



Thyroid Functions in Healthy Children and Adolescents Attending Tertiary Care Centre in Jammu Region: The Physiological Variations.

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Citation this Article: Ravinder K. Gupta, Abhai S Bhadwal, Priyanka Sharma, Saishte Mahajan, Vikas Sharma, “Thyroid Functions in Healthy Children and Adolescents Attending Tertiary Care Centre in Jammu Region: The Physiological Variations”, IJMSIR- February - 2022, Vol – 7, Issue - 1, P. No. 01 – 06.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Thyroid hormones play an active role in the regulation of somatic and intellectual growth, intermediary metabolism and thermoregulation. Hypothyroidism is a challenge among every age group especially in the young mainly the neonates it is a challenge to be diagnosed and is one of the most common cause of intellectual disability which is preventable.

Aim: To study age and sex related changes in thyroid functions in healthy children and adolescents in Jammu region.

Design: Prospective study

Material and Methods: The study was conducted at the OPD of Department of Pediatrics, ASCOMS between Jan 2021 to December 2021. The study population consisted of 200 healthy children attending OPD for vaccination which were divided into two groups of 0-10 and 10-19 years. The blood samples for thyroid functions were drawn from the non-fasting patients and tests were performed. The differences in means of T₃, T₄, & TSH (Thyroid stimulating hormone) of males and females were statistically evaluated using the unpaired t-test.

Results: The levels of T₃ and T₄ declined with the age with mean level of 1.456 & 104.12 respectively in 1-9 years to 1.114 & 100.24 respectively in 10-19 years

while TSH levels increased from 4.81 to 5.51 between the groups 1-9 years and 10-19 years respectively.

Conclusion: Serum T₃ decline significantly with age while T₄ decline in the late adolescents. On the other hand, levels of TSH increase significantly from children to adolescents. There is no significant difference in levels of TSH, T₃, T₄ between males and females irrespective of their age.

Keywords: Thyroid, TSH, T₃, T₄.

Introduction

Thyroid hormones play an active role in the regulation of somatic and intellectual growth, intermediary metabolism and thermoregulation. TSH levels are found elevated immediately after birth and which lead to increase in the levels of T₃, T₄ reaching their maximum levels at 24hrs and decline after. Thyroid functions are assessed using the TSH which is the primary indicator for the thyroid disorders and it serves as the most sensitive indicator [1-2]. Measurement of T₃, FT₃, and FT₄ by the immunoassay methods commonly used by the majority of laboratories is problematic, especially for low levels of thyroid hormones. A significant number of patients are misclassified as having normal levels of thyroid hormones when they actually have levels below the reference range by LC-MS/MS [3]. Still TSH levels along with T₃, T₄ serves as the most important test to detect the thyroid status of an individual. Hypothyroidism is a challenge among every age group especially in the young mainly the neonates it is a challenge to be diagnosed and is one of the most common cause of intellectual disability which is preventable [4-6]. Our study purposes to provide a way to determine the average levels of TSH, T₃, T₄ and how these levels change with the advancing age. Hence, we

can extrapolate the obtained data to set a standard against which the results can be compared.

Material and Methods

The study was conducted in the outdoor wing of Department of Paediatrics, ASCOMS between January 2021 to December 2021. The study was conducted on 200 healthy children and adolescents belonging to Jammu region who were ambulatory and apparently in normal nutritional state without any abnormality on routine physical examination who had come to OPD for routine immunization. A detailed history was taken to rule out the presence of any thyroid disease (hypothyroidism and hyperthyroidism) or intake of drugs known to affect thyroid functions. They were also screened for presence of any chronic illness such as renal or hepatic disorder, malignancy or other diseases known to affect thyroid functions. The study population was further categorized based on their age into two groups 1-9 years and 10-19 years. The blood sample was withdrawn from non-fasting subjects and test were performed by radio-immunoassay method as per the protocol given in the RIAK-4A, RIAK-5A and RIAK-9 kits for T₃, T₄ and TSH respectively supplied by BARC Mumbai. The data was collected and differences in means of T₃, T₄, & TSH of males and females of different age groups were statistically evaluated using the unpaired t-test.

Results

The subjects comprised of 200 individuals among whom 106 were males and 94 were females. The subjects in the study were equally distributed among all the age groups. The detailed age and sex wise distribution of subjects is given in table 1.

Table 1: Age and Sex wise distribution of subjects.

