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Physiological Variation in the Thyroid Functions in Healthy Aging Men of Jammu Region

Ravinder Kumar Malhotra*, Anjali Nadir Bhat, Anil Sharma
Postgraduate Department of Physiology, Government Medical College, Jammu, Jammu and Kashmir, India

***Corresponding author**
Ravinder Kumar Malhotra

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Abstract: There is a considerable variation in the effects of aging on healthy individuals, with some persons exhibiting extensive alteration in physiological functions with age, others little or none. With an increase in age, marked changes in thyroid hormone production, metabolism and action occur. Several changes in thyroid functions have been described in elder people. Age related changes in serum T_3 has been reported to result from reduced peripheral conversion of T_4 into T_3. Serum T_4 usually remains the same or decreases in females. Serum thyroid stimulating hormone (TSH) has been reported to either increase, decrease or remains unchanged with aging. The present study was carried out with an objective of finding out if any age related variations exist in the thyroid functions in normal healthy aging men of Jammu region. The present prospective, one-year study was conducted on 200 healthy male subjects aged 50 years and above of Jammu region. Subjects with any thyroid disorder or intake of drugs known to affect thyroid function, persons with chronic illness such as renal failure, malignant neoplasm, hepatic cirrhosis and diabetes mellitus were excluded from the study. They were divided into four groups – Group A: 50-60 years (45%), Group B: 61-70 years (30.5%), Group C: 71-80 years (14%) and Group D: 81 years and above (10.5%). There was no statistically significant difference in the mean values of respective thyroid functions of the four age groups. Mean T_3 value was higher in Group A (1.10 ng/ml), declined in Group B (1.07 ng/ml) and further dropped in Group C (1.05 ng/ml). However, it increased slightly in age group D subjects. Mean T_4 values were within normal range for laboratory in all the age groups. A slight increase in mean T_4 values with increasing age up to group C subjects followed by a decline thereafter were observed in the present study. Higher mean TSH values, though within normal range for laboratory, were observed in group B subjects. Anti-TPO performed in 8 subjects with raised TSH values was negative as the values were well within the normal range for laboratory.
Keywords: Thyroid functions, Age, Thyroid hormone, Serum T3, Serum T4, Serum TSH

INTRODUCTION

Aging is the progressive universal decline, first in functional reserve and then in function that occurs in organisms over time. It is heterogeneous and varies widely in different individuals and in different organs within a particular individual. Aging is not a disease; however the risk of developing disease is increased [1].

Advancing age is associated with increasing disability and functional impairments which may be contributed to by functional decline in cardiovascular, pulmonary, musculoskeletal and other systems [2].

Part of the aging process involving body composition (*i.e.*, loss of muscle strength, loss of bone and increase in fat mass) might also be related to changes in the endocrine system. The two most important clinical changes in endocrine activity during aging involve the pancreas and the thyroid gland. There may be impaired glucose tolerance or diabetes mellitus. These adults are at risk for development of secondary complications, mainly macrovascular at an accelerated rate. Age-related thyroid dysfunction is also common. Normal aging is accompanied by a slight decrease in pituitary thyrotropin release which results in a gradual age dependent decline in serum triiodothyronine (T_3) concentrations without changes in thyroxine (T_4) levels. This slight decrease in plasma T_3 concentration occurs largely within the broad normal range of the healthy elderly population [3]. Serum thyroid stimulating hormone (TSH) concentrations decrease in healthy elderly subjects due to an age related decrease in TSH secretion by the pituitary [4].

Reports regarding age related changes in serum T_4 levels are conflicting. Some studies report stable T_4 levels for men throughout life, and T_4 values lower in females older than 60 years. TSH values

increase significantly in females over age 60. Throughout all decades, males have stable TSH levels that are slightly higher than the females before age 60 and lower thereafter [5].

The thyroid undergoes some "physiological" changes with aging either as a result of its participation in the senescence process or as an effect of other systems changes. Moreover some thyroid diseases are more frequently encountered in the elderly and thyroid disorders which start as subtle dysfunctions in younger people may appear as clinically overt disorders in older [6].

Although there have been numerous reports concerning the effects of aging on thyroid function test, conflicting data have been presented about free T_4, free T_3 and serum TSH values in the elderly [7, 8]. The present study was undertaken to define the pattern of physiological variations in the levels of T_3, T_4 and TSH of healthy aging men of Jammu region.

