

To Assess the Thyroid Status of Adolescents Aged 10-19 Years Coming to a Tertiary Care Centre

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Received: 20 February 2023

Revised: 28 February 2023

Accepted: 02 March 2023

ABSTRACT

Background: Adolescence is the phase of life between childhood and adulthood, from ages of 10 -19 years, during which thyroid disorders peak and mostly goes undetected. Hence, there is a need for evaluation of thyroid functions in this age group. **Objective:** To assess the thyroid status of adolescents aged 10-19 years coming to a tertiary care Centre.

Material and Methods: This cross sectional analytical study was conducted among adolescents between the age of 10-19 years who attended the Department of Paediatrics at JSS Hospital, a tertiary care centre in Mysuru, Karnataka, India. Duration of study was 18 Month. Consecutive Sampling technique was used.

Results: Family history of hypothyroidism was seen in 2% of study subjects. Subclinical hypothyroidism(14%) was the most common thyroid abnormality followed by subclinical hyperthyroidism (3.3%).

Conclusion: In our study, subclinical hypothyroidism is the most common presentation of thyroid abnormalities in adolescents. Hence, thyroid function test is strongly recommended to identify the thyroid abnormalities & early initiation of treatment.

Keywords: TSH, T3, T4, subclinical hypothyroidism.

INTRODUCTION

The thyroid gland is the first endocrine gland to develop, on 24th day of gestation. This occurs under the influence of fibroblast growth factor signaling pathways^[1] The thyroid gland originates from 2 main structures - the primitive pharynx and the neural crest. The rudimentary lateral thyroid develops from neural crest cells, while the median thyroid, which forms the bulk of the gland, arises from the primitive pharynx.

The thyroid gland forms as a proliferation of endodermal epithelial cells on the median surface of the developing pharyngeal floor. The site of the development lies between the tuberculum impar & copula and is known as the foramen caecum. Division of the thyroid into right and left lobes occurs in the 5th week of gestation.^[1]

The thyroid gland is located in the anterior neck & lies on C5-T1 vertebrae. It consists of 2 lobes - right & left which are connected by isthmus anteriorly forming butterfly shaped appearance. Thyroid gland is the largest endocrine organ.^[2]

Thyroid disease can present with overt symptoms, insidiously, or with isolated thyromegaly. Thus evaluation of the thyroid gland should be included in the routine examination of children. The thyroid gland can be visualized by having the patient look to the ceiling and swallow. As the thyroid moves, the margins of the gland are viewed to estimate size and

symmetry. The thyroid should be palpated to assess size, consistency, and symmetry. This can be performed with the clinician standing behind the patient and palpating the neck with the fingertips. The texture of the thyroid can be assessed to determine if it is smooth or irregular and if nodules are present, which may feel firm or soft. If any asymmetry or abnormal thyroid fullness is noted, ultrasonographic evaluation is recommended because pathological thyroid nodules may feel like normal tissue.

Thyroid diseases are, arguably, among the commonest endocrine disorders worldwide. According to a projection from various studies on thyroid disease, it has been estimated that about 42 million people in India suffer from thyroid diseases. Thyroid diseases are different from other diseases in terms of their ease of diagnosis, accessibility of medical treatment, and the relative visibility that even a small swelling of the thyroid offers to the treating physician. Early diagnosis and treatment remain the cornerstone of management. Hence this study was conducted to assess the thyroid status of adolescents aged 10-19 years coming to a tertiary care Centre.

MATERIAL & METHODS

This cross sectional analytical study was conducted among adolescents between the age of 10-19 years who attended the Department of Paediatrics at JSS Hospital, a tertiary care centre in Mysuru, Karnataka, India. Duration of study was 18 Month. Consecutive Sampling technique was used. Permission for conducting the study was taken from JSS University Ethical Committee. Written and informed consent was taken from the parents of the children involved in the study.

Sample size calculation-The sample size was calculated based on the literature³, absolute precision of 5% and 5% alpha error, as 149.

$$\text{Using the formula Sample size: } Z^2 \cdot \frac{1-\alpha/2 \cdot p(1-p)}{d^2}$$

is equal to 149,

where Z = Standard value,

p: expected proportion

d: absolute precision

1- α /2: desired confidence level.

Inclusion Criteria

- Adolescents aged 10-19 years who came to a tertiary care centre

Exclusion Criteria

- Adolescents with known thyroid disorders on treatment.
- Adolescents with other endocrinopathies like diabetes.
- Adolescent patients with underlying thyroid disorder, secondary to Down syndrome, Turner syndrome etc.

