Indian J Physiol Pharmacol 1997; 41(2): 167–170

# TOTAL SERUM LEVELS OF TRIIODOTHYRONINE ($T_3$) THYROXINE ($T_4$) AND THYROTROPINE (TSH) IN SCHOOL GOING CHILDREN OF DIBRUGARH DISTRICT : AN ENDEMIC GOITRE REGION OF ASSAM

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**( Received on February 14, 1996 )**

**Abstract :** The Thyroid Status was studied by estimating the total serum levels of $T_3$ and $T_4$ by radioimmunoassay (RIA) and TSH by radioimmunometric Assay (IRMA) from 635 school children (8-20 years; male 129, female 506) of the Dibrugarh district : a chronic endemic goitrous region of India. The results were compared with the control group of 147 (male 48, female 99) of healthy medical students of the same geographical area. The average values of $T_3$ and TSH of school children were found higher and $T_4$ lower than the control; the difference were only significant for $T_3$ and TSH. $T_3/T_4$ ratio is more in school children than the control. The findings of low $T_4$ and high TSH indicate that the school children (Pubertal stage) from chronic iodine deficients areas suffer from poor thyroid status; the male seemed to have been affected more than the female. As age advances the thyroid status improves in female.

**Key words :** goitre, endemic, euthyroid, hypothyroid, cretin, thyroxine ($T_4$), triiodothyronine ($T_3$), thyrotropin (TSH)

## INTRODUCTION

Man needs approximately 130-150 µgm of iodine daily for normal thyroid activities (1). There is increased thyroid activities during rapid growing periods of puberty and pregnancy. Iodine Deficient Disorders (IDD) : endemic goitre, cretinism, mental, physical and sexual retardations are widely prevalent in a chronic environmental iodine deficient sub-Himalayan region of India (2, 3). Recent investigations have established that in chronic iodine deficient areas apparently, normal school children attain a lower mental and psychomotor level, an affect potentially grave consequences for adult life. In epidemiological studies conducted by ICMR in 1989 (3) Dibrugarh district of North East India revealed the highest goitre cases (65.8%) among the 14 districts of India, with 2.2% cretins compared to other districts (0.7%).

The present study aims at evaluation of thyroid status in growing children who apparently look euthyroid without any visible goitre. Subclinical hypothyroid state, if found, among apparently normal children will be helpfull in taking preventive measures, so that in future, the children born in the iodine deficient areas will always be at part in all respects with the children of the nongoitrous regions. The United Nations have pledged the virtual elimination of iodine deficiency by the year 2000 (4). Therefore, it is a matter of prime

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importance to identify endemic zones for IDD to provide informations to work out systematic iodine prophylaxis.

## METHODS

635 school children : (8-20 yrs, male 129 and female 506 numbers) were selected randomly from various schools of the district. 147 euthyroid healthy medical students (17-21 yrs, male 48, female 99) without having any clinical evidence of thyroid disorders and systemic diseases served as control.

The blood samples were collected by venepunctures with disposable syringe and needle in polysterene tube. Blood samples or separated serum were carried in ice box from distant areas. The serum was stored at –20°C until analysis.

Total serum $T_3$ and $T_4$ were estimated by Radioimmunoassay (RIA); and TSH by Immunoradiometricassay (IRMA) techniques in duplicate with the commercial kits supplied by Radiopharmaceutical Division, Bhabha Atomic Research Centre, Bombay India (5). The protocol provided with the kits were followed strictly in analysis. All hormones analysis for each test were run concurrently to avoid any day to day variation in results.

## RESULTS

All the results are summarised in Tables I and II.

The $T_3$ and $T_4$ values are expressed in nanogram per millilitre (ng/ml), TSH in micro international unit per millilitre (μIU/ml). The tables show the average total serum levels of $T_3$, $T_4$ and TSH with standard deviations, range, and number of cases in brackets. The mean values in control group of $T_3$, $T_4$ and TSH were found 1.37 ± 0.24 ng/ml, 92.8 ± 21.92 ng/ml and 1.56 ± 0.65 μIU/ml respectively (Table I). Our control values are comparable with the values of euthyroid subjects of nongoitrous regions of India and other countries. When the results are compared between the two sexes of the control (Table I) the male mean values for $T_3$, $T_4$ and TSH were found higher, only $T_4$ being significant ($P<0.05$).

