ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Serum Glutamate Pyruvate Transaminase Is Best Marker Enzyme For Thyroid Function –A Report Based On Nellore Females, Andhra Pradesh, India.

Sujatha Gundeboina., Venkataswamy Mallepogu., Suman Bukke., Kamala Katepogu and Thyaga Raju K*

Manuscript Info

Manuscript History:

Received: 14 December 2015
Final Accepted: 22 January 2016
Published Online: February 2016

Key words:
Fasting Blood Glucose, Hypothyroidism, Tetraiodothyronine, Total Cholesterol, Thyroid Stimulating Hormone, Tri- iodothyronine.

Corresponding Author

Thyaga Raju K.

Abstract

Thyroid dysfunction is known to cause significant changes in liver functions. The aim of present study was performed to evaluate the changes in biochemical markers of hepatic function in hypo and hyperthyroidism of 100 females. The subjects were analyzed for levels of tri-iodothyronine, tetra-iodothyronine, thyroid stimulating hormone, fasting blood glucose, total cholesterol, serum glutamate oxaloacetate transminase and serum glutamate pyruvate transaminase. Data was analyzed using ANOVA tests and correlation analyses. The data on females was divided into two groups based on the levels of TSH as hypo and hyper thyroidism conditions. In lower level TSH patients the levels of T_4 was more in all groups and T_3 was more in age groups of 40 to above 60 years. In hypothyroidism the females of age group 40 and above showed high levels of glucose, cholesterol and SGOT and in hyper thyroidism the level of SGOT was found to be more than normal. Hence our results based on the values of TSH of females conclude that the age group of 40 and above affects more since their SGOT, Glucose, SGPT and cholesterol were found higher values. However primarily induced transaminases was SGPT in both thyroidism conditions in females as revealed from the studies conducted on females of Nellore coastal region.

Introduction:-

Thyroid hormones are essential for normal growth, development and function of all tissues of the body and to regulate BMR of all cells, including hepatocytes. The hepatocytes in turn influenced by thyroid hormones and for regulation of their systemic endocrine effects. Therefore thyroid dysfunction shall disturb liver functions and diseases to modulate thyroid hormones metabolism (Malik and Hodgson 2002). Thyrotoxicosis is associated with a variety of abnormalities of liver function. The pathogenesis of hepatic dysfunction in thyrotoxicosis is unknown, but has been attributed to mitochondrial dysfunction and hepatic tissue hypoxia.

The thyroid hormones serum level is very important for normal hepatic function and bilirubin metabolism. Besides the associations between thyroid and liver diseases of an autoimmune nature, such as primary biliary cirrhosis and thyrotoxiosis, thyroid diseases are frequently associated with liver injuries and biochemical test abnormalities, i.e., elevation of SGPT and SGOT. These thyroids and liver associations may cause diagnostic confusions and neglect of these facts may result in over or under diagnosis of liver or thyroid associated diseases. Therefore it is suggested to measure free T_4 and TSH level to rule out coexistent possibility of thyroid dysfunction in any patient with unexplained liver biochemical test abnormalities (Huang and Liaw 1995). All the studies carried out reflect a strong relationship between thyroid and liver in health and disease.The most common endocrine diseases in India are thyroid related disorders (Kochupillai 2000). Impaired thyroid gland function is accompanied by signs and symptoms that mimic those of other common diseases, such as fatigue, dyspnea, and weight gain, palpitations associated with anemia, cold intolerance, and tiredness. However, laboratory detection of subclinical or early thyroid diseases usually occurs before these manifestations of disease develop (Bernard 2011).

In 1997 a study on 800 children in India has referred for thyroid problems. Investigators has determined the percentages of the children whose laboratory tests determined their thyroid status as 79%, 19% were euthyroid, and 2% were hypothyroid, euthyroid and hyperthyroid, respectively, (Meena 1997). The deficiency of thyroid activity has caused the low production of thyroid hormones in the body. Occurrence of mild and severe forms, were observed in between 2 and 15% of the population. In hypothyroid patients, occurrence of an ovulation and menstrual disturbances particularly hemorrhagic were observed. So women are affected more often than men and both sexes are found to affect more frequently with increasing age (Burts and Ashword 1998).

