

Thyroid dysfunction in children and adolescence: Experience of a tertiary care centre in Kerala

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Abstract

Background: There is limited data regarding the prevalence of thyroid disorders in children and adolescents from India. **Methods:** All subjects aged 1-19 years, who underwent estimation of thyroid function tests (TFTs) at the EMS Memorial Cooperative Hospital and Research Centre, Perinthalmanna (2009-2013) were included in the study. **Results:** A total of 784 subjects (males-336, females-448), aged between 1-19 (Mean 11.12, SD-6.23) years, who underwent estimation of TFTs were studied. The prevalence rate of all thyroid function abnormalities was 9.18%. The thyroid function disorders were more common (10.89%) in adolescents (14-19 years) than children (1-13 years) (7.82%) and in females (12.05%) than males (5.36%) in both age groups. The prevalence rates of subclinical hypothyroidism (SCH), overt hypothyroidism (OH) and hyperthyroidism were 4.08%, 3.05% and 2.04% respectively. **Conclusions:** The thyroid function abnormalities are common in children and adolescents affecting about ~ 9% in study population. The SCH was the commonest thyroid function disorder, followed by OH and hyperthyroidism with female: male ratios of 2.5:1, 2.43:1 and 7:1 respectively. Majority of cases OH were of primary hypothyroidism. The SCH and hyperthyroidism were more prevalent in the adolescents than children; however, OH was more common in children than adolescents.

Key-words: Hypothyroidism, Hyperthyroidism, Subclinical Hypothyroidism,

Introduction

The thyroid function disorders are very common in the world, however, there is limited data regarding them in children and adolescents. The reported prevalence rates vary from 0.11 to 0.12 % in two studies [1,2] to 3.7 % in another study [3]. Prevalence of subclinical hypothyroidism (SCH) was found in <2% of study population; in an Indian study [4]. The evolution rate of SCH to overt hypothyroidism (OH) on follow-up ranges from 0-28.8 % in another study[5]. Most cases of childhood hypothyroidism are sporadic and 10-15% disorders are caused by inherited defects. [6,7,8].

Chronic lymphocytic thyroiditis is the most frequent etiology for hypothyroidism in children after neonatal period with common age of onset during in adolescence. [6, 7, 8]. The clinical presentation of hypothyroidism varies widely and the prognosis of depends on age of onset of disease; early diagnosis and levothyroxine supplementation has a better result on linear growth and mental development. [6, 7, 8]. There is limited data regarding prevalence of thyroid disorders in children and adolescents from India. In one of the study prevalence rates of SCH and OH was 6.1% and 0.4 % respectively among study population of ~39,000 children [9]. There is no data regarding the prevalence rates of thyroid disorders in children and adolescents from Kerala.

Manuscript received: 25th Nov 2015
Reviewed: 16th Dec 2015
Author Corrected: 29th Dec 2015
Accepted for Publication: 4th Jan 2016

Material and Methods

Study design and subjects: This was a retrospective study conducted at EMS Memorial Cooperative Hospital and Research Centre, Perinthalmanna, Malappuram, Kerala; a tertiary care, referral centre in northern Kerala. All subjects aged 1-19 years, who underwent estimation of thyroid function tests (TFTs) on their first outpatient visit from September 2009 to December 2013, were included in the study. The subjects were categorised into two groups based on age (1-13 years-children, 14-19 years-adolescents) and gender for analysis. Aims of the study were to measure the overall prevalence of thyroid disorders in children and adolescents, and to analyse their differences based on age and gender.