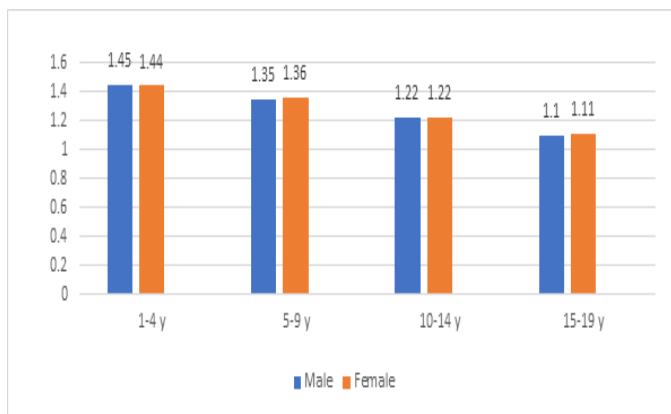
Age (in years)	Males	Females	Total
01-04	18	18	36
05-09	26	28	54
10-14	32	24	56
15-19	30	24	54
Total	106	94	200

The mean value of T₃ consistently declined with the increasing age from level of 1.4 to 1.1. The pattern of decline was similar both in the females and the males emphasising that gender doesn't play a role in the magnitude of serum levels of T₃. The detailed data is shown in table 2 and fig 1.

Table 2: Mean values of T₃ (ng/ml) in subjects.

Age (in years)	Males	Mean value of T ₃ (ng/ml)	Females	Mean value of T ₃ (ng/ml)
01-04	18	1.45±0.173	18	1.44±0.172
05-09	26	1.35±0.141	28	1.36±0.143
10-14	32	1.22±0.132	24	1.22±0.134
15-19	30	1.1±0.146	24	1.1±0.145
Total	106		94	

Fig 1: Mean values of T₃ (ng/ml) in subjects.



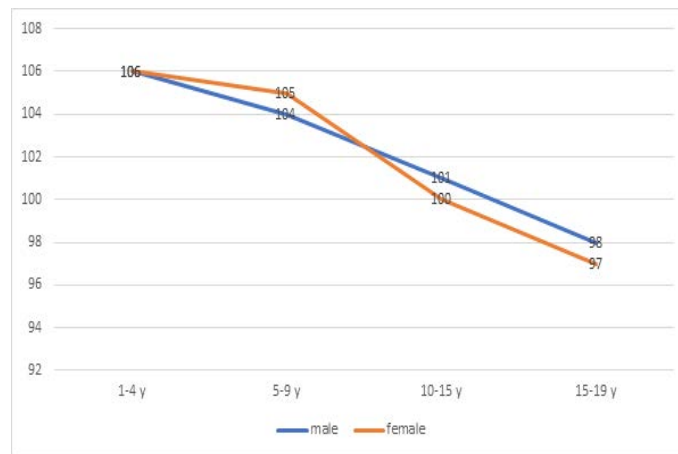
The mean value of T₄ declined with a narrow slope in the first few years of the life but after adolescence there was

a drastic decline in the mean value of the T₄ levels. The mean value fell from 106 to 104 in the first 9 years of life while between 9-14 years it declined from 105 to 100. The pattern of decline was fairly consistent in both the genders. The mean values of T₄ are shown in table 3 and fig 2.

Table 3: Mean values of T₄ (ng/ml) in subjects.

Age (in years)	Males	Mean value of T ₄ (ng/ml)	Females	Mean value of T ₄ (ng/ml)
01-04	18	106±3.012	18	106±3.012
05-09	26	104±3.022	28	105±3.022
10-14	32	101±2.011	24	100±2.011
15-19	30	98±2.111	24	97±2.145
Total	106		94	

Fig 2: Mean values of T₄ (ng/ml) in subjects.

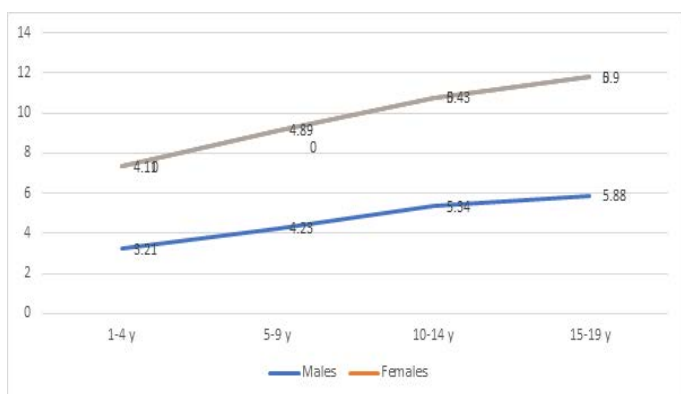


The mean value of TSH rose at a constant level with the increasing age and both males and females shared a common pattern of inclination in the levels of the TSH from levels of 3.21 to 5.9. The detailed description of the mean value of TSH in the subjects is shown in the table 4 and fig 3.