In hyperthyroidism there is an elevation in the rate of glucose absorption, production (or utilization) and glycogen synthesis (or degradation) leading to decreased glycogen level (Donckier 2003) but insulin resistance, degradation and requirements are increased and there is an increase in secretion of thyroid hormones with exaggerated effects of glucagon and adrenaline on the liver to activate hepatocyte metabolism. In hypothyroidism there is reduction in the rate of glucose absorption, gluconeogenesis and glucose production (and utilization) and glycogen synthesis (and degradation) leading to increased glycogen level. Additionally, insulin half-life was prolonged with increase in its level and occurred reduction in insulin requirement. Glucose level was stabilized during treatment of hypothyroidism but the risk of recurrent hypoglycemia increase was not decreased due to insulin dose influence (Mohn et al 2002).

The present cross-sectional study was performed to determine whether thyroid dysfunction, subclinical and overt, has deleterious effects on hepatic function. For this, total cholesterol (TG), fasting blood glucose (FBG), serum glutamate oxaloacetate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) levels were measured in patients\ who presented with hyper and hypothyroidism. Although hepatic function is profoundly influenced by thyroid status, this has not been studied in detail in women in Nellore coastal region. The purpose of the present study was therefore to determine the relationship between hepatic function, and thyroid status of the south coastal area, Nellore, A. P., India.

Materials and methods:-

Chemicals:-

The required reagent kits were obtained from CDR and Omega chemical companies, Chennai and Hyderabad, respectively for analysis of T_3 and T_4 by ELISA Kit to estimate total cholesterol was purchased from Merck, Mumbai, India. All other chemicals were of analytical grade procured from local companies.

Experimental design:-

In the experiment a total of100 female employees in the south coastal area, SPS Nellore district, were divided into five age groups and each group consisted of ten female members, for analysis of hypo and hyper thyroidism, respectively. They are Group 1: Below 30 years, Group 2: 30-40 years, Group 3: 40-50 years, Group 4: 50-60 years and Group 5: Above 60 years.

Sample collection:-

The blood sample was collected from 100 female employees in the south coastal area, SPS Nellore district, Andhra Pradesh. The blood collected from each female was allowed to clot for 30 min and was spun at 3500xg for 20 min. The serum obtained was separated and used for biochemical assays. Quantitative determination of triodothyronine and thyroxin concentration was performed using micro plate enzyme immune assay (EIA). In this assay procedure the patient serum was added along with TSH antibody horse radish peroxidase conjugate to the antibody coated wells. Reaction between the two antibodies and native TSH antigen forms a sandwich complex that binds with the coated well. After attaining the equilibrium, the antibody bound fraction was separated from unbound antigen by denaturation. The activity of the enzyme was quantified by the addition of reaction with an enzyme substrate 3, 3^1, 5, 5^1 - tetra methyl benzidine and hydrogen peroxide. The peroxidase enzyme acts on H_2O_2 to evolve nascent oxygen, which oxidize the colorless substrate to a yellow colored end product. The intensity of colour produced was measured spectrophotometrically at 450 nm. Using the above principle the following protocols were adopted to estimate T_3, T_4 and the procedure for the estimation of T_3, T_4 and TSH were performed as earlier reports(Sujatha et al 2006).

Blood glucose estimation:-
The fasting blood glucose (FBG) concentration was analyzed using glucose oxidase method as described (Barham and Trinder 1972).

Biochemical assays:-
Cholesterol determination was performed with ferric acetate, uranium acetate and sulphuric acid, ferrous sulphate reagent (Parekh and Jung 1970). Serum glutamate pyruvate transaminase (SGPT) and serum glutamate oxaloacetate transaminase (SGOT) were measured spectrophotometrically by utilizing the method (Reitman and Frankel 1957).