Thyroid function test estimation, diagnosis and statistics: The triiodothyronine (T3), tetraiodothyronine (T4) and thyroid stimulating hormone (TSH) were analysed by electrochemiluminescence assay (Cobas-Roche Elecys Core immunoassay system - Roche Diagnostics, Mannheim, GmbH). Normal range for T4, T3 and TSH were 5.1-14.1 µg/dL, 60-180 ng/dL and 0.35 to 5.5 µIU/mL respectively, with intra assay and inter assay coefficient of variation (CV) being less than 7 % for all three parameters. There was no specified normal range for the local population; hence, the TFTs were classified as abnormal if values were beyond normal limits of according to TFT kit. The TFT reports

Observations

A total of 784 subjects (males-336, females-448), aged between 1-19 (Mean 11.12, SD-6.23) years, who underwent estimation of TFTs from 2009 to 2013 were included in the study [Table 1]. The majority (85%) of the study population was reportedly consuming iodized salt. The range, mean and standard deviation of age, TSH, T3, and T4 are summarised according to age groups in table 1. Thyroid function abnormalities were present in 9.18 % of subjects [table 2]. The prevalence rate of thyroid function abnormalities was higher in females (12.05 %) than males (5.36 %) [Table 2]. Thyroid function abnormalities were more prevalent in adolescents (10.89%) than children (7.82%) [Table 3].

Table 1: Descriptive data of T3, T4, and TSH levels according to age groups

Parameter	Age group		
	All subjects (n = 784) Mean ±SD (Range)	1-13 years (n = 435) Mean ±SD (Range)	14-19 years (n = 349) Mean ±SD (Range)
Age	11.12 ± 6.23	6.48 ± 4.38	16.91 ± 1.72
T3 ng/dL	128.71 ± 31.07 19.53 – 348.20	133.37± 30.74 20 - 251	122.91±30.52 26.45-348.20
T4 µg/dL	9.25 ± 2.37 0.51 – 21.19	9.45 ± 2.47 0.51- 17.49	0.53 ± 21.19 0.43-24.86
TSH µIU/mL	4.56 ± 13.48 0.005 – 100	4.64 ± 13.66 0.02 - 100	4.46 ±13.26 0.00-100

above the laboratory reference ranges are considered abnormal by most Pediatricians.

In our study subjects were classified using following definitions:

Primary hypothyroidism: TSH > 5.5 µIU/mL and T4 <5.1 µg/dL or T3 < 60 ng/dL.

Subclinical hypothyroidism: TSH > 5.50 µIU/mL and normal T4, normal T3.

Secondary hypothyroidism: T4 <5.1 µg/dL or T3 <60 ng/dL and a TSH level that is not appropriately elevated.

Hyperthyroidism: TSH <0.35 µIU/mL and T3 >180 ng/dL or T4 >14.1 µg/dL.

Subclinical hyperthyroidism: TSH < 0.35 µIU/mL and normal T3, normal T4.

Secondary hyperthyroidism: T3 >180 ng/dL or T4 >14.1 ng/dL and a TSH level that is not appropriately suppressed.

Statistical analysis was performed using SPSS (Version 17) for Windows. The quantitative variables (age, TSH, T3, T4) have been described as mean ± SD and range. The prevalence rates of thyroid disorders were summarized as counts and percentages. A Chi-square test was used to assess the trends in the prevalence of hypothyroidism, SCH and hyperthyroidism among different age groups and gender categories. A p value of <0.05 was taken as significant.

Table 2: Prevalence rate of thyroid dysfunction and its variation according to gender.

Parameter	Age 1-19 Years			Chi square test (prevalence in males vs females) p value
	All Subjects (784) n (%)	M (336) n (%)	F (448) n (%)	
Hypothyroidism (primary)	23 (2.93)	6 (1.78)	17 (3.79)	0.09
Hypothyroidism (secondary)	1 (0.12)	1 (0.30)	0	0.24
Subclinical Hypothyroidism	32 (4.08)	9 (2.68)	23 (5.13)	0.08
Hyperthyroidism (primary)	16 (2.04)	2 (0.59)	14 (3.12)	0.01
Hyperthyroidism (secondary)	0	0	0	
Subclinical Hyperthyroidism	0	0	0	
Total subjects with thyroid dysfunction	72 (9.18)	18 (5.36)	54 (12.05)	0.001

Table 3: Prevalence rate of thyroid dysfunction and its variation according to age.