MATERIALS AND METHODS

The present prospective, one-year study was conducted on healthy male subjects aged 50 years and above of Jammu region. After explaining the purpose of the study to all the subjects, they were requested to participate in the study with a written consent. A detailed history was taken to rule out the presence of any thyroid disorder (hyperthyroidism or hypothyroidism) or intake of drugs known to affect thyroid function. Care was taken to exclude persons with chronic illness such as renal failure, malignant neoplasm, hepatic cirrhosis and diabetes mellitus and other diseases known to affect thyroid function.

Two hundred subjects who fulfilled the eligibility criteria were selected for the study. The subjects included in the study were ambulatory and apparently in normal nutritional state without any abnormality on routine physical examination.

The physical and clinical examinations were performed in the Postgraduate Department of Medical Physiology and thyroid function tests were performed in the Radioimmunoassay (RIA) Section of Government Medical College, Jammu.

The subjects were distributed into four groups according to their age:

Age group	Age in years	No. of subjects (%)
A	50 – 60	90 (45.00)
B	61 – 70	61 (30.50)
C	71 – 80	28 (14.00)
D	$\geq$ 81	21 (10.50)
Total		**200 (100.00)**

All the eligible subjects were interviewed by the investigator himself and details of information like age, respiratory rate, pulse rate, blood pressure and any significant recent or past illness was recorded.

For thyroid function tests, blood sample was taken between 9 am and 11 am from non-fasting subjects after obtaining their consent because fasting causes a rapid fall in serum T_3 concentration [9].

4 ml of venous blood was taken from each subject under aseptic precautions. The blood was collected in a glass test-tube (without anti-coagulant) and allowed to clot at room temperature. The serum samples collected after centrifugation were stored at -20^0C till assay was performed. The samples were thawed prior to assay. The tests were performed by radioimmunoassay method as per the protocol given in the RIAK-4A, RIAK-5A and IRMAK-9 kits for T_3, T_4 and TSH respectively.

The subjects who were found to have altered thyroid function tests values especially higher TSH values, their blood samples were tested for anti-TPO antibodies by using Solid Phase Enzyme Immunoassay Technology.

Statistical analysis

The data was analyzed using computer software Microsoft Excel and SPSS version 12.0 for Windows. Mean and standard deviation (SD) was calculated and reported for quantitative variables. ANOVA (analysis of variance) was performed to evaluate statistical significance in more than two groups. A p-value of <0.05 was considered a statistically significance. All p-values reported are two-tailed.

RESULTS

The present study was conducted on 200 healthy aging men above 50 years. They were divided into four groups – Group A: 50-60 years, Group B: 61-70 years, Group C: 71-80 years and Group D: 81 years and above. Mean age (± standard deviation) of all subjects was 62.86 (± 11.28) years. Baseline haemodynamic and clinical characteristics are given in Table 1.

The mean (±standard deviation) values of serum T_3, serum T_4 and serum TSH of 200 subjects was 1.09 (±0.12) ng/ml, 88.17 (±11.12) ng/ml and 2.84 (±7.32) µIU/ml respectively, while as shown in Table 2,

there was no statistically significant difference in the mean values of respective thyroid functions of the four age groups ($p>0.05$).

In the age groups 61-70 years, 71-80 years and ≥81 years, the study observed eight subjects who had raised serum TSH. Subsequently, their blood samples were tested for anti-TPO antibodies, which were found to be well within the normal range for laboratory and were considered negative in all eight cases (Table 3).

Table-1: Mean haemodynamic and clinical parameters of subjects (n=200)

Parameter	Mean ± Standard deviation
Pulse rate/ minute	77.39 ± 4.28
Respiratory rate/minute	16.72 ± 1.88
SBP (mm Hg)	124.40 ± 6.18
DBP (mm Hg)	80.29 ± 4.43