Statistical analysis:-
All the grouped data were statistically evaluated using the Statistical Package for Social Sciences (SPSS) version 7.5 (Chicago, IL, USA). Hypothesis testing methods included one way analysis of variance (ANOVA) followed by Duncan's multiple range test. P-values of less than 0.05 were considered to indicate statistical significance. All the results were expressed as mean ± standard deviation (SD) for ten female members in each group

Results:-

The patients were randomly selected on the basis of signs and symptoms which are associated with thyroid dysfunction. The total 100 patients who were selected were ranged in age from below 30-to-above 60 years. **Table 1 and 2** shows the differences among T_3, T_4, and TSH levels in the two study groups: hypothyroidism and hyperthyroidism. Mean levels of all three hormones significantly differed the among age groups ($p < 0.001$). The mean TSH levels in hypothyroidism were 12.837±1.420, 17.949±2.227, 19.378±1.913, 23.507±2.465 and 39.849±2.204 µIU/mL, and 4.07, 5.69, 6.15, 7.46 and 12.65 fold increases were observed in below 30 to above 60 years (30-40, 40-50 and 50-60 years) and in hyperthyroidism TSH levels were 0.153±0.004, 0.211±0.006, 0.199±0.066, 0.186±0.010 and 0.152±0.009µIU/mL and 20.58, 14.92, 15.8, 16.93 and 20.72 fold decreases compare with normal female individuals. The mean T4 levels in hypothyroidism were 6.652±0.169, 5.341±0.156, 5.053±0.080, 5.383±0.158 and 3.434±0.065 µg/dL and in hyperthyroidism were 13.178±0.365, 13.992±0.965, 14.105±1.291, 12.787±0.158 and 13.905±0.962 µg/dL. The mean T3 levels in hypothyroidism were 1.352±0.023, 1.027±0.031, 0.987±0.018, 1.077±0.029 and 0.659±0.019 ng/mL and in hyperthyroidism were 1.791±0.122, 2.025±0.098, 20256±0.125, 2.649±0.0813 and 2.995±0.0830 ng/mL. **Table 1 and 2** shows correlations of T3, T4, and TSH in the different groups of patients with thyroid dys- functions.

Fasting blood glucose (FBG) levels in normal females were in the range of 95–100 mg/dl. In Thyroid dysfunctional condition of below 30 to more than 60 years female individuals had normal in the blood glucose level (BGL). But in the age of above 60 years of hypothyroidism female individuals has 1.23 fold significantly increased BGL compare to normal females.

Table 1: Hypo thyroidism showing the levels of T_3, $T_{4,}$ TSH, Cholesterol, Glucose, SGOT and SGPT in the females of different age groups of Nellore coastal region:-

S. No	Age group (Years)	T_3 (ng/dl)	T_4 (µg/dl)	TSH(µIU/ml)	Cholesterol (mg%)	Glucose (mg%)	SGOT (U/l)	SGPT(U/l)
1	Normal levels	0.7-2.10	4.6-11.7	0.3-6.0	Up to 200	70-110	30	35
2	Below 30	1.352 ± 0.023^{e}	6.652 ± 0.169^{d}	12.837 ± 1.420^{a}	188.52 ± 6.07^{a}	97.73 ± 2.54^{a}	30.37 ± 2.31^{a}	42.710 ± 3.11^{a}
3	30-40	1.027 ± 0.031^{c}	5.341 ± 0.156^{c}	17.949 ± 2.227^{b}	218.15 ± 11.63^{b}	99.64 ± 3.67^{a}	27.00 ± 2.37^{a}	38.74 ± 1.34^{a}
4	40-50	0.987 ± 0.018^{b}	5.053 ± 0.080^{b}	19.378 ± 1.913^{b}	228.28 ± 9.10^{b}	102.66 ± 3.70^{a}	37.66 ± 3.24^{b}	42.61 ± 3.02^{a}
5	50-60	1.077 ± 0.029^{d}	5.383 ± 0.158^{c}	23.507 ± 2.465^{c}	247.72 ± 7.93^{c}	110.26 ± 6.91^{b}	37.40 ± 3.48^{b}	42.56 ± 3.08^{a}
6	Above 60	0.659 ± 0.019^{a}	3.434 ± 0.065^{a}	39.849 ± 2.204^{d}	257.77 ± 8.42^{c}	136.11 ± 5.77^{c}	35.36 ± 2.76^{b}	41.47 ± 1.95^{a}

