Original Article:

Effect of Ageing on the Concentration of FT3, FT4 and TSH Levels among Different Age Groups

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Abstract :

Background: *The activities of the thyroid gland depend on the age. However, with advancing age the concentration of FT_3, FT_4 and TSH decrease in apparently healthy elderly persons.* ***Objective:****This cross-sectional study was designed to observe the influence of ageing on thyroid hormone levels.* ***Methods:****This 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 T_3, free T_4, TSH by Radioimmunoassay(RIA) and Immunoradiometric assay(IRMA). Data were analyzed by ANOVA Test.* ***Result:****Significant drop of FT_3 level and non-significant drop of FT_4, TSH level with advancing age.* ***Conclusion:****This study suggested that ageing has effect on FT_3 level more than FT_4 and TSH level.*

Keywords: Free triiodothyronine (FT_3), Free thyroxine (FT_4), Thyroid Stimulating Hormones (TSH), Radioimmunoassay (RIA), Immunoradiometric assay (IRMA).

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Introduction

The thyroid gland synthesizes and releases two hormones 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. T3 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[1].

About 99.98% of T_4 in plasma is bound; the free T_4 level is only about 2 ng/dl. Free T_3 accounts for only about 0.5% of the total T_3. The free T_4 in the plasma are physiologically active causing the inhibition of the Thyroid stimulating hormone (TSH) secretion. The free T_4 in plasma is important in the metabolic control of human body and therefore free T_4 is believed to be a direct indicator of thyroid status in an individual. Free T_3 like free T_4 measurement also reflects the thyroid status of individual accurately[2].

The function of thyroid gland controlled by TSH. The secretion of this tropic hormone is in turn regulated in part by thyrotropin releasing hormone (TRH) from hypothalamus and is subjected to 'negative feedback control' by high circulating levels of thyroid hormones acting on the anterior pituitary and hypothalamus[1].

Ageing is a physiological process which is characterized by a progressive generalized impairment of many functions of the body resulting in the loss of adaptive responses to stress and a growing risk of age associated disease. However, after the age of 60 years a person is commonly known as old aged person, when it involves progressive loss of cells, reduced metabolic activities and decreased efficiency of many functions of different organs[3]. Ageing is not solely an intrinsic process, as it also occurs in the context of an individual's interaction with the environmental factors such as lack of exercise, poor diet, cigarette smoking and heavy alcohol consumption. Moreover, genetic factor also plays a role in causing physiological changes in ageing process[3].

The relation of the thyroid gland to the ageing

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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].

Rahman *et al*.[3]and Dambal *et al*.[5] found that FT_3 and FT_4 level were declined with increasing age but TSH levels raised as the age advanced. But Dika *et al*.[6] found no statistically significance difference of T_3, T_4 and TSH with increasing age.

Wllke *et al.*[7] found that free T_4 progressively decreased. But Peeters et al.[8] observed serum TSH and T_3 level decrease with age whereas serum free T_4 level usually remains unchanged.

In addition Kumari *et al*.[9] and Bremner *et al*.[10] found FT_4 level remain almost static throughout all decades of life and TSH level Increase with age.

So, the present study has been designed to find out the normal level of FT_3, FT_4 and TSH among different age.

Materials and Methods

This cross-sectional descriptive study was carried out in the department of Physiology in collaboration with institute of Nuclear medicine and Allied Sciencesbetween the period of January 2016 to December 2016. The protocol of this study was approved by Institutional Review Board (IRB) and Ethical Review Committee (ERC) of Rajshahi Medical College. Apparently 120 healthy persons aged 8-65 years were selected residing in Rajshahi City. Purposive sampling technique was applied to select each subject. Subject having history of thyroid disorder, chronic illness, renal failure, malignancy, cirrhosis of liver, diabetes mellitus, pregnancywas excluded from this study.

After proper counseling, the aim, objectives, benefit, risk and procedure of the study were explained in details to the subjects. 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 was used for estimation of FT_3, FT_4 and TSH level 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 (statistical package for social sciences) computer software programmed (version-20) and the tests of significance were calculated by using ANOVA test. P value at or below 0.05 was taken as level of significance.