The mean $T_3$, $T_4$ and TSH levels in school children were found 1.69 ± 0.85 ng/ml, 88.13 ± 53.79 ng/ml and 1.81 ± 1.3 μIU/ml

TABLE I : Total serum levels of $T_3$, $T_4$ and TSH in the control and school children.

| *Groups* | *$T_3$ ng/ml* | *$T_4$ ng/ml* | *TSH μIU/ml* |
|---|---|---|---|
| 1. Control (Male + Female) | 1.37 ± 0.24<br>0.7 – 2.2<br>(125) | 92.8 ± 21.92<br>56 – 135<br>(133) | 1.56 ± 0.65<br>0.5 – 4.5<br>(135) |
| a. Male | 1.39 ± 0.39<br>0.8 – 2.2<br>(26) | 99.32 ± 22.01<br>58 – 135<br>(38) | 1.64 ± 0.76<br>0.5 – 3.8<br>(48) |
| b. Female | 1.36 ± 0.35<br>0.7 – 2.2<br>(99) | 90.2 ± 21.96<br>56 – 135<br>(95) | 1.51 ± 1.03<br>0.5 – 4.5<br>(87) |
| 2. School children (Male + Female) | 1.69 ± 0.85<br>0.22 – 6.2<br>(634) | 88.13 ± 53.79<br>19 – 200<br>(588) | 1.81 ± 1.3<br>0.1 – 9<br>(581) |
| a. Male | 1.74 ± 0.95<br>0.38 – 4.1<br>(128) | 85.41 ± 25.7<br>24 – 200<br>(129) | 1.98 ± 1.31<br>0.25 – 6.2<br>(126) |
| b. Female | 1.68 ± 0.82<br>0.22 – 6.2<br>(506) | 88.9 ± 59.34<br>19 – 200<br>(459) | 1.77 ± 1.29<br>0.1 – 9<br>(455) |

Means ± S.D. with range and number of cases in brackets. The numbers in bracket indicate the actual number of analysis of the item done (loss or damage values are deleted).

respectively. In comparison with the control group , it is found that in school children $T_3$ and TSH were higher ($P<0.05$), $T_4$ lower though statistically insignificant. $T_3/T_4$ ratio of (0.019) in school children was higher than that of the control group (0.015). In female children, the mean values of $T_3$ and TSH were observed higher and $T_4$ lower than the control female. Only $T_3$ difference was significant ($P<0.001$). In the experimental male, values of $T_3$ and TSH were higher while $T_4$ lower ($P<0.001$) than the corresponding values in the control group. When the mean results are compared between male and female children, the $T_3$ and TSH values in male were found higher and $T_4$ lower than the female. The ratios of $T_3/T_4$ in male and female are 0.02 and 0.019 respectively and were observed higher than the corresponding values in the control group (Table I).

Table II shows the mean levels of $T_3$, $T_4$ and TSH in different age group of school children. The mean values of $T_3$ both in males and females and TSH in females progressively decreased with increasing age, whereas $T_4$ values in females showed increasing trend with increasing age. In the age group of 16-20 years the TSH levels in male were observed significantly higher than female ($P<0.00$). When the levels of $T_3$, $T_4$ and TSH of control : male and female (17-21 yrs) are compared with the values of corresponding sex of similar age groups (16-20 yrs, Table I and II) of school children, the later male showed lower $T_3$, $T_4$ and higher TSH than control; whereas in female very little difference was observed of the values between the two groups.