Table 2: Hyper thyroidism showing the levels of T_3, $T_{4,}$ TSH, Cholesterol, Glucose, SGOT and SGPT in the females of different age groups of Nellore coastal region:-

S.No	Age group (Years)	T_3 (ng/dl)	T_4 (µg/dl)	TSH(µIU/ml)	Cholesterol (mg%)	Glucose (mg%)	SGOT (U/l)	SGPT(U/l)
1	Normal levels	0.7-2.10	4.6-11.7	0.3-6.0	Up to 200	70-110	30	35
2	Below 30	1.791 ± 0.122^{a}	13.178 ± 0.365^{a}	0.1537 ± 0.004^{a}	135.25 ± 5.19^{c}	85.17 ± 3.66^{a}	30.37 ± 2.52^{b}	39.37 ± 2.44^{a}
3	30-40	2.025 ± 0.098^{b}	13.992 ± 0.965^{a}	0.1990 ± 0.006^{c}	130.29 ± 4.44^{b}	90.59 ± 4.37^{b}	27.00 ± 1.82^{a}	39.64 ± 1.81^{a}
4	40-50	2.256 ± 0.125^{c}	14.105 ± 1.291^{a}	0.1860 ± 0.010^{b}	122.86 ± 3.22^{a}	92.58 ± 2.45^{bc}	37.66 ± 1.29^{a}	38.33 ± 2.16^{a}
5	50-60	2.249 ± 0.081^{d}	12.787 ± 0.158^{a}	0.2114 ± 0.006^{d}	157.66 ± 2.37^{d}	96.20 ± 1.85^{c}	37.40 ± 2.31^{a}	39.19 ± 2.79^{a}
6	Above 60	2.225 ± 0.083^{e}	13.905 ± 0.962^{a}	0.1523 ± 0.009^{a}	121.51 ± 3.78^{a}	99.51 ± 1.19^{d}	35.36 ± 2.61^{a}	41.38 ± 2.47^{a}

Biochemical parameters:-

The **Tables 1 and 2** also shows activities of serum glutamate pyruvate transaminase (SGPT) and serum glutamate oxaloacetate transaminase (SGOT) which are biomarkers of liver toxicity and the SGOT were significantly ($P < 0.05$) 1.11,1.10 and 1.02 fold elevated in hypothyroidism of 40-50, 50-60 and above 60 year females (37.66±1.29, 37.40±2.31 and 35.36±2.61 U/I), respectively. While in hyperthyroidism of different aged females individual has normal SGOT and SGPT activities were observed. However, TC significantly increased from 188.52 ± 6.07 mg/dl to 257.77± 8.42 mg/dl in hypothyroidism of different aged female (below 30 to above 60 years) individuals shown in **Table 1.**

Figure 1 Effect of different ages on the serum glutamate oxaloacetate transferase (SGOT) and serum glutamate pyruvate transferase (SGPT) of Thyroid disfunction females. Values are given as mean ± SD from ten women's in each group

