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THE INCIDENCE OF GOITER AMONG STUDENTS LIVING IN A GROUP OF MOUNTAIN VILLAGES IN THE BLACK SEA REGION AND THEIR THYROTROPIN AND THYROID HORMONE VALUES*

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For many years now it has been recognized that goiter is endemic in the Black Sea region and that it is more severe in the upper mountain villages. The importance of iodine deficiency as the cause of goiter in this region has been reported previously[1-4]; but since the incidence of goiter in children in this area and the serum thyrotropin and thyroid hormone values of these children had so far not been studied we decided to find out the incidence of goiter among children and also to measure the serum thyrotropin and thyroid hormone levels. Salpazarı is a central village and children come there from the neighboring villages for their education. This study was carried out on the invitation of the school principal with a view to documenting the changes in goitrous children and also to giving them medical treatment.

Material and Methods

The total number of students was 732. Of these 236 were in the elementary school and their ages ranged from 6 to 12; the rest were middle school and high school students aged between twelve and twenty years.

The staging of the goiter was done according to the criteria of the Pan American Health Organization[5] which are as follows :

Stage I goiter: The goiter is visible and palpable only when the neck is fully extended.

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Stage II goiter: The goiter is visible with neck in normal position; palpation is not needed for diagnosis.

Stage III goiter: Very large goiter which can be recognized at a considerable distance.

The symptoms were investigated to see if they were due to hypo- or hyperthyroidism. Serum thyrotropin (TSH), thyroxin (T_4), and triiodothyronin (T_3) assays were done by the radioimmunoassay method using commercial kits (Amersham) and a minigammacounter. The samples were analyzed in duplicate.

Results

The incidence and stages of goiter in the various age groups are given in Table I. There were no symptoms or physical findings compatible with hypo- or hyperthyroidism.

The serum TSH, T_4 and T_3 values of the goitrous children are given in Table II. No biochemically hypothyroidic case was detected in the stage I group. Sixteen

TABLE I

The Incidence of Goiter by Age Group

Age group (years)	Total no. of children	No. of goitrous children	Stage of goiter		
			I	II	III
6 – 9 (1st – 2nd grade)	93	29 (31%)	26 (90%)	3 (10%)	–
9 – 11 (3rd – 4th grade)	99	42 (42%)	36 (86%)	6 (14%)	–
10 – 12 (5th grade)	44	24 (55%)	18 (75%)	6 (25%)	–
Total	**236**	**95 (40%)**	**80 (84%)**	**15 (16%)**	–
12 – 20 (Middle school and high school)	496	248 (50%)	117 (47%)	98 (39%)	33 (14%)

percent of stage II goitrous students and thirty-eight percent of stage III goitrous students were biochemically hypothyroidic.

There was a significant difference in TSH, T_4 and T_3 values between stage I goiter and stage II goiter, and also between stage I and stage III goiter, but no difference between stage II goiter and stage III goiter (Table II).

TABLE II

TSH, T_4 and T_3 Values of Goitrous Children

	TSH (μIU/ml)	T_4 (μg/dl)	T_3 (ng/ml)
Stage I (n = 20)	1.01 ± 0.98*	7.62 ± 1.30	1.40 ± 0.27
Stage II (n = 19)	3.12 ± 3.49	5.97 ± 1.88	1.83 ± 0.40
Stage III (n = 16)	4.39 ± 2.56	5.51 ± 2.54	1.96 ± 0.54
Stage I – II	$p < 0.02$	$p < 0.01$	$p < 0.001$
Stage I – III	$p < 0.001$	$p < 0.001$	$p < 0.001$
Stage II – III	$p > 0.05$	$p > 0.05$	$p > 0.05$

* Mean ± SD

Discussion

In the Black Sea area the incidence and the distribution of the stages of goiter among children vary with the different age groups (Table I). Among elementary school children the incidence of goiter increased from thirty-one percent to fifty-five percent as the age of the children rose from six to twelve years. Among middle school and high school children the incidence of goiter was fifty percent. The stages of goiter also varied with the different age groups. Of the goitrous elementary school children eighty-four percent were in stage I. There was no stage III goiter in this age group. In the 12-20 year group, fourteen percent of the goitrous children were in stage III, thirty-nine percent were in stage II and fourty-seven percent were in stage I. Thirty-eight percent of the stage III goitrous

children and sixteen percent of the stage II goitrous children were found to be chemically hypothyroid. Among stage I goitrous children no hypothyroid case was found. There was, moreover, no sign of hypothyroidism in children whose serum TSH concentrations were high and whose T_4 concentrations were low. The absence of signs and symptoms due to hypothyroidism could be explained with normal or high serum T_3 values. As serum T_4 decreased, T_3 and TSH increased (Table II). The increased serum T_3 and decreased T_4 suggest an increase in monodeiodination of T_4 to T_3 in both thyroid and peripheral tissues.

This is the first study of its kind to be done on children of the Black Sea region and the results in general agree with those of previous reports from other countries which show that although serum T_4 may be low in subjects from endemic goiter regions, their serum T_3 remains within the range of values observed in subjects from regions where goiter is uncommon, and may even be higher[6,7]. The finding that all students are clinically euthyroid and not hyperthyroid despite supranormal serum T_3 suggests that higher than normal levels of serum T_3 may be needed to maintain euthyroidism when the serum T_4 is low.