TABLE II : Total serum levels of $T_3$, $T_4$ and TSH in various age groups of school children.

| *Groups* | *$T_3$ ng/ml* | *$T_4$ ng/ml* | *TSH μIU/ml* |
|---|---|---|---|
| 1. Upto 11 yrs | | | |
| a. Male | 2.78 ± 0.72 | 104 ± 34.06 | 2.1 ± 1.36 |
| | 0.94 – 3.4 | 64 – 200 | 0.5 – 4.6 |
| | (13) | (13) | (13) |
| b. Female | 2.45 ± 0.85 | 84.85 ± 35.2 | 2.51 ± 1.8 |
| | 1.14 – 4.4 | 42 – 172 | 0.3 – 7.8 |
| | (35) | (34) | (34) |
| 2. 12 to 15 yrs | | | |
| a. Male | 1.69 ± 0.9 | 83.26 ± 24.36 | 1.88 ± 1.25 |
| | 0.4 – 4.1 | 24 – 145 | 0.25 – 6.2 |
| | (97) | (98) | (96) |
| b. Female | 1.62 ± 0.77 | 88.86 ± 26.02 | 1.85 ± 1.28 |
| | 0.22 – 4.5 | 28 – 216 | 0.1 – 9 |
| | (362) | (319) | (316) |
| 3. 16 to 20 yrs | | | |
| a. Male | 1.22 ± 0.83 | 83.67 ± 21.79 | 2.44 ± 1.57 |
| | 0.38 – 3.6 | 50 – 122 | 0.8 – 5.8 |
| | (18) | (18) | (17) |
| b. Female | 1.49 ± 0.55 | 93.35 ± 123.91 | 1.35 ± 0.95 |
| | 0.36 – 3.5 | 33 – 921 | 0.14 – 4.6 |
| | (91) | (88) | (87) |

Means ± S.D. with range and number of cases in brackets.

## DISCUSSION

The higher $T_3$, $T_4$ and TSH average levels in male than female control though statistically not reached significant level seem to be the influence of sex. The androgens play significant role for higher metabolic activities in male; it is not unlikely that, in some way the androgens take part in subtler adjustments of regulatory mechanisms of TSH and thyroid hormone secretion in male.

The pattern of hypothyroid state in most of the endemias of developing countries is low

$T_4$, high $T_3$ and TSH levels. These alterations are considered to be functional decompensation of the thyroid (1, 6).

The higher $T_3$ and TSH and lower $T_4$ in school children from the endemic district of Dibrugarh than control show poor thyroid status. The higher $T_3/T_4$ ratios in school children than control also suggest lower thyroid activities (7, 8). In the experimental group in male, the mean higher values of $T_3$ and TSH and lower $T_4$ level indicate that relatively male seemed to have been affected more than female. It could be due to greater demand of thyroid hormone in growing male adolescents, since the rate of growth and the period of growth continue for a longer duration in male than the female. Nutritional iodine deficiency in this district may be aggravated by malnutrition (9). Our findings of decreasing trend of $T_3$ and TSH and the increasing $T_4$ in females with age is suggestive of improvement of thyroid status in female with advancement of age. Rather, in female, as age advances, thyroid status is compensated near to the control level (Tables I and II).

Iodine content of water samples of rivers, tanks, and borewells from Sibsagar : a border district of Dibrugarh was found very low - 2 ppm only, which is far less than the required minimum levels of 5 ppm. Three fourth of salt samples obtained from the same district (rural areas) showed insufficient iodine content, less than 15 ppm (10). The chemical hypothyroidism in the district can mainly be ascribable for iodine deficiency. The children of iodine deficient areas are always in their later life is in disadvantageous position for low IQ. The present study further confirms the chemical hypothyroidism in the study area. Proper institution of an iodine supplementation programme with efficient monitoring mechanism will result in regression of thyroid hormone deficiencies and associated disorders in the population of the region.

## ACKNOWLEDGMENTS

Authors are thankful to the Board of Research in Nuclear Science, DAE, Government of India for full financial support for the project and also supplying the kits for $T_3$, $T_4$ and TSH. We are grateful to Dr. H.P. Barua, Principal Assam Medical College, for giving all support. We acknowledge the technical help offered by Dr. M. Rahman, Scientist RIA Centre, Assam Medical College. Thanks are to the help and cooperation from the staff and students of the Assam Medical College and Hospital and doctors of various hospitals and teachers and school children.

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