Table 4: Mean value of TSH (mU/ml) in subjects.

Age (in years)	Males	Mean value of TSH (mU/ml)	Females	Mean value of TSH (mU/ml)
01-04	18	3.21±0.433	18	4.11±0.345
05-09	26	4.23±0.342	28	4.89±0.346
10-14	32	5.34±0.567	24	5.43±0.457
15-19	30	5.88±0.123	24	5.90±0.112
Total	106		94	

Fig 3: Mean value of TSH (mU/ml) in subjects.



Comparative study of average of different thyroid tests in the two groups i.e., 1-9 years and 10-19 years is given in table 5. While, the levels of T₃ fell from 1.456 to 1.114, T₄ levels fell from 104.12 to 100.24, and TSH levels rose from 4.81 to 5.51 in children and adolescent group. The t value was calculated using the unpaired t-test and value were found to be 1.073, 0.0011 and 2.097 for the T₃, T₄ and TSH respectively.

Table 5: Comparison of thyroid function tests of different age groups.

Thyroid function Tests	Children (1-9 years)	Adolescents (10-19 years)	t-statistics
Mean T ₃ (ng/ml)	1.456	1.114	1.073
Mean T ₄	104.12	100.24	0.0011

(ng/ml)			
Mean TSH (mU/ml)	4.81	5.51	2.097

The normal range of levels of T₃, T₄ and TSH is shown in the table 6.

Table 6: Normal range for healthy subjects of different age groups.

Age (in years)	T ₃ (ng/ml)	T ₄ (ng/ml)	TSH (mU/ml)
01-04	1.2-1.7	98-110	1-4.5
04-09	1.1-1.6	96-110	0.9-5.0
10-14	0.8-1.5	92-108	0.9-5.4
15-19	0.8-1.3	90-107	1.2-5.9

Discussion

Thyroid gland is an endocrine gland which plays a key role in the metabolism in the body. The hormones produced by thyroid gland have effect on nearly all the systems in the body while the excess of thyroid hormone can increase the speed of metabolic events many fold, on the contrary, a decline in their levels can make the events sluggish. Many studies focusing on these physiological processes have been conducted in different settings which supports the above mentioned facts [7-10]. TSH is a hormone produced by the hypothalamus and acts as the most sensitive indicator in diagnosing the problems related to thyroid. Although, there are some drawbacks to the use of TSH as an indicator but the widely related data related to its use as an indicator and wide acceptability throughout the world still favours its use in diagnosing the diseases of thyroid [11]. Bremner AP et al. in his study has supported the results that we encountered in our study also, they have reported that with age the levels of TSH increase in the body of the individuals although the age groups that they have studied is more wide and

elaborate to the study that we have done but the similarity in results is noted[12]. While, we focused only at the age as a factor for the levels of TSH many other studies have been conducted world-wide which focused on different settings like how blood pressure and serum lipid concentration plays a role in the variations in the levels of TSH[13-16]. Other studies have been conducted which focused on the changes in the levels of T_3 and T_4 with the age of the person although the kind of study which solely focuses on the pediatric age group is still missing and our study tries to fill the void in that knowledge. Despite this, the study conducted on the older age groups also provides similar results which were shown by our study. Many studies confirm that with increasing age the levels of T_3 and T_4 decline [17-19]. The main difference between T_3 and T_4 is that T_4 can be converted to T_3 in the peripheral organs hence T_4 serves as a better parameter to measure in hypothyroid events as T_3 can appear to be falsely normal in thyroid deplete state. While our study provided us with the pattern that these thyroid hormones level follow with the advancing age there are many aspects which were not touched by our study by which the levels of these hormones could be altered one being the BMI of the patient, other being the circadian rhythm which is shown to have impact on the levels of various substances in the human body. Thyroid is a key gland and many aspects still need to be understood about the gland and how the hormones produced by it act in different scenarios.

Conclusion

We conclude that serum T_3 levels decline significantly with age while the levels of serum T_4 decline in the late adolescents. The serum TSH levels on the other hand increase significantly from childhood to adolescents. Also, we found that there is no significant difference in

the mean T_3 , T_4 and TSH levels in males and females in any age group

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