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Comparison of FT_3, FT_4 and TSH Level in non-pregnant women in Uttarakhand, India

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ABSTRACT

This study was carried out to investigate thyroid hormone TSH (Thyroid-stimulating Hormone), Free T_3 (FT_3) and Free T_4 (FT_4) status in non-pregnant women in Uttarakhand (India). Only 100 healthy pregnant women were selected for the present study. TSH, Free T_3 (FT_3) and Free T_4 (FT_4) were quantitatively analysed. FT_3, FT_4 and TSH in Euthyroid showed 6.19±1.14 (pmol/L), 18.42±4.50 (pmol/L), 2.02±0.64 (mIU/L) respectively. Our study showed that 72, 6, 5, 2, 1, 10, 4 women were characterized into Euthyroid, Primary hypothyroid, Primary hyperthyroid, Secondary hypothyroid, Secondary hyperthyroid, Sub clinical hypothyroid and Sub clinical hyperthyroid respectively. Our study concluded that major non-pregnant women were healthy but 28% female were suffering from thyroid disease. Reference ranges of FT_3, FT_4 and TSH have been established for non-pregnant women of Uttarakhand by using 5th and 95th percentiles.

INTRODUCTION

It has been estimated that about 42 million people in India suffer from thyroid diseases [1]. The thyroid gland generates the hormones thyroxine (T_4), 3,5,3-triiodothyronine (T_3), calcitonin and secretes them into the bloodstream. These thyroid hormones are essential for proper growth, proliferation, differentiation, apoptosis, development, neurotransmission, behavior, and metabolic homeostasis [2-3]. In early stages of brain development in mammals, thyroid hormones promote cell proliferation and subsequently act by inhibiting proliferation and stimulating cell differentiation [4]. Several changes in thyroid function occur with advancing age, as reviewed [5-6]. Serum TSH concentrations decrease in healthy elderly subjects due to an age-related decrease in TSH secretion by the pituitary [7]. Further, broadly, thyroid disease is characterized on the basis of quantity of thyroid hormones secretion i.e. hyperthyroidism and hypothyroidism. In hyperthyroidism, tissue is exposed to excessive amounts of circulating thyroid hormone. The most common cause of this syndrome is Graves' disease, followed by toxic multinodular goitre, and solitary hyper functioning nodules. Autoimmune postpartum and subacute thyroiditis, tumors that secrete thyrotropin, and drug-induced thyroid dysfunction, are also important causes [8]. Hyperthyroidism in pregnant women is low but untreated overt hyperthyroidism are at increased risk for spontaneous miscarriage, fetal growth restriction, congestive heart failure, thyroid storm, preterm birth, pre-eclampsia, increased perinatal morbidity and mortality [9-11]. Hypothyroidism is a condition in which the thyroid gland does not produce enough amounts of the thyroid hormones- thyroxine (T_4) and triiodothyronine (T_3). Hypothyroidism is related with a broad spectrum of reproductive disorders. Hypothyroidism is related with a broad spectrum of reproductive disorders ranging from abnormal sexual development through menstrual irregularities to infertility. The impact of hypothyroidism on the menstrual cycle has been identified since the 1950s [12-13]. Women with thyroid dysfunction often have menstrual irregularities, infertility and increased morbidity during pregnancy [14]. Literature suggests that no proper investigation on thyroid hormones secretion of non-pregnant women at Uttarakhand, India. Therefore, this study was carried out to investigate thyroid hormone TSH, Free T_3 (FT_3) and Free T_4 (FT_4) status in non-pregnant women in Uttarakhand (India).

MATERIALS AND METHODS

Study population: This study comprises 100 non-pregnant women at various part of *Uttarakhand* and blood sample was dispatched to Doon (PG) Paramedical College, Dehradun,

Uttarakhand (India) for thyroid test. Age of non-pregnant women was ranging from 20 to 35 years. These cases were selected over a period of 3years (2010 to 2013). 7 group of thyroid case were categorized as per guidelines of Rijal [15] i.e. groups- Euthyroidism, primary hypothyroidism, primary hyperthyroidism, secondary hypothyroidism, secondary hyperthyroidism, subclinical hypothyroidism, and subclinical hyperthyroidism as mentioned in table 1 [15].

Sample collection: Venous blood (5 mL) of non-pregnant women was collected in fasting state. Serum was prepared within 60 min of blood collection. Serum was store at -20°C till get analyzed for thyroid function test. These samples were analyzed within 24 h from blood collection time.

Hormone analysis: Thyroid stimulating hormone (TSH), Serum free 3,5,3'- triiodothyronine (FT_3) and free 3,5,3',5'-tetraiodothyronine (FT_4) were analyzed using ERBA THYROKIT. Measurement of Free T_3 (FT_3) and Free T_4 (FT_4) was based on a direct, labelled antibody, competitive immunoassay, but TSH assay is based on one step immunoenzymatic sandwich principle, in conjunction with biotin-streptavidin technology.

Statistical analysis: Data were represented as percentile; mean and standard deviation.