Result

Table-I: Serum free triiodothyronine (FT_3) levels in different age groups (n=120).

Age group in years (including both male and female)	FT_3 fmol/ml (mean±SD)	p-value
Group 1 (8-17 yrs)	8.01±2.32	0.144 ^{ns}
Group 2 (18-40 yrs)	8.21±1.75	
Group 3 (41-65 yrs)	7.42±1.23	

Level of significance among different age group figured by ANOVA test

	FT_3 fmol/ml
(Group 1) Vs (Group 2)	0.907^{ns}
(Group 2) Vs (Group 3)	0.018^{ns}

ns=Not significant (p=>0.05).
s=Significant (p=<0.05)

The mean FT_3 levels is almost same in adolescent group and in people up to 40 years of age. After that slight decrease of FT_3 level is seen. FT_3 level showed significant variation between people from 18 to 40 years and people whose age is above 40 years shown in table I.

The test of significance was calculated using ANOVA test.

Table-II: Serum free thyroxine (FT_4) levels in different age groups (n=120).

Age group in years (including both male and female)	FT_4 fmol/ml (mean±SD)	p-value
Group 1 (8-17 yrs)	22.10±5.88	0.932 ns
Group 2 (18-40 yrs)	21.46±12.53	
Group 3 (41-65 yrs)	22.42±5.94	

Level of significance among different age group figured by ANOVA test

	FT_4 fmol/ml
(Group 1) Vs (Group 2)	0.170^{ns}
(Group 2) Vs (Group 3)	0.979^{ns}

ns=Not significant (p=>0.05).

FT_4 level does not differ significantly among different age group. Which was shown in table II.The test of significance was calculated using ANOVA test.

Table-III: Serum thyroid stimulating hormone (TSH) levels in different age groups (n=120).

Age group in years (including both male and female)	TSH µIU/ml (mean±SD)	p-value
Group 1 (8-17 yrs)	2.62±3.50	0.862 ns
Group 2 (18-40 yrs)	3.17±7.60	
Group 3 (41-65 yrs)	2.59±3.90	

Level of significance among different age group figured by ANOVA test

	TSH µIU/ml
(Group 1) Vs (Group 2)	0.346^{ns}
(Group 2) Vs (Group 3)	1.00^{ns}

ns=Not significant (p=>0.05).

TSH level does not differ significantly among different age group which was shown in table III.The test of significance was calculated using ANOVA test.

Discussion:

In this study, significant drop of FT_3 level and non-significant drop of FT_4, TSH level with advancing age. These findings are compatible with Ahmed *et al*.[11], Khan *et al*.[12], Suzuki *et al*.[13], Abbas *et al*.[14], Alom *et al*.[15] and Kumari *et al*.[9]. Ageing affect FT_3 level more than FT_4 level.[9] It occurs due to reduced secretion and concentration of FT_3 levels and increaseturnover rate of FT_3[11]. FT3 levels decrease with advancing age and slightly increased level of FT_4 in older age, due to primary retardation process for hormone metabolism within the cell which is associated with ageing process, increase degradation rate of thyroid hormone in old age[15]. Decline of hepatic 52-deiodinase activity with ageing that may reduce peripheral conversion of T_4 to T_3 which leads to higher level of FT_4 but lower level of FT_3[16].

On contrary, Dika *et al*.[6] showed non-significant influence of aging on FT_4, FT_3 and TSH level. It may be due to narrow age range of their sampling which failed to find out influence of aging process.However, there is increased level of FT_4, FT_3 and decrease level of TSH concentration in advanced age[3]. This discrepancy may be due to the increased requirement of these hormones for the various biochemical and physiological function of the body[12].

This study showed higher FT_4 and TSH concentration in (8-17) years age group in comparison to all other groups. Almost similar type of result observed by other previous studies[4]. This finding represents that marked changes occur in thyroid function during puberty as an adaptation to physical and sexual development. Adaptation of hypothalamo-pituitary-thyroid axis during puberty in response to increase energy expenditure may be the reason[5].

