Age and Gender Effects on FT3, FT4 and TSH Levels Among Healthy Population in Rajshahi City

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Abstract

Background: The levels of serum free T_3, free T_4 and TSH are remarkable different from infant to old age including both male and female. This variation of free T_3, free T_4 and TSH levels in different decades of life also affected by gender, nutritional status, seasons, geographical region. Due to particular family setup in Bangladesh, female are more exposed to nutritional deficiencies that causes health problems including thyroid disorder. However, with increasing age, the concentration of these hormones dropped in both sexes. The drop was more in female than males. Higher frequencies of thyroid problems in females may be attribute to stress, multiple pregnancies and lactation. **Objectives:** To observe the effect of age and gender on FT_3, FT_4 and TSH levels among normal healthy population residing in Rajshahi City. **Methods:** A cross-sectional descriptive study was carried out at the department of physiology, Rajshahi Medical College in collaboration with institute of Nuclear medicine and Allied Sciences, Rajshahi, Bangladesh. A total of 120 healthy persons with the male and female ratio 1:1 i.e. 60 males and 60 females aged 8 – 65 years were selected by stratified sampling as sample in this study. Non fasting blood sample was taken to measure the level of free T_3, free T_4, TSH by Radioimmunoassay (RIA) and Immunoradiometric assay (IRMA) techniques. Data were analyzed by ANOVA Test and independent t test. **Result:** The mean FT_3 and FT_4 levels are non significantly higher in male than female and mean TSH levels are significantly higher in male than female. **Conclusion:** It can be concluded that, mean FT_3 and FT_4 concentration is non-significantly higher in male in comparison to female. However mean TSH concentration is significantly higher male in comparison to female.

Key words: free Triiodothyronine (FT3), free Thyroxine (FT4), Thyroid Stimulating Hormones (TSH), Radioimmunoassay (RIA), Immunoradiometric assay (IRMA).

Introduction

The principal hormones of thyroid gland are thyroxine (T_4) and Triiodothyronine (T_3) and their concentrations are 93% and 7% respectively. Both T_4 and T_3 hormones are iodine containing amino acids. T_3 is about four times as potent as T_4, but it is present in the blood in

much smaller quantities and persists for shorter time than does T_4. The normal total plasma T_4 level is approximately 8 µg/dl (103 nmol/l) and the plasma T_3 level is 0.15 µg/dl (2.3 nmol/l).[1] It was found that during a normal human life span, serum T_3 remains high during adolescence, then it remains stable until late middle age and ultimately decrease, in both male and female with their increasing age. Some studies reported that stable T_4 levels for males throughout life and T_4 values lower in females older than 60 years.[2]

The levels of serum free T_3, free T_4 and TSH are remarkable different from infant to old age including both male and female. TSH values increased significantly in females over age 60. Throughout all decades, males had stable TSH levels that were slightly higher than the female levels before age 60 and lower there after.[3] Estrogens cause increased secretion of thyroid binding globulin (TBG). On the other hand, TBG levels are depressed by androgens.[4]
Gender has also an effect on the concentration of T_3, T_4 and TSH, and also thyroid function. Meng, *et al.* (2015)[5] reported that females had higher incidence of thyroid dysfunction than males.[5]

Khan *et al* (2001)[6] and Kumari *et al.* (2015)[7] showed that concentration of T_3 and T_4 was significantly higher in females than males, while TSH concentration was not significantly different in both sexes. But Bremner *et al.* (2012)[8] found female with advancing age had high TSH and high FT_3 level than male. Peeters *et al.* (2008)[9] indicated that the level of T_4, T_3 and TSH in Blood Serum of male and female were of insignificant difference.

Dambal *et al.* (2013)10 observed that T_3 and T_4 levels declined but TSH levels raised as the age advanced. T_3 and T_4 levels were lower and TSH levels higher in female subjects as compared to male subjects, in the age group of 21-40 years. Franklyn *et al.*(1985)[11] stated that levels of total T_4, total T_3, free T_4 and T_4: TBG ratio were lower in women between 16 and 49 years than in men despite an increase in TBG lower levels of free T_3 were confined to the group of women aged 16-29 year. TSH values were unaffected by sex.