Parameter	Age group (Years)			Chi square test (prevalence in males vs females) p value
	All subjects (784) n (%)	1-13 (435) n (%)	14-19 (349) n (%)	
Hypothyroidism (primary)	23 (2.93)	13 (2.98)	10 (2.86)	0.91
Hypothyroidism (secondary)	1 (0.12)	1 (0.23)	0	0.37
Subclinical Hypothyroidism	32 (4.08)	12 (2.76)	20 (5.73)	0.03
Hyperthyroidism (primary)	16 (2.04)	8 (1.84)	8 (2.29)	0.65
Hyperthyroidism (secondary)	0	0	0	
Subclinical Hyperthyroidism	0	0	0	
Total subjects with thyroid dysfunction	72 (9.18)	34 (7.82)	38 (10.89)	0.13

Subclinical hypothyroidism: Subclinical hypothyroidism (SCH) was the commonest of the thyroid function abnormalities; observed in 4.08 % ($n=32$) of subjects; affecting females (5.13%) more than males (2.68%) [Table 2]. The prevalence rate of SCH was higher in the adolescents (5.73 %) than children (2.76%) [Table 3]. The adolescent females were the most affected off all with a prevalence rate of 7.39% [Table 4 & 5].

Table 4: Prevalence rate of thyroid dysfunction in according to gender in age group of 1-13 years

Parameter	Age group of 1-13 Years			Chi square test (prevalence in males vs females) p value
	All subjects (435) n (%)	Males (216) n (%)	Females (219) n (%)	
Hypothyroidism (primary)	13 (2.98)	5 (2.31)	8 (3.65)	0.61
Hypothyroidism (secondary)	1 (0.23)	1 (0.46)	0	0.13
Subclinical Hypothyroidism	12 (2.76)	6 (2.78)	6 (2.74)	0.98
Hyperthyroidism (primary)	8 (1.84)	1 (0.46)	7 (3.20)	0.03
Hyperthyroidism (secondary)	0	0	0	
Subclinical Hyperthyroidism	0	0	0	
Total subjects with thyroid dysfunction	34 (7.82)	13 (6.01)	21 (9.59)	0.16

Table 5: Prevalence rate of thyroid dysfunction in according to gender in age group of 14-19 years

Parameter	Age group of 14-19 Years			Chi square test (Males vs females) p value
	All subjects (349) n (%)	Males (119) n (%)	Females (230) n (%)	
Hypothyroidism (primary)	10 (2.86)	1 (0.84)	9 (3.91)	0.10
Hypothyroidism (secondary)	0	0	0	
Subclinical Hypothyroidism	20 (5.73)	3 (2.25)	17 (7.39)	0.06
Hyperthyroidism (primary)	8 (2.29)	1 (0.84)	7 (3.04)	0.19
Hyperthyroidism (secondary)	0	0	0	
Subclinical Hyperthyroidism	0	0	0	
Total subjects with thyroid dysfunction	38 (10.89)	5 (4.2)	33 (14.34)	0.003

Overt Hypothyroidism: Overt hypothyroidism (OH) was the second commonest of the thyroid function abnormalities; observed in 3.05 % ($n=24$) of subjects; affecting females (3.79 %) more than males (2.08 %) [Table 2]. Majority of cases OH were of primary hypothyroidism (95.8%, 23 out of 24) [Table 2]. The prevalence rate of hypothyroidism was higher in females than males; both in adolescents and children [Table 4, 5].

Hyperthyroidism: The hyperthyroidism was observed in 2.04 % ($n=16$) of subjects [Table 2]. The hyperthyroidism was more prevalent in females (3.12%) than males (0.59%) [Table 2]. The prevalence rate of hyperthyroidism was higher in adolescents (2.29%) than children (1.84%) [Table 3] and in both age groups females were more affected than males [Table 4 & 5].

Discussion

In our study thyroid function abnormalities were noted in 9.18 % of children and adolescents. In one of the population based Indian studies almost 12 % of children aged 5-16 years were found to have elevated TSH reports above reference range according to kit manufacturer [10].