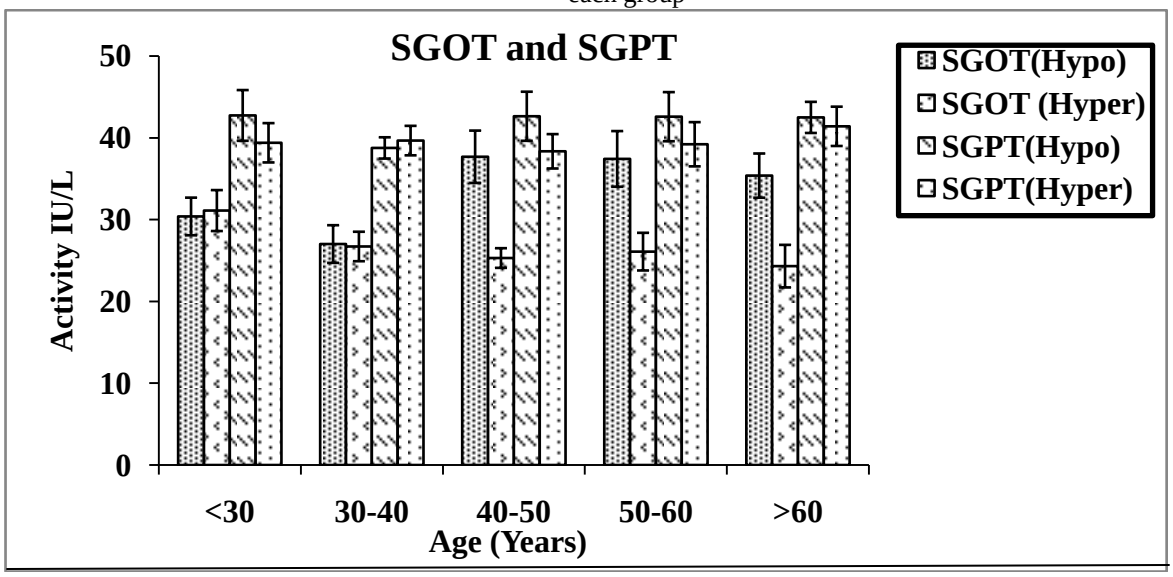


Figure 1 represents the comparison levels of serum glutamate pyruvate transferase (SGPT) and serum glutamate oxaloacetate transferase (SGOT), respectively, in the serum of hypo and hyperthyroidism in the females of Nellore coastal region population, Andhra Pradesh, showed 1.08, 1.11, 1.08, 1.002 fold decreases SGPT were noted compare with hyper thyroidism, except <30y. The **Figure 2** represents the comparison levels of serum cholesterol and fasting blood glucose, respectively, showed 1.39, 1.67, 1.85, 1.57 and 2.12 fold decreases cholesterol were noted compare to hyperthyroidism and 1.14, 1.09, 1.10, 1.14 and 1.36 fold decreases fasting blood glucose were noted compare to hyperthyroidism. **Figure 3 and 4** represents the comparison the levels of serum thyroid stimulating hormone, showed 85.3, 94.2, 107.1, 111.9 and 265.3 fold decreases TSH were noted compare to hyperthyroidism, and also represents the levels of T_3 and T_4 respectively, showed 1.32, 1.97, 2.28, 2.46, 4.60 and 1.98, 2.61, 2.79, 2.37, 4.05 fold decreases T_3 and T_4 were noted compare to hypothyroidism.

Figure 2 Effect of different ages on the serum glucose and cholesterol of Thyroid disfunction females. Values are given as mean ± SD from ten women's in each group.

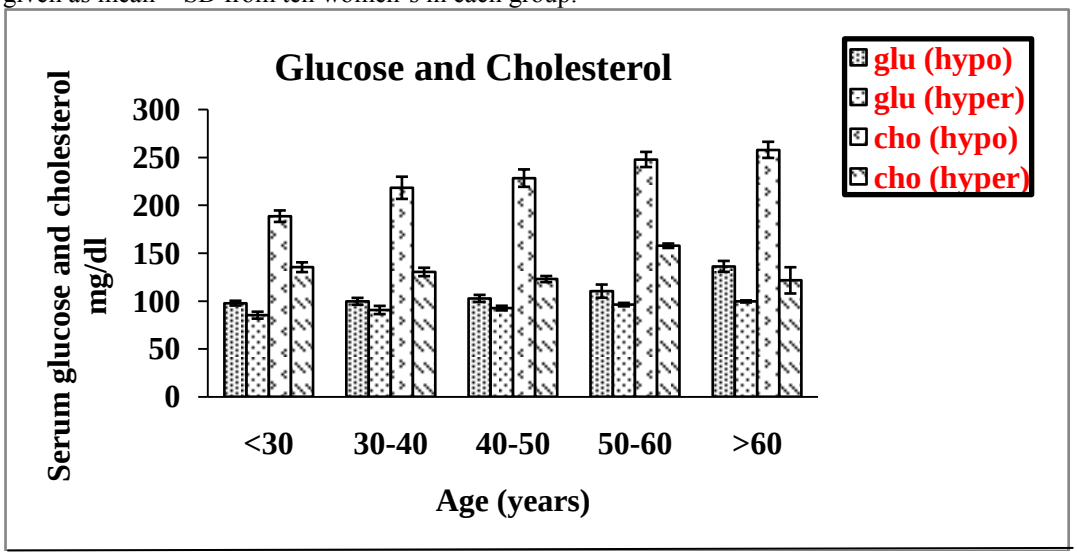


Figure 3 Comparison between the hypo and hyper thyroidism TSH and T_4 under different age groups.

