



Estimation of FT₃, FT₄ and TSH Levels Among Different age-sex Groups of Healthy Population in Rajshahi city

Farjana Kabir^{1*}, Shamima Nazneen Rupa¹, Sayeeda Sultana Jolly², Bedowra Begum¹

¹Department of Physiology, Pabna Medical College

²Department of Physiology, Rajshahi Medical College

³Department of Physiology, Khulna City Medical College

Abstract: *Background:* Thyroid is an endocrine gland which is located below the larynx. The principal hormones of thyroid gland are thyroxine (T₄), and tri-iodothyronine (T₃). The activity of the thyroid gland depends on the age as well as gender. However, with advancing age the concentration of these hormones decreases in apparently healthy male and female. The current study was carried out to investigate the impact of age and gender on the level of free triiodothyronine (FT₃), free thyroxine (FT₄) and thyroid stimulating hormone (TSH) in apparently healthy individuals. *Objective:* This study was designed to observe the levels of FT₃, FT₄ and TSH among different age-sex groups of normal healthy population residing in Rajshahi City. *Methods:* This cross-sectional descriptive study was carried out in the department of physiology in collaboration with institute of nuclear medicine and Allied Sciences, Rajshahi. 120 apparently healthy persons in age group of 8-65 years were studied. Random blood sample was taken to measure the level of free T₃, free T₄, TSH by Radioimmunoassay (RIA) and Immunoradiometric assay (IRMA). Data were analyzed by ANOVA Test and independent t test. *Result:* Non-significant drop of FT₄, TSH level and significant drop of FT₃ level with advancing age. Moreover, mean FT₃ and FT₄ concentration is non-significantly higher in male in comparison to female. However mean TSH concentration is significantly higher in male in comparison to female. *Conclusion:* It can be concluded from the present study that non-significant drop of FT₄, TSH level and significant drop of FT₃ level with advancing age.

Keywords: Free Triiodothyronine (FT₃), Free Thyroxine (FT₄) and Thyroid Stimulating Hormones (TSH), Radioimmunoassay (RIA) and Immunoradiometric assay (IRMA).

Article at a glance:

Study Purpose: To contribute to existing knowledge or propose new ideas.

Key findings: According to results obtained in this study, normal aging is characterized by gradual sex dependant decline in FT₃ concentration without significant change in FT₄ and TSH concentration. The mean FT₃ and FT₄ levels are non significantly higher in male than female and mean TSH levels are significantly higher in male than female.

Newer findings: Mean FT₃ and FT₄ concentration is non-significantly higher in male in comparison to female. However mean TSH concentration is significantly higher male in comparison to female but serum thyroid hormones and TSH levels were found to be higher in females than males in previous study.

Abbreviations: FT₃ – Free Triiodothyronine, FT₄ – Free Thyroxine, TSH – Thyroid Stimulating Hormone, RIA – Radioimmunoassay



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*Correspondence:

Dr. Farjana Kabir

Assistant professor (cc)

Department of Physiology,

Pabna Medical College

Email: kabirfarjana54@gmail.com

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INTRODUCTION

The Human thyroid gland secretes about 103 nmol of thyroxine T₄ and 7 nmol of triiodothyronine T₃ per day. T₃ is 3 to 5 times more active than T₄, T₃ is also formed in the peripheral

tissue (liver, kidney, muscle) by deiodination of T₄. Thyroid hormones mostly transport in the blood as bind form. Normally 99.98% of T₄ and 99.8% of T₃ in plasma are bound to plasma proteins and the rest are in free forms. 67% of T₄ is bound to Thyroxine

binding α - globulin (TBG), 20% to Thyroxine binding pre-albumin (TBPA) and 13% to albumin. On the other hand, 46% of binding T_3 is loosely bound to TBG and 54% to albumin but bond not at all to TBPA. The free forms are the active form (FT₃ and FT₄) and the free forms are in equilibrium with bindings form in plasma and tissue.¹