Alom *et al.* (2016)[12] and Abbas *et al.* (2014)[13] showed that the serum thyroid hormones and TSH levels were found to be higher in females than males. On comparing the different thyroid hormone levels in different age groups showed that serum T_3 levels were higher in children and declined progressively with age while serum T_4 levels declined slightly only in elderly age group. Lipson *et al.* (1979)[3] stated that, mean T_4 values for men were stable throughout life but in female under age 60, T_4 values were significantly higher than in older women. TSH values increased significantly in females over age 60. Throughout all decades males had stable TSH levels that were slightly higher than the female results before age 60 and lower thereafter.

So the present study has been designed to know the variation of normal level of free T_3, free T_4 and TSH regarding gender of people in Rajshahi City. So, that normal level is easily detectable in respect of sex to differentiate from the abnormal one.

Methods

This cross-sectional descriptive study was carried out in the department of physiology in collaboration with institute of Nuclear medicine and Allied Sciences between the period of January 2016 to December 2016. Apparently healthy persons aged 8-65 years residing in Rajshahi City constituted the study population.

A total 120 persons were selected by stratified sampling from the study population as a sample. Firstly total 60 males, 20 from each three age strata, i.e., 8-17 years, 18-40 years and 41-65 years were selected. Then another 60 females were selected from the three age strata as like the males in same number and proportion by careful individual matching of age with ± 2 years.

After taking informed consent, complete history taking and physical examination were done and recorded in a preformed data sheet. After breakfast, 5ml of venous blood sample were drawn from the anticubital space of the forearm into a test tube by venipuncture after taking all aseptic precautions. After coagulation, serum was separated by centrifugation at 3500 rpm for 2 minutes. Then FT_3, FT_4 and TSH levels were estimated from the serum by Radioimmunoassay (RIA) and Immunoradiometric assay (IRMA). The results of TSH were expressed in μIU/ml and FT_3 and FT_4 were expressed in fmol/ml. Collected data were analyzed by using SPSS Version 20.0 for Window. Means of serum FT_3, FT_4 and TSH were compared between different gender and age groups using the t-test and a one-way analysis of variance (ANOVA test). P value at or below 0.05 was taken as level of significance.

Results

The mean FT_3 level was almost same in adolescent (8-17 yrs) and young adult males (18-40 yrs). FT_3 level in the older males (41-65 yrs) was declined to 7.16 ±1.10 fmol/ml, but it was not statistically significant than the other younger groups. Age was not associated with the FT_3 level in males (Table I).

Table I: Mean serum FT3 level of males in different age groups (n=60)

Age group (in years)	FT_3 fmol/ml (mean±SD)	95% CI	P-value
Group 1 (8-17 yrs), n = 20	8.36±3.10	8.36-11.46	.198 ns
Group 2 (18-40 yrs), n = 20	8.23±1.90	8.23-10.13	
Group 3 (41-65 yrs), n = 20	7.16-±1.10	7.16-8.26	

One Way ANOVA test was applied ns=Not significant (p>0.05)

Table II: Serum FT4 level of male in different age groups (n=60)

Age group (in years)	FT_4 fmol/ml (mean±SD)	95 % CI	P-value
Group 1 (8-17 yrs)	24.22±5.56	24.22-29.78	.695 ns
Group 2 (18-40 yrs)	22.15±13.73	22.15-35.88	
Group 3 (41-65 yrs)	21.79±6.37	21.79-28.16	

One Way ANOVA test was applied ns=Not significant (p>0.05)

The mean FT4 level was highest in adolescent group. It was gradually declined with increase of the age of the males. A sharp fall is seen after that in the age group upto 40 years. Further little decrease in the mean level of FT4 is seen after 40 years. But the differences of the serum FT4 levels in different age groups were not statistically significant with each other (Table - II). The Serum TSH level was highest (4.57±10.37 μIU/ml) among young adult male group, followed by adolescents and it was lowest (2.68±4.32 μIU/ml) in older age group (Table III).