One of the strengths of this study is that we have included only healthy persons (both males and female) who are absolutely free from any diseas-

es. So, it was possible for us to detect the variation of FT3, FT4 and TSH level in different age.

Conclusion :

After analyzing the result of the study, it can be concluded that ageing has significant effect on the level of FT_3, without significant effect on the level of FT_4 and TSH.

Limitations :

- The sample size was small.
- Only healthy persons range from 8 to 65 years were included in the study.
- Infant, newborn baby, pregnant women were not included in this study.
- Seasonal variation was not considered.

Recommendation :

- A study with larger population should be conducted.
- Infant, newborn, pregnant women, BMI group should be included in the study for understanding their thyroid status.
- Comparative study between different variables should be done.

References

1. Guyton AC, Hall JE. Thyroid metabolic hormones, Textbook of Medical Physiology. 12th Ed.Singapore: Harcourt Publication, W.B. Saunders Company; 2011. 907-916.

2. Ganong WF. The Thyroid gland, Review of Medical Physiology. 24th edition.New Delhi:Tata McGraw Hill Education Private Limited;2012. 339-351.

3. Rahman S, Jahan N, SultanaN. Age related change in thyroid function.J Bangladesh Soc Physiol.2012; 7(2): 72-77.

4. Kaur G, Kalstra L, Sadhoo AK. Age and sex related changes in thyroid functions in normal healthy subjects of Jammu region.JK Science. 2007; 9(3): 132-136.

5. Dambal AA, Padaki S, Herur A, Kashinakunti SV. Manjula R, Gurupadappa K. Thyroid status in relation to age and gender-A cross sectional study.MRIMS Journal of Health Sciences. 2013; 1(2): 37-40.

6. Dika H, Kasolo J, Bimenya G. Thyroid hormones profile in students of Makerere College of Health Sciences in Kampala Uganda.Tanzania Journal of Health Research. 2010; 12(1): 1-7.

7. Wllke TJ. Influence of age and sex on the concentration of free thyroxin in serum and on the free thyroxin: total thyroxin ratio.Clin. Chem. 1983; 29(7): 1428-1430.

8. PeetersRP.Thyroid hormones and ageing. Hormones.2008; 7(1): 28-35.

9. Kumari T, Prasad A, Sinha KK, Bharti MLG, Satyam K. Age and sex specific thyroid hormone profile in euthyroid subjects.J Biochem Tech.2015; 6(3): 1008-1012.

10. Bremner AP, Feddema P, Leedman PJ, Brown SJ, Beilby. JP, Lim EM, Wilson SG, O'Leary PC, Walsh JP.Age-related changes in thyroid function: A longitudinal study of a community-based cohort.J Clin Endocrinol Metab.2012. 97(5): 1554-1562.

11. Ahmed Z, KhanMA, Haq Au, Attaullah S, Rehman JU. Effect of race, gender and age on thyroid and thyroid stimulating hormone levels in North West Frontier Province, Pakistan. J Ayub Med Coll Abbottabad. 2009; 21(3): 21-24.

12. KhanA, Akhter S, Siddiqui MM, Khan MMA, Nawab G. Effect of age, sex and seasons on the concentration of thyroid and thyroid stimulating hormones. The Sciences.2001; 1(4):224-227.

13. Suzuku S, Nishio SI, Takeda T, Komatsu M. Gender-specific regulation of response to thyroid

hormone in ageing.Thyroid Research.2016; 5(1): 56-59.

14. Abbas R, Abbas HG, Shahid A. Chand S, Nawaz. S. Reference intervals for free T3 and Free T4 in Pakistani euthyroid patients: effect of age and gender on thyroid function.Journal of the College of Physicians and Surgeons Pakistan.2014; 24(11): 806-809.

15. Alom MJ, Islam MR, Haque MM. Gender, age and race related thyroid hormones People of normal healthy subjects in Northern Area, Bangladesh.IJSR.2016; 5(10): 506-509.

16. Chaurasia P, Modi B, Mangukiya S, Jadav P, Shah R. Variation in thyroid hormones level among people of different age, gender and seasons, Piparia, Gujarat. National Journal of Medical Research.2011; 1(2): 57-59.