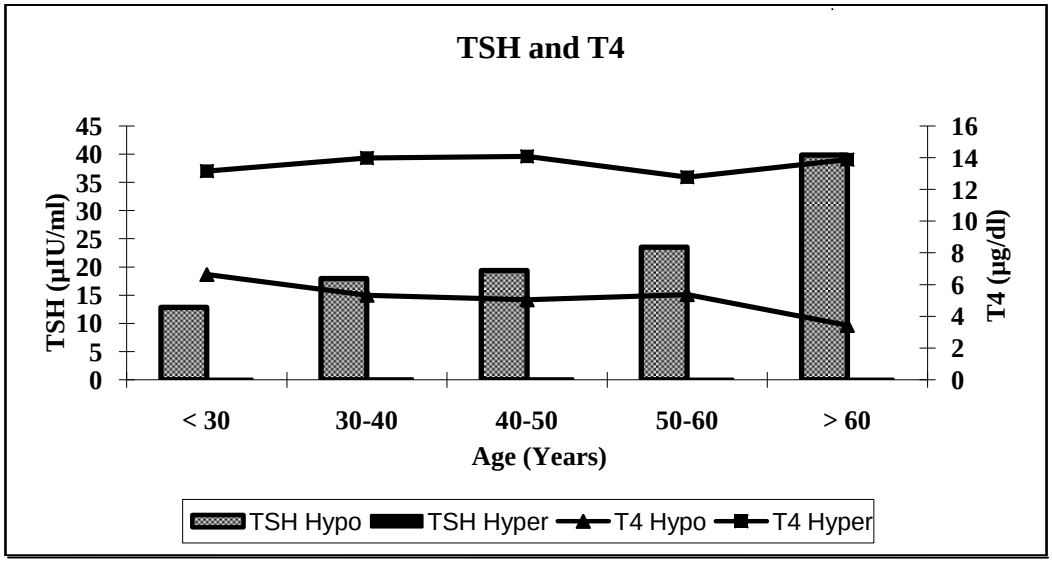
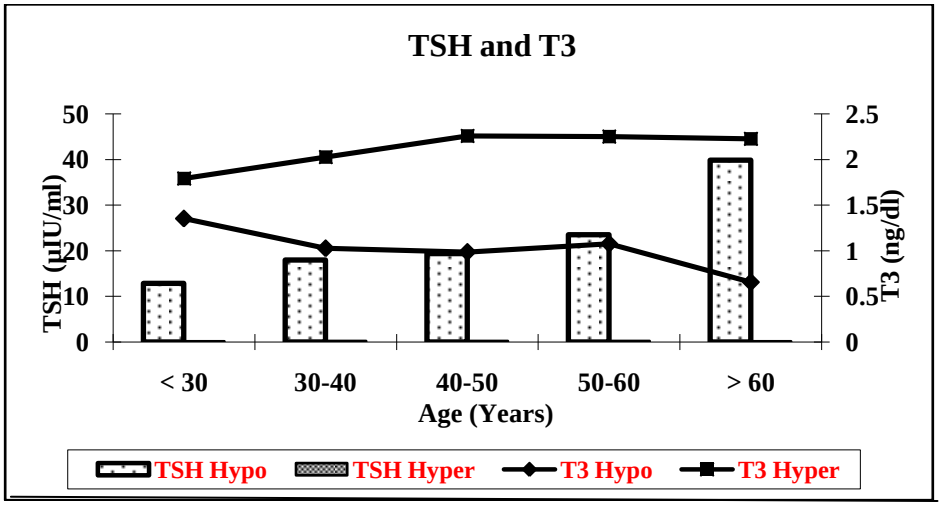


Figure 4 Comparison between the hypo and hyper thyroidism TSH and T_4 under different age groups.