Method of collection of data

The selected adolescents were subjected to the following:

- ✓ Full history taking and detailed clinical examination
- ✓ Current and past medication history, specifically regarding thyroid medications.
- ✓ Anthropometric assessment: Height was measured using a stadiometer. Weight was measured using a weighting machine. BMI was calculated using formula $\text{weight}/(\text{height})^4$.
- ✓ According to WHO Classification subjects were classified according to their body mass index into⁵
- ✓ Vitals of each study subject was recorded.

- ✓ Reference values of Thyroid hormones, TSH were as follows^[6] which were in line to laboratory values in JSS Hospital Mysuru :
- ✓ Based on thyroid profile study subjects are classified into^[3]
- Primary hypothyroidism - TSH >5.5µIU/L & T3 <1.23nmol/L or T4 <4.2µg/dl.
- Subclinical hypothyroidism - TSH >5.5µIU/L and normal T3, T4.
- Primary Hyperthyroidism - TSH <0.5µIU/L and T3 >3.23 or T4 >13µg/dl.
- Subclinical hyperthyroidism with TSH <0.5µIU/L & normal T3 and T4.

E) Euthyroid with Normal TSH, T3, T4. & prevalence of thyroiddisorders was estimated based on the above data.

✓ **SAMPLE COLLECTION & TESTS:**

- Under aseptic conditions, 3mL of venous blood was collected in a plain red vacutainer and sent for analysis of serum TSH, TOTAL T3, TOTAL T4 levels.

Thyroid Profile was analyzed using ECLIA (Electro-chemiluminescence immunoassay Analyzer) in the fully automated hormone Analyzer ROCHE411601

Statistical Analysis

Data Collected was entered in Microsoft Excel & was analysed using SPSS version 23 software. Summary statistics was done by means of proportions for categorical/binary variables and mean, median, Standard deviation, Inter Quartile Range (IQR) for continuous variables. Inferential statistics was done by using chi square test/fisher exact test & independent t test/Mann Whitney test. P-value of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

RESULTS

Among the subjects of our study 123 (82%) were between 10 - 14 years & 27 (18%) were between 15 - 19 years. The mean age was 12.76 ± 1.92 years. In our study subjects 42.75% were males and 57.3% were females. Sex ratio being 0.7: 1 [M: F]

Among the study subjects T3 levels were noted to be normal in 56 % of subjects, with mean T3 of 1.44 ± 0.65 nmol/L.

Table 1: Distribution of T3 levels among study subjects

T3 levels	Frequency	Percentage
< 1.23 nmol/L	64	42.6 %
1.23 - 3.23 nmol/L	84	56 %
>3.23 nmol/L	2	1.3 %
Total	150	100 %
Mean T3: 1.44 ± 0.65 nmol/L		

Among the study subjects T4 levels were found to be normal in 92% with the mean T4 level being 9.28 ± 2.48 mcg/dl.

Table 2: Distribution of T4 levels among study subjects

T4 levels	Frequency	Percentage
< 4.2 µg/dl	4	2.6 %
4.2 - 13 µg/dl	138	92 %
>13 µg/dl	8	5.3 %
Total	150	100%
Mean T4: 9.28 ± 2.48 µg/dl		

Among the study subjects TSH levels were found to be normal in 78.6% with the mean TSH level being $5.19 \pm 12.28 \mu\text{IU/L}$

Table 3: Distribution of TSH levels among study subjects

TSH levels	Frequency	Percentage
< 0.5 $\mu\text{IU/L}$	12	8 %
0.5 - 5.5 $\mu\text{IU/L}$	118	78.6 %
>5.5 $\mu\text{IU/L}$	20	13.3 %
Total	150	100%
Mean TSH: $5.19 \pm 12.28 \mu\text{IU/L}$		

In overweight children, abnormalities of TSH is observed in 3 subjects. All 3 subjects were found to be females

Table 4: Comparison of TSH levels in overweight subjects (n=13)

	Male	Female	Frequency	Percentage
Decreased TSH	0	1	1	7.6 %
Normal TSH	2	8	10	76.9 %
Increased TSH	0	2	2	15.3 %

In our study, BMI's were correlated with TSH levels a weakly positive correlation (0.21) with TSH was seen which is statistically significant ($p < 0.001$) at all levels.

Table 5: Correlation between BMI & TSH levels

Correlation	TSH
Pearson correlation	0.21
Significance	0.001**
N	150
Levels of significance : $p < 0.05$	

Table 6: Interpretation of thyroid function tests among study subjects

Interpretation	Frequency	Percentage
Subclinical hypothyroidism	21	14%
Primary hypothyroidism	3	2%
Euthyroid	118	78.6%
Subclinical hyperthyroidism	5	3.3%
Primary hyperthyroidism	3	2%
Thyroid function abnormalities in study subjects	32	21.3%

Among the study subjects, 78.6% were Euthyroid, thyroid function abnormalities were found in 21.3% of subjects out of which - 14% subjects had subclinical hypothyroidism, 2% had primary hyperthyroidism, primary hypothyroidism each, 3.3% had subclinical hyperthyroidism.