Table III: Serum TSH level of male in different age groups (n=60)

Age group in years	TSH µIU/ml (mean±SD)	95% CI	P-value
Group 1 (8-17 yrs)	3.92±4.60	3.92-8.52	.711[ns]
Group 2 (18-40 yrs)	4.57±10.37	4.57-14.94	
Group 3 (41-65 yrs)	2.68±4.32	2.68-7.0	

One Way ANOVA test was applied ns=Not significant (p>0.05)

Table IV: Serum FT3 level of female in different age groups (n=60)

Age group (years)	FT_3 fmol/ml (mean±SD)	95% CI	P-value
Group 1 (8-17 yrs)	7.66±1.09	7.66-8.75	0.388[ns]
Group 2 (18-40 yrs)	8.17±1.62	8.17-9.79	
Group 3 (41-65 yrs)	7.65±1.32	7.65-8.97	

One Way ANOVA test was applied ns=Not significant (p>0.05)

Table V: Serum FT4 level of female in different age groups (n=60)

Age group (years)	FT_4 fmol/ml (mean±SD)	95% CI	P-value
Group 1 (8-17 yrs)	19.99±5.54	19.99-25.53	0.626[ns]
Group 2 (18-40 yrs)	20.69±11.37	20.69-32.06	
Group 3 (41-65 yrs)	22.34±5.67	22.34-28.01	

One Way ANOVA test was applied ns=Not significant (p>0.05).

Mean serum FT4 level was highest among the oldest age group. It was gradually declined among the younger age groups (Table V). The mean serum FT3 levels were almost same in different age groups in the females (Table IV).

Table VI: Mean serum TSH level of female in different age groups (n=60)

Age group in years	TSH µIU/ml (mean±SD)	95% CI	P-value
Group 1 (8-17 yrs)	1.33±0.66	1.33-1.99	0. 216[ns]
Group 2 (18-40 yrs)	1.63±0.99	1.63-2.62	
Group 3 (41-65 yrs)	2.51±3.59	2.51-6.1	

One Way ANOVA test was applied ns=Not significant (p>0.05)

Mean serum TSH level was 1.33±0.66 µIU/ml among the female adolescent group. It was gradually increased with the age of the female respondents. But there was no statistical association between serum TSH level and age of the females (p=0.21)(Table VI).

Table VII: Comparison of mean serum thyroid hormones levels between males and females.

Hormone level	Male (n=60)	Female (n=60)	P-value
FT_3 (fmol/ml)	7.96±2.24	7.83±1.38	0.708[ns]
FT_4 (fmol/ml)	22.74±9.48	21.04±7.93	0.282[ns]
TSH (µIU/ml)	3.79±7.15	1.81±2.21	0.044[s]

Independent t test was applied ns=Not significant (p>0.05) s=Significant (p<0.05).

Mean serum levels of FT3, FT4 and TSHwere higher in males than females. But the difference of TSH between males and females was only statistically significant (p=.044). The difference of the rest two hormones levels, i.e., FT3 and FT4 were not statistically significant.

Discussion

In this study, FT_4, FT_3 and TSH levels were higheramong males in comparison to females. This finding is consistent with Ahmed *et al.* (2009)[14], Chaurasia *et al.* (2011)[15] and Dambal *et al.* (2013)[10]. Lower thyroid hormone

concentration in female may represent the fact that hypo-thalamo-pituitary-thyroid axis in female is set at lower regulatory level. Furthermore, the finding may be due to influence of female sex hormone estrogen on thyroid binding globulin (TBG) level. Estrogen stimulates the synthesis of TBG which increases total T_4 and T_3 but decreases FT_4 and FT_3 concentration.

In a study, Rotha *et al.* (2015)[16] observed that higher T_4 in female than male. It may be due to the fact that they measured total T_4 concentration instead of FT_4 concentration. Moreover, Dika *et al.* (2010)[17] found no influence of sex on thyroid hormone concentration. It may be due to the fact that they selected very narrow age range (19-37years). So influence of sex hormones were maximum in both gender to find out any significant difference of thyroid hormone concentration. Furthermore, Kaur *et al.* (2007)[2], Khan *et al.* (2010)[6] and Alom *et al.* (2016)[18] showed higher concentration of T_4 & T_3 in female than male. Ahmed *et al.* (2009)[14] noted that T_4 & T_3 concentration decreases in female after 60 years of age. It represents that menopause causes abrupt reduction of estrogen level as well as TBG and total T_4 & T_3 concentration.

Moreover in this study it was observed that FT_4, FT_3 and TSH concentration was higher in below forty years male in comparison to corresponding female group. It reveals that hypothalamo-pituitary-thyroid axis is set at lower regulatory level in female. Wllke *et al.* (1983)[19] also agreed with this finding. However, after forty years age, TSH concentration was non-significantly higher and FT_4, FT_3 concentration were non-significantly lower in male in comparison to female. It indicates that aging process affects the hypothalamo-pituitary-thyroid axis more in male in comparison to female.

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