In another older study from America (1965-1968); 3.7 % of children (11-18 years) were found to have thyroid function abnormalities [3]. Although; prevalence of thyroid function disorders in children and adolescents is lesser than adults (19.6%) [12], screening them is important, due to their adverse impact on growth and development.

The prevalence rate of thyroid function abnormalities was higher in females (12.05 %) than males (5.36 %). Thyroid function abnormalities were more prevalent in adolescents (10.89%) than children (7.82%) (Table 3).

Subclinical hypothyroidism: The SCH was the most common (4.08%) of the thyroid function abnormalities in our study; the prevalence was higher in females (Table 2); female: male ratio of 2.5:1. One of previous study had reported the of SCH as 6.1 %. [9]. The prevalence rate of SCH was higher in the adolescents

than children (Table 3). The adolescent females were the most affected off all with a prevalence rate of 7.39% and female: male ratio of 5.67:1 (Table 4 & 5). The previous reported prevalence of SCH in children and adolescence is up to 2%. [4, 5, 11]. The subjects with SCH need long term follow due to their unpredictable course, with 1 to 20% developing OH or hyperthyroidism during follow-up [4, 5, 6, 11].

Overt Hypothyroidism: The OH was the second commonest (3.05%) of the thyroid function abnormalities (Table 2); however, a lesser prevalence rate (0.4 %) was reported in an earlier study [9]. The OH was more common in females than males; with female: male ratio of 2.43:1. (Table 2). Majority of cases OH were of primary hypothyroidism. (Table 2) The prevalence rate of hypothyroidism was higher in children than adolescents.

Hyperthyroidism: The hyperthyroidism was the third common disorder affecting 2.04 % of subjects; which was also more prevalent in females; female to male ratio of 7:1 (Table 2). The prevalence rate of hyperthyroidism was higher in adolescents than children (2.29 vs 1.84%) (Table 3). The hyperthyroidism was more common in females than

males in both children and adolescents age groups (Table 4 & 5). The prevalence of hyperthyroidism is known to increase during childhood and peaks during adolescence, and more common in females than in males, in a ratio of 3:1 to 5:1; consistent with observation of our study [7].

To summarize the present study is to first of its kind to assess the prevalence of thyroid disorders in children and adolescents with majority consuming iodized salt.

Limitations: Our study has few limitations; firstly, study sample was relatively smaller; however, post hoc power of our study is 90.7%, which shows that sample size is adequate. Secondly, classification was based on kit manufacturers recommendations regarding normal values of TFTs, as there were no reference values for the study population.

Conclusions

The present study was the first of kind to assess the prevalence of thyroid function abnormalities in children and adolescents from northern Kerala.

Thyroid function disorders are common in children and adolescents; affecting about ~ 9% in study population, underlining the importance of multicentre trials to assess their prevalence at national level; due to their adverse impact on growth and development. Thyroid function abnormalities were more common in females than males. The prevalence rate TFTs abnormalities was more in adolescents than children.

Subclinical hypothyroidism was the commonest thyroid disorder with a female to male ratio of 2.5:1; and the prevalence was higher in the adolescents than children. The subjects with SCH need long term follow due to their previously reported unpredictable course.

The OH was the second commonest of the thyroid function abnormalities; with female: male ratio of 2.43:1. Majority of cases OH were of primary hypothyroidism.

The hyperthyroidism was the third common disorder also more common in females; female to male ratio of 7:1. The prevalence rate of hyperthyroidism was higher in adolescents than children.

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How to cite this article?

Lakshminarayana Gopaliah R¹, Sheetal Lakshminarayana G², Nidhish P Sadanandan³, Pramod Mundekkat. Thyroid dysfunction in children and adolescence: Experience of a tertiary care centre in Kerala. Pediatr Rev: Int J Pediatr Res 2016;3(1):3-8.doi:10.17511/ijpr.2016.i01.02

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