DISCUSSION

In our study, 42.75% were males and 57.3% were females. There is female preponderance in our study. Sex ratio in our study was 0.7:1.

Table 7: Comparison of gender distribution with other studies

Authors	Year	Place	Gender
Present Study	2022	India	Male - 42.75% Female - 57.3%
Carmona Carmona CA1 et al ³¹	2018	Columbia	Males – 28.2% Females – 71.8%
Lakshminarayana Gopaliah R, et al ²⁸	2016	India	Males - 42.8% Females - 57.1%
Raman K. Marwaha et al ³²	2009	India	Males - 49.08% Females- 50.92 %

In a study done in Colombia⁷ statistical significance between thyroid disorders & female gender was noted. In a study done by Carmona CA17 et al prevalence of TSH abnormalities were found to be significantly higher in females - 71.8% compared to males – 28.2%. Other studies also showed female preponderance similar to our study.

In the present study, T3 levels were normal in 84% of study subjects, levels were < 1.23 in 64% of subjects & > 3.23 in 2% of subjects. Mean T3 levels were 1.44± 0.65 nmol/L.

T3 levels, more appropriately FT3 levels were important to exclude overt, central hypothyroidism & to recognize the progression of subclinical hypothyroidism.

Table 8: Comparison of T3 levels distribution with other studies

Authors	Year	Place	T3 levels(nmol/L)
Present Study	2022	India	1.44 ± 0.65 nmol/L
Lakshminarayana Gopaliah R, et al ²⁸	2016	Israel	128.71± 31.07 ng/dl
S.Shalitin et al ³⁰	2009	India	2.64 ± 0.68 nmol/L

In a study done by S.Shalitin⁸ et al mean T3 levels were 2.64 ± 0.68 nmol/L which was higher than our study possibly due to different age group considered in the study. In our study T3 abnormalities were seen in 44% of study subjects. In a study done by Carmona Carmona CA1 et al¹⁷ prevalence of T3 abnormalities were seen in 8% of study subjects which was much lower than our study. In a study done by Lakshminarayana et al³¹ mean T3 levels were found to be 128.71± 31.07 ng/dl (Conversion factor is 2.5). In their study the standard units taken into consideration were different which can be accountable to a different mean T3.

In our study, T4 levels were found to be normal in 92% of individuals, <4.2mcg/dl in 2.6%, >13 in 5.3% of the participants. Mean T4 levels were 9.28 ± 2.48mcg/dl.

T4 levels are important in diagnosis & treatment of thyroid disorders. Monitoring of T4 levels helps to ascertain compliance & treatment response in children.

In a study done by Lakshminarayana gopaliah^[3] et al to study prevalence of thyroid abnormalities mean T4 was 9.25 ± 2.37 which is near similar to our study.

In our study, TSH levels were found to be normal in 78.6% of individuals, $< 0.5 \mu\text{IU/L}$ in 8%, $> 5.5 \mu\text{IU/L}$ in 13.3% of the study participants. Mean TSH levels in our study were $5.19 \pm 12.28 \mu\text{IU/L}$.

In a study done by Raman K. Marwaha et al⁹ in school going children mean TSH was found to be 2.72. In a study done in Columbia⁷ TSH abnormalities were found in 24.5% of subjects out of which 19% had increased TSH concentrations with statistically higher levels in females.

In our study primary hypothyroidism, primary hyperthyroidism were equally prevalent. Primary hypothyroidism was found only in female study subjects. A study done by Lakshminarayana et al¹^[3] in children & adolescents overt hypothyroidism is 2nd most common thyroid disorder with female to male ratio of 2.43:1. In the same study children were found to be more prevalent for hypothyroidism than adolescents.

In our study, in overweight children, abnormalities of TSH is observed in 3 subjects. All 3 subjects were found to be females. In a study done by S.Shalitin et al⁸, in 207 obese children 46 (22.2%) were found to have hyperthyrotropinemia, out of which 30 were females, 16 were males.

In a study done by S.Shalitin et al^[8] in obese children & adolescents none of the children had goitre which was similar to our study.

CONCLUSION

In our study, subclinical hypothyroidism(14%) was the most common thyroid abnormality followed by subclinical hyperthyroidism(3.3%). The least common abnormalities observed were primary hypothyroidism(2%) & hyperthyroidism(2%). In overweight children TSH abnormalities were observed in 23% of study subjects. A positive correlation between BMI & TSH levels was noted. Weight gain is the most common symptom in our study subjects accounting to 8.6% of study subjects.

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