distribution and factors associated with iodine deficiency goitre among 6-12 years old children in a rural region of South Karnataka. ¹⁵ In this study, a cross sectional study was conducted among 838 children, using a questionnaire adopted from iodized salt program assessment tool and the tools prescribed by WHO for goitre survey. There was higher prevalence of goitre among those having salt iodine less than 15 ppm (parts per million) than those with salt iodine more than 15 ppm. The study area was found to be moderately endemic for goitre, based on the WHO criteria.

Sometimes, even when sufficient iodine is present in food and water, goitre occurs. This could be due to some other competing ions in the ingested food and water, which prevent incorporation of iodine into the thyroid gland. Perchlorate is one such ion and is reported to have thirty times more affinity to thyroid, than iodine. When analyzed by a study in South India, perchlorate level was significantly high in different water sources of industrialized areas, when compared to nonindustrial areas. These high percholrate levels could be the explanation for the high prevalence of goitre in areas with sufficient iodine availability. ¹⁶

CONCLUSION

Iodine deficiency is not the etiological factor behind the large volume of multinodular goitre cases admitted in

government medical college Trivandrum, Kerala, India as only 2% of cases evaluated showed iodine deficiency. The limitations of the study included the fact the study period is limited to one year only and that this being tertiary care centre based study, may not exactly represent the actual situation in the community. Also, the difficulty in quantifying goitrogens intake and inability to estimate water and soil iodine levels from the community could be other confounding factors.

While the concept of iodine deficiency still dominates most discussions about the pathogenesis of multinodular goiter, we think it is time to dwell on the fundamental process of goitrogenesis, which operates through mechanisms innate to the hereditary and acquired heterogeneity among the thyrocytes themselves. In this view, goiter nodules and nodular goiters are true benign neoplasms arising by mechanisms common to all benign endocrine and non-endocrine neoplasms. May be, superimposed iodine shortage does enhance the incidence of goiters. However, we do reiterate that continued supplementation of edible salt fortified with iodine should be monitored carefully, and supplementation programs should be tailored to the particular region.

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Ethical approval: The study was approved by the

institutional ethics committee

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