RESULTS

In present study, we analysed only 100 non-pregnant women. We used 5th, 50th and 95th percentile and mean ±SD of FT_3, FT_4 and TSH. It was noted that FT_3 concentration increased in 50th, 95th percentile by 92.07, 164.35% respectively as compared to 5th percentile. FT_4 concentration also increased in 50th, 95th percentile by 257.76, 419.25% respectively as compared to 5th percentile. TSH concentration increased in 50th, 95th percentile by 575, 1282.35% respectively as compared to 5th percentile. Mean value of FT_3, FT_4, and TSH was 5.73±1.73 pmol/L, 16.90±6.17 pmol/L, 2.49±1.33 mIU/L respectively (Table 2). Maximum standard deviation was observed in FT_4 which clearly indicated that non-pregnant women have large difference among in term of secretion of FT_4. We observed 7 categories of non-pregnant i.e. 72 Euthyroid, 6 Primary hypothyroid, 5 Primary hyperthyroid, 2 Secondary hypothyroid, 1 Secondary hyperthyroid, 10 Subclinical hypothyroid, 4 Subclinical hyperthyroid (Table 3).

DISCUSSION

These results showed that major non-pregnant women were euthyroid and mean value of FT_3, FT_4, TSH was 6.19 pmol/L, 18.42 pmol/L, 2.02 mIU/L respectively. Remaining 28 non-pregnant women were suffered from various thyroid diseases i.e. Primary hypothyroid, Primary hyperthyroid, Secondary hypothyroid, Secondary hyperthyroid, Subclinical hypothyroid and Subclinical hyperthyroid. Similarly, Yang [16] concluded that Hospitalized patients with primary hypothyroidism may present as heart or neuromental diseases. Ages and hyponatremia attributed to 2-year mortality in the hospitalized patients with hypothyroidism. Thyroid disease affect on the pregnancy in female. Poppe and Velkeniers [17] mentioned that thyroid hormones have reflective effects on reproduction, pregnancy and there is a known association of hyper- and hypothyroidism with menstrual disturbances and decreased fecundity. Krassas [18] reported that hat 50 to 70% of hypothyroid female patients had menstrual abnormalities. Female with untreated subclinical hypothyroidism (elevated TSH only) had approximately one third the incidence of this problem [19]. Gayathri *et al.* [20] reported that 2.8% women had subclinical hyperthyroidism (normal serum thyroxine with suppressed serum TSH levels). All above literature and our finding suggested about the variation in thyroid hormones secretion in non-pregnant women in Uttarakhand.

Table 1: Reference- Categorization of cases on the basis of thyroid profile [15]

Thyroid	FT_3 (pmol/L)	FT_4 (pmol/L	TSH (mIU/L)
Euthyroid	4.26 - 8.10	10.0 – 28.2	0.46 – 4.5
Primary Hypothyroid	< 4.26	< 10.0	> 4.5
Primary Hyperthyroid	> 8.1	> 28.2	< 0.46
Secondary Hypothyroid	< 4.26	< 10.0	< 0.46
Secondary Hyperthyroid	> 8.1	> 28.2	> 4.5
Subclinical Hypothyroid	4.26 - 8.10	10.0 - 28.2	> 4.5
Subclinical Hyperthyroid	4.26 - 8.10	10.0 - 28.2	< 0.46

Table 2: Percentile values, Mean value ± SD of FT3, FT4 and TSH of 100 non-Pregnant women

Thyroid hormones	Percentile			Mean value ± SD
	5^{th}	50^{th}	95^{th}	
FT_3 (pmol/L)	3.03	05.82	08.01	05.73±1.73
FT_4 (pmol/L)	4.83	17.28	25.08	16.90±6.17
TSH (mIU/L)	0.34	2.295	04.70	02.49±1.33

Table 3: Thyroid status and mean of thyroid hormone

Thyroid	Number (100)	FT_3 (pmol/L)	FT_4 (pmol/L	TSH (mIU/L)
Euthyroid	72	6.19±1.14	18.42±4.50	2.02±0.64
Primary Hypothyroid	6	3.17±0.10	5.79±1.64	4.57±0.04
Primary Hyperthyroid	5	6.66±2.03	5.46±1.59	4.56±0.03
Secondary Hypothyroid	2	3.93±0.04	9.27±0.62	0.33±0.20
Secondary Hyperthyroid	1	9.7±0.00	32.23±0.00	5.22±0.00
Subclinical Hypothyroid	10	6.03±1.11	19.5±5.5	4.69±0.08
Subclinical Hyperthyroid	4	5.11±0.96	13.96±2.85	0.30±0.02

CONCLUSION

Thyroid hormones are essential for metabolic activity and proper growth. In term of thyroid hormones, 72% women were healthy but 28% showed thyroid disease. Dysfunction of thyroid may cause infertility in women, weight gain, and weight loss. Our results clearly indicated that more than one fourth of selected women in uttrakhand were affected with thyroid disease. Further, study indicated that there is urging to find out the thyroid level in women in large area of Uttrakhand, India.

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