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.² This variation of free T_3 , free T_4 and TSH levels in different decades of life also affected by sex, 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.³ Thyroid disease is common and its prevalence increases with age especially in the elderly and in often associated with greater morbidity than in younger person. The relation of the thyroid gland to the ageing process is of interest because of the importance of the organ in regulating the rates of various body functions. 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 with their increasing age.⁴ 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.⁵ Estrogens cause increased secretion of thyroid binding globulin (TBG). On the other hand, TBG levels are depressed by androgens.⁶

Khan *et al.*⁷ and Kaur *et al.*⁴ 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 Meng *et al.*⁸ found female with advancing age had high TSH and high FT₃ level than male. Mukhtar *et al.*⁹ indicated that the level of T_4 , T_3 and TSH in Blood Serum of male and female were of insignificant difference. Rotha *et al.*¹⁰ showed that level of T_4 was higher in female than male. They

further concluded that T_3 and TSH levels are not influenced by gender. But Ahmed *et al.*¹¹ and Chaurasia *et al.*¹² have observed serum T_4 level slightly higher in male and TSH level higher in female. Alom *et al.*³ and Abbas *et al.*¹³ shows 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. On contrary mean TSH levels was found to be significantly changed with age. Suzuki *et al.*¹⁴ suggested that concentration of free thyroid hormone and resistance indices were decreased with aging in males. In female the free thyroid hormone concentration was not altered by aging but TSH level increased in an age dependent manner. So the present study has been designed to know the variation of normal level of free T_3 , free T_4 and TSH regarding age and sex of people in Rajshahi City. So, that normal level is easily detectable in respect of age to differentiated 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 120 healthy persons aged 8-65 years were selected residing in Rajshahi City. Purposive sampling technique was applied to select each subject. 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 into the test tube (from the anticubital space of the forearm) by venipuncture after taking all aseptic precautions. After coagulation serum was separated by centrifugation at 3500 rpm for 2 minutes. Then serum were used for estimation of FT₃, FT₄ and TSH level by Radioimmunoassay (RIA) and Immunoradiometric assay (IRMA). The results of TSH were expressed in μ IU/ml and FT₃ and FT₄ were expressed in fmol/ml. Collected data were analyzed by using SPSS (statistical package for social sciences) computer software programmed (version-20) and the tests of significance were calculated by using ANOVA test

and independent t test. P value at or below 0.05 was taken as level of significance.

RESULTS

Table 1: Serum FT₃ level of male in different age groups (n=60)

Age group in years including only male respondents	FT ₃ fmol/ml (mean±SD)	P-value
Group 1 (8-17 yrs)	8.36±3.10 (8.36-11.46)	.198 ^{ns}
Group 2 (18-40 yrs)	8.23±1.90 (8.23-10.13)	
Group 3 (41-65 yrs)	7.16±1.10 (7.16-8.26)	

ns=Not significant (p>0.05).

The test of significance was calculated using Anova test.

Table 1 shows FT₃ level of male respondents in different age group. The mean FT₃ level is almost same in adolescent group and in man

upto 40 years of age, after that slight decrease of FT₃ level is seen.

Table 2: Serum FT₄ level of male in different age groups (n=60)

Age group in years including only male respondents	FT ₄ fmol/ml (mean±SD)	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)	

ns=Not significant (p>0.05).

The test of significance was calculated using Anova test.

Table 2 shows FT₄ level of male respondents in different age group. The mean FT₄ level is seen highest in adolescent group. 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.

Table 3: Serum TSH level of male in different age groups (n=60)

Age group in years including only male respondents	TSH μIU/ml (mean±SD)	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)	

ns=Not significant (p>0.05)

The test of significance was calculated using Anova test.

Table 3 shows TSH level of male respondents in different age group. The TSH level increases from adolescent group to middle age

group. But after 40 years there is a decrease in TSH level which comes down to lower than the adolescent level.

Table 4: Serum FT₃ level of female in different age groups (n=60)

Age group in years including only female respondents	FT ₃ fmol/ml (mean±SD)	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)	

ns=Not significant (p=>0.05).

The test of significance was calculated using Anova test.

Table 4 shows FT₃ levels of female respondents in different age group. The mean FT₃ level is almost same in adolescent group and in

female upto 40 years of age. After that slight decrease of FT₃ level is seen.