Table-2: Comparison of mean values of thyroid functions of different age groups

Thyroid function tests	Mean ± Standard deviation (Range)				Statistical inference
	Group A (51-60 years) (n=90)	Group B (61-70 years) (n=61)	Group C (71-80 years) (n=28)	Group D (≥81 years) (n=21)	
Serum T_3 (ng/ml)	1.10 ± 0.12 (0.92 – 1.38)	1.07 ± 0.13 (0.39 – 1.30)	1.05 ± 0.10 (0.88 – 1.28)	1.10 ± 0.13 (0.92 – 1.42)	F=1.53, p=0.20*
Serum T_4 (ng/ml)	87.71 ± 10.06 (55 – 110)	88.70 ± 13.53 (70 – 110)	89.53 ± 9.53 (70 – 107)	86.80 ± 10.09 (70 – 104)	F=0.34, p=0.79*
Serum TSH (μIU/ml)	2.56 ± 2.77 (0.54 – 5.5)	3.83 ± 2.80 (0.12 – 12)	2.01 ± 1.17 (0.51 – 6.2)	2.29 ± 1.11 (0.54 – 14.9)	F=0.57, p=0.63*

Normal Serum T_3 range = 0.7 – 2.0 ng/ml
Normal Serum T_4 range = 55 – 135 ng/ml
Normal Serum TSH range = 0.3 – 5.0 μIU/ml
*Non-significant

Table-3: Status of anti-TPO antibodies in subjects with raised TSH values (n = 8)

S. No.	Serum T_3 (ng/ml)	Serum T_4 (ng/ml)	Serum TSH (μIU/ml)	Anti-TPO Antibodies	
				U/ml	Inference
1.	0.92	95	6.2	6.21	Negative
2.	0.86	84	14.9	14.68	Negative
3.	1.1	82	7.6	19.76	Negative
4.	0.98	74	7.2	11.86	Negative
5.	1.04	90	8.6	22.02	Negative
6.	0.68	55	22.5	31.05	Negative
7.	1.08	82	12.0	13.55	Negative
8.	0.39	74	70.0	36.13	Negative

Normal value of Serum Anti-TPO = <50 U/ml

DISCUSSION

Age-related changes in serum T_3 are well documented. During a normal human life span, serum T_3 is low at the time of birth, increases markedly during early infancy, remains high during childhood, is reduced after adolescence, then remains stable until late middle age and ultimately decreases in old age [5,8,10].

Mean T_4 values remain stable throughout life in males but in females under age 60 years, T_4 values are significantly higher than in older women [5]. This is believed to result from a decline in estrogen dependent TBG concentration after the age of sixty [11].

The present study was carried out with an objective of finding out if any age related variations exist in the thyroid functions in normal healthy aging men of Jammu region. The study was restricted to the subjects of Jammu region only since the iodine intake of the population of a particular region affects the status and nature of thyroid disorders of that area [12].

In the present study, the mean T_3 value was higher in Group A (1.10 ng/ml), declined in Group B (1.07 ng/ml) and further dropped in Group C (1.05 ng/ml). Similar findings of progressive decrease in T_3 values with advancing age in elderly was reported by Lipson *et al.* [5] and Mariotti *et al.* [10]. A possible explanation of this decrease in serum T_3 with advancing age could be decreased thyroidal production and release or decrease in peripheral conversion of T_4 to T_3 [5,8,10]. In the present study, the mean T_3 value was found to increase slightly in age group D subjects but

the difference in the mean values of all four age groups was statistically non-significant.

Even minor differences in iodine intake between populations are associated with differences in the occurrence of thyroid disorders. Both iodine intake levels below and above the recommended quantity are associated with an increase in the risk of disease in the population [13].

In the present study, the mean T_4 values were within normal range for laboratory in all the age groups. A slight increase in mean T_4 values with increasing age up to group C subjects followed by a decline thereafter were observed in the present study. The difference in the mean values of T_4 in all age groups was statistically non-significant.

Van den Beld *et al.* [14], in their study on 403 elderly men aged 73-94 years reported increased mean values of T_4, though in normal range in the subjects. They explained that the changes in thyroid hormone concentrations may be due to a decrease in peripheral (hepatic) thyroid hormone metabolism with aging and also probably reflecting the effect of subtle NTI (non-thyroidal illness), and/or an increased catabolic state.

In the present study, higher mean TSH values, though within normal range for laboratory, were observed in group B subjects. The difference in the mean values of TSH in all the age groups was statistically non-significant. The TSH values also showed a decline after the age group B, though the values were well within the normal range for laboratory.

Mariotti *et al.* [10] in their study, which included healthy centenarians individuals free of major age-related disease, found that serum TSH concentrations decrease with age and observed that studies showing an increase in basal TSH levels might have not carefully excluded subjects with primary 'sub-clinical' hypothyroidism. This study also suggested that a resetting of the pituitary threshold of TSH feedback suppression occurs in healthy elderly leading to reduced TSH levels for a given concentration of circulating thyroid hormone.