There have been other studies that have led to similar tentative conclusions. However, the clinical evaluation of minor degrees of hypo- or hyperthyroidism can be difficult and more sensitive and specific tests for the peripheral effects of thyroid hormones and their application to subjects with endemic goiter are needed. Despite the high serum T_3, serum TSH was found to be higher in children with a low serum T_4 than in children with normal serum T_4. This suggests that it is the serum T_4 rather that the T_3 that regulates TSH secretion[9,10]. Recent studies suggest that intracellular concentration of T_3 is reduced in the cerebral cortex of such patients despite a normal level of serum T_3[11,12]. Kaplan et al[13,14] suggest that the hypothalamus also converts T_4 to T_3. Thus whatever is occurring in the pituitary may also be occurring in the hypothalamus. Given these results, it is not surprising that a complete definition of thyroid status requires more than the measurement of the serum concentrations of thyroid hormones. For the benefit of these children, iodination of this region has to be seriously considered and iodized salt seems to be the most practical and suitable way of doing it. The importance of age for beginning iodination lies in the fact that once nodule formation has begun it may be too late to give iodine since this could give rise to thyroid storm[15].

Summary

This study has been done in order to find the incidence of goiter among 732 school children, aged between 6 and 20 years who are living in a mountain village in the Province of Trabzon, and at the same time to determine the grades of goiter of the various age groups and also to determine the serum TSH, T_4 and T_3 values

of the goitrous children. The results show that the incidence and the grades of goiter increase as the students get older. Although no clinical signs of hypothyroidism were found in these children, 16 percent of children with stage II goiter and 38 percent of children with stage III goiter were found to be chemically hypothyroidic.

REFERENCES

1. Kologlu S. Memleketimizdeki endemik guatr vakalarının etiopatojenezinde rol oynayan guatrojen faktörler. *Ankara Üniversitesi Tıp Fakültesi Mecmuası* 14:23, 1961.
2. Kologlu S, Kologlu LB, Candan İ. Endemik guatr ve tirotoksıdozda plazma inorganik iyodu üzerinde mukayeseli inceleme. *Ankara Üniversitesi Tıp Fakültesi Mecmuası* 19:811, 1966.
3. Kologlu S. Kologlu LB. Türkiye'de endemik guatrda ^{131}I, ^{127}I, ve organik iyod kinetikleri. *AÜ Tıp Fak Mec* 23:1709, 1970.
4. Kologlu S, Kologlu LB. Türkiye'de endemik guatrda tiroid bezinin iodoaminoasit muhteviyatı ve ^{131}I'in bu iodoaminoasitler arasındaki dağılımı üzerinde araştırma. *AÜ Tıp Fak Mec* 24:1074, 1971.
5. Ibbertson HK. Endemic goitre and cretinism. *Clin Endocrinol Metab* 8:97, 1979.
6. Stevenson C, Silva E, Pineda G. Thyroxine (T4) and triiodothyronine (T3):effects of iodine on the serum concentrations and disposal rates in subjects from an endemic goiter area. *J Clin Endocrinol Metab* 38:390, 1974.
7. Chopra IJ, Hershman JM, Hornabrook RW. Serum thyroid hormone and thyrotropin levels in subjects from endemic goiter regions of New Guinea. *J Clin Endocrinol Metab* 40:326, 1975.
8. Chopra IJ, Solomon DH, Chua Teco GN. Thyroxine; just a prohormone or a hormone too? *J Clin Endocrinol Metab* 36:1050, 1973.
9. Connors JM, Hedge, GA. Feedback effectiveness of periodic versus constant triiodothyronine replacement. *Endocrinology* 106:911, 1980.
10. Larsen PR. Thyroid-pituitary interaction: feedback regulation of thyrotropin secretion by thyroid hormones. *N Engl J Med* 306:23, 1982.
11. Crantz FR, Larsen PR. Rapid thyroxine to 3,5,3'-triiodothyronine conversion and nuclear 3,5,3'-triiodothyronine binding in rat cerebral cortex and cerebellum. *J Clin Invest* 65:935, 1980.
12. Crantz FR, Silva JE, Larsen PR. An analysis of the sources and quantity of 3,5,3'-triiodothyronine specifically bound to nuclear receptors in rat cerebral cortex and cerebellum. *Endocrinology* 110:367, 1982.
13. Kaplan MM, Yaskoski KA. Maturational patterns of iodothyronine phenolic and tyrosyl ring deiodinase activities in rat cerebrum, cerebellum, and hypothalamus. *J Clin Invest* 67:1208, 1981.
14. Kaplan MM, McCann UD, Yaskoski KA, et al. Anatomical distribution of phenolic and tyrosyl ring iodothyronine deiodinases in the nervous system of normal hypothyroid rats. *Endocrinology* 109:397, 1981.
15. Ingbar SH, Woeber KA. The thyroid gland. In Williams RA (ed). *Textbook of Endocrinology* (5th ed). Philadelphia: WB Saunders Co, 1974, p 204.