Table 5: Serum FT₄ level of female in different age groups (n=60)

Age group in years including only female respondents	FT ₄ fmol/ml (mean±SD)	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)	

ns=Not significant (p=>0.05).

The test of significance was calculated using Anova test.

Table 5 shows FT₄ levels of female respondents in different age group. Mean FT₄ level

is seen highest after 40 years of age. Gradually increase is seen after adolescent age group upto 65 years.

Table 6: Serum TSH level of female in different age groups (n=60)

Age group in years including only female respondents	TSH μIU/ml (mean±SD)	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)	

ns=Not significant (p=>0.05).

The test of significance was calculated using Anova test.

Table 6 shows TSH levels of female respondents in different age group. The level of TSH increases from adolescent group to older age

group. But after 40 years there is a increase in TSH level which comes higher than the adolescent group.

Table 7: Gender distribution of hormone level

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

ns=Not significant (p>0.05).

s=Significant (p<0.05).

The test of significance was calculated using independent t test.

Table 7 shows thyroid hormone levels among total male and total female respondents, mean value of all the hormone show higher value in male group but the difference is not significant in case of FT₃ and FT₄. Statistically significant difference is seen in case of TSH, which showed much higher value in male group.

DISCUSSION

The levels of FT₃, FT₄ and TSH have significant effects among gender with age. Gender has a vital role in the level of thyroid hormones. However with increasing age, the concentration of these hormones dropped in both sexes. The drop is more in female than men. Women have more economic and family responsibility as compared to men. Present study found that, non-significant drop of FT₄, TSH level and significant drop of FT₃ level with advancing age. This findings are similar with the study of Suzuki *et al.* (2012)¹⁴, Abbas *et al.* (2014)¹³, Alom *et al.* (2016)³ It occurs due to reduced secretion and concentration of FT₃ levels and increaseturn over rate of FT₃.¹⁴ In this study, it is found that higher FT₄, FT₃ and high TSH level in male in comparison to female. This finding is consistent with Ahmed *et al.* (2009)¹¹, Chaurasia *et al.* (2011)¹² and Dambal *et al.* (2013).¹⁵ 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 T₄ and T₃ but decreases FT₄ and FT₃ concentration.

In contrast, Rotha *et al.* (2015)¹⁰ state that higher T₄ in female than male. It may be due to the

fact that they measured total T₄ concentration instead of FT₄ concentration. Moreover, Dika *et al.* (2010) found no influence of sex on thyroid hormone concentration.¹⁶ It may be due to the fact that they selected very narrow age range (19-37) years. 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)⁴, Khan *et al.* (2010)⁷ and Alom *et al.* (2016)³ showed higher concentration of T₄, T₃ in female than male. Ahmed *et al.* (2009)¹¹ state that T₄, T₃ 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 T₄, T₃ concentration. This study showed higher FT₄ and TSH concentration in (8-17) years age group in comparison to all other groups. This finding is in agree with Kaur *et al.* (2007)⁴, Alom *et al.* (2016)³ and Dambal *et al.* (2013).¹⁵ This finding represents that marked changes occur in thyroid function during puberty as an adaptation to body and sexual development. Adaptation of hypothalamo-pituitary-thyroid axis during puberty in response to increased energy expenditure may be the reason. Moreover, we observed FT₄, FT₃ and TSH concentration is higher in below forty years male in comparison to corresponding female group. It exhibits that hypothalamo-pituitary-thyroid axis is set at lower regulatory level in female Wilke *et al.* (1983).¹⁷ However, after forty years age, TSH concentration is non-significantly higher and FT₄, FT₃ concentration is non-significantly lower in male in comparison to female. It represents, that aging process affects the hypothalamo-pituitary-thyroid axis more in male in comparison to female.

Declarations

I, hereby, declare that the submitted Research Paper is my original work and no part of it has been published anywhere else in the past.

Ethical approval

Ethical clearance for the study was taken from the Institutional Review Board and concerned authority, Rajshahi Medical College & Hospital.

Conflict of interest

None declared.

Consent

Informed written consent was taken from each patient or patient's attendant.

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