In the present study, ATA (anti-TPO) performed in subjects with raised TSH values were negative as the values were well within the normal range for laboratory. The explanation for this could be the less number of subjects with raised TSH and less prevalence of autoimmunity in the euthyroid male subjects of the region.

CONCLUSION

As a result of conclusions drawn from the present study in different age groups of elderly male, the normal range for healthy male subjects of different age groups of Jammu region can be established as:

Age group (in years)	T_3 (ng/ml)	T_4 (ng/ml)	TSH (µIU/ml)
50 – 60	0.86 – 1.33	67.99 – 107.42	-2.86 – 7.98
61 – 70	0.81 – 1.32	62.19 – 115.21	-1.65 – 9.31
71 – 80	0.85 – 1.24	70.86 – 108.2	0.28 – 4.3
$\geq$ 81	0.84 – 1.35	67.03 – 106.57	0.12 – 4.46

REFERENCES

1. Caruso LB and Silliman RA. Geriatric medicine. Harrison's Principles of Internal Medicine, 17th edition 2008; 1:53-59.
2. Kathrotia R, Rao P, Shah C, Shukla P, Trivedi D and Oomen E. Swimming: a step toward healthy aging. Indian J Pract Doc. 2008; 5 (4): 1-2.
3. Lamberts SWJ. Endocrinology and aging. Williams Textbook of Endocrinology, 11th Edition. Saunders Elsevier 1600, John F Kennedy Blvd Suite 1800, Philadelphia 2008:1185-1186.
4. Van Coevorden A, Laurent E and Decoster C. Decreased basal and stimulated thyrotropin secretion in healthy elderly men. J Clin Endocrinol Metabol. 1989; 69: 177-185.
5. Lipson A, Elleen L, Nickoloff, Hsu TH, Kasecamp WR, Drew HM, Shakir R and Wagner HN Jr. A study of age-dependent changes in thyroid function tests in adults. J Nucl Med. 1979; 20: 1124-1130.
6. Latrofa F and Pinchera A. Aging and thyroid. Hot Thyroidology. 2005; 1: 1-11.
7. Hesch RD, Gatz J, Pape J, Schmidt E and Muhlen A. Total and free triiodothyronine and thyroid-binding globulin concentration in elderly human persons. Eur J Clin Invest. 1976; 6 (2): 139-146.
8. Westgren U, Burger A, Ingemansson S, Melander A, Tibblin S and Wahlin E. Blood levels of 3,5,3'-triiodothyronine and thyroxine: differences between children, adults and elderly subjects. Acta Med Scand. 1976; 200 (6): 493-495.
9. Palmblad J, Levi L, Burger A, Melander A, Westgren U, Schenck H and Skuda G. Effects of total energy withdrawal on the levels of growth hormone, thyrotropin, cortisol, adrenaline, nor-adrenaline, T_4, T_3 and rT_3 in healthy males. Acta Med Scand. 1977; 201: 15.
10. Mariotti S, Barbesino G, Caturegli P, Bartelena L, Sansoni P, Fagnoni F, Monti D, Fagiolo U, Franceschi C and Pinchera A. Complex alteration of thyroid function in healthy centenarians. J Clin Endocrinol Metabol. 1993; 77: 1130-1134.
11. Braverman LE, Foster AE and Ingbar SH. Sex-related differences in the binding in serum of

thyroid hormones. J Clin Endocrino. 1967; 27: 227-232.
12. Laurberg P, Pederson KM, Hreidarsson A, Sigfusson N, Iversen E and Knudsen PR. Iodine intake and the pattern of thyroid disorders: a comparative epidemiological study of thyroid abnormalities in the elderly in Iceland and in Jutland, Denmark. J Clin Endocrinol Metabol. 1998; 83: 765-769.
13. Laurberg P. Iodine intake as a determinant of thyroid disorders in populations. Best Pract Res Clin Endocrinol Metab. 2010; 24 (1): 13-27.
14. Van den Beld AW, Visser TJ, Feelders RA, Grobbee DE and Lamberts SWJ. Thyroid hormone concentrations, disease, physical function and mortality in elderly men. J Clin Endocrinol Metabol. 2005; 90 (12): 6403-6409.