Acknowledgement:-

We are grateful to University Grant Commission (UGC) for providing financial support as Rajiv Gandhi National Fellow (UGC-RGNF) to carry out the research work.

References:-

1. Barham D, Trinder P (1972) An improved colour reagent for the determination of blood glucose by the oxidase system. Analyst 97, 142-5
2. Bernard, M.: Signs and symptoms of thyroid dysfunction. Hosp. Phys. (2011) Hosp. Phys 42(10), 43-48
3. Biscoveanu M & Helsinki S (2000) Abnormal results of liver function tests in patients with Graves' disease Endocr Pract 6(5), 367–9
4. Burts CA & Ashword ER (1998) Thyroid function Tietz Textbook of Clinical Chemistry 3p1496 – 1525
5. Cooper DS (2003) Hyperthyroidism Lancet 362, 459–68
6. Donckier JE, Endocrine diseases and diabetes. In : Textbook of diabetes mellitus . Pickup JC, Williams G (eds), Blackwell Publishing Company, Chichester.2003; 27(1): 27-25
7. Elder J, McLelland A & O'Reilly D (1990) An Association Between Varying Degrees of Hypothyroidism and Hypercholesterolemia in Women: The Thyroid-Cholesterol Connection Ann Clin Biochem 36(4), 110–113
8. Gershengon MC, Ballantyne CM. Thyroid horomone and hypercholesterolemia: trends in recognition and treatment. Thyroid Update. 1995;2:2–6
9. Huang MJ & Liaw YF (1995) Clinical associations between thyroid and liver diseases. J Gastroenterol Hepatol 10, 344–5
10. Kochupillai N (2000) Clinical endocrinology in India. Curr. Sci 79, 1061-1067
11. Kutty KM, Bryant DG & Farid NR (1978) Serum lipids in hypothyroidism J Clin Endocrinol Metab 46, 55–60
12. Kuusi T, Taskinen MR & Nikkila EA (1988) Lipoproteins, lipolytic enzymes ans hormonal status in hypothyroid women at different levels of substitution. J Clin Endocrinol Metab 66, 51–56
13. Lithell H, Boberg J & Hellsing K (1981) Serum lipoprotein and apolipoprotein concentrations and tissue lipoprotein-lipase activity in overt and subclinical hypothyroidism: the effect of substitution therapy Eur J Clin Invest 11, 3–10
14. Malik R & Hodgson H (2002) The relationship between the thyroid gland and the liver. International Journal of Medicine 95, 559–69
15. Meena P (1997) Disorders of thyroid gland in India Indian J. Pediat 64, 11-20
16. Mohn A, Di Michele S, Di Luzio R, Tumini S & Chiarelli F (2002) The effect of subclinical hypothyroidism on metabolic control in children and adolescents with Type 1 diabetes mellitus Diabetic Medicine 19, 70-73
17. Parekh A.C. Jung. Cholesterol determination with ferric acetate, uranium acetate and sulphuric acid, ferrous sulphate reagent. Analytical Chemistry. 1970; 112: 1423-1427

18. Reitman S & Frankel SA (1957) A colorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminases American Journal of Clinical Pathology 28, 56-63.
19. Staub JJ, Althaus BY & Engler H (1992) Spectrum of subclinical and overt hypothyroidism: effect on thyrotropin, prolactin, and thyroid reserve, and metabolic impact on peripheral target tissues Am J Med 6, 631-642
20. Valemanson S, Hansson P, Hedner P, et al. Relations between thyroid function, hepatic and lipoprotein lipase activities, and plasma lipoprotein concentrations. Acta Endocrinol. 1983;104:50–56.
21. Wiseman S, Powell JT & Humphries SE (1993)The magnitude of the hypercholesterolemia of hypothyroidism is associated with variation in the low density lipoprotein receptor gene J Clin Endocrinol Metab 77, 108-112.