International Journal of Research and Review
www.gkpublication.in E-ISSN: 2349-9788; P-ISSN: 2454-2237

Original Research Article

Thyroid Dysfunction in a Rural Region of North Kerala, India- Its Association with Dyslipidemia and Diabetes Mellitus

Sangeetha V Joice[1], Rebecca Abraham[1], Dinesh Kumar[2], Beena Kumari[1]

[1]Department of Biochemistry, Malabar Medical College & Research Centre, Calicut, Kerala PINCODE-673315
[2]Department of Psychiatry, Malabar Medical College & Research Centre, Calicut, Kerala PINCODE- 673315

Corresponding Author: Rebecca Abraham

ABSTRACT

The principle aim of our study was (i) to assess the thyroid status of this region and (ii) to study the relationship of thyroid dysfunction with Dyslipidemia and Diabetes Mellitus. Thyroid dysfunction was seen in 10.6% of the total 650 subjects with hypothyroidism in 8.6% subjects and hyperthyroidism in 2%. 46% of subjects with hyperthyroidism were in the age group 35-44 years and 32% with hypothyroidism in the age group 45-54 years. A higher percentage of women was both hypothyroid (13.2%) and hyperthyroid (2.3%) (p=0.000). 58% of women with hypothyroidism were in the age group 45-64 years and men in the age group 45-54 years. The majority of men with hyperthyroidism (50%) and women (57%) were in the age group 35-44 years. No significant association between TSH levels and economic status, diet and life style was observed. The total cholesterol levels were higher in the hypothyroid group whereas the LDL cholesterol was slightly increased in the hyperthyroid group. Women had higher serum total cholesterol levels across all three thyroid states as compared to men.12.5% of hypothyroids and 24.2% of hyperthyroids had associated diabetes mellitus. Hypothyroidism is predominantly present, principally amongst women in this region and in the age group 45-64 years. Associated dyslipidemia and diabetes mellitus was also higher in this group. Early screening and treatment can help prevent possible cardiovascular outcomes.

Key Words: thyroid dysfunction, dyslipidemia, diabetes mellitus.

INTRODUCTION

Diseases of the thyroid gland are amongst the most abundant endocrine disorder in the world second only to diabetes mellitus. [1] The prevalence and pattern of thyroid disorders depends on sex, age, ethnic and geographical factors and especially on iodine intake. [2] A high iodine intake is associated with lower prevalence of goiter and higher prevalence of hypothyroidism whereas low intake is associated with a higher prevalence of hyperthyroidism. [3] The total burden of thyroid disorders in India is 42 million. This projection was based on nationwide studies on thyroid disorders among adolescents and young adults. [4] Hypothyroidism has been reported to be more common in older women and ten times more common in women than men. [5] Prevalence of hyperthyroidism is also reported to be more common in women than men. [6]

Thyroid disorders are known to influence lipid metabolism. Overt and subclinical hypothyroidism has an adverse effect on serum lipid profile that may predispose to the development of atherosclerotic disease. [7] The association between diabetes mellitus and thyroid dysfunction is well known. However the reported prevalence of thyroid dysfunction and associated diabetes mellitus varies with

population diversity. [8] There is a paucity of data from this region of Kerala. Our principle aim was (a) to assess the thyroid status of this region, (b) to study the relationship of abnormal thyroid function and abnormal serum lipid concentrations (c) to study the relation of thyroid dysfunction and Diabetes mellitus.

MATERIALS AND METHODS

This is a retrospective hospital based study. 650 subjects, (both male and female) who attended the "Sampoorna Arogya Project", – a health scheme of Malabar Medical College Hospital and Research Centre during the period November 2012 to March 2013 formed part of the study group. Their age ranged from 18 to 80 years. The medical history, demographic details and anthropometric measurements were recorded in the patient data sheet. The lab investigations included fasting and post prandial blood sugar levels, lipid profile and measurement of TSH levels.

Inclusion criteria – subjects above the age of 18 yrs were included in the study.

The study was approved by the ethical committee of Malabar Medical College Hospital & Research Centre.

LAB INVESTIGATIONS:

Blood samples were collected by anterior cubital fossa venepuncture. They were requested to fast for 12 hrs prior to having their blood drawn.

TSH:

Levels of TSH were estimated quantitatively using the Enzyme Linked Fluorescent Assay (ELFA) technique on the Minividas Analyzer (Biomerieux, France). The analytical detection limit was 0.05µIU/ml, the laboratory's reference values for TSH = 0.25. – 5.0 µIU/ml. [9]

FASTING AND POST PRANDIAL BLOOD SUGAR:

It was estimated by the glucose oxidase peroxidase method (GOD-POD). [10]

Cholesterol was estimated by the cholesterol oxidase peroxiddase method (CHOD-PAP). [11] LDL cholesterol was calculated using the Friedwald's formula, LDL cholesterol= total cholesterol-(triglycerides/5 + HDL). Triglycerides were estimated by the glycerol phosphate oxidase peroxidase method (GPO-PAP). [12] HDL cholesterol was estimated by a direct method. [13]

The estimation of the above parameters was carried out on the fully automated analyzer EM 360 (Transasia Biomedicals Ltd, Erba Manheim, Germany).

DATA ANALYSIS:

The thyroid status was defined as follows,

Hypothyroid – TSH levels ≥ 5.0µIU/ml

Hyperthyroid- TSH levels ≤ 0.25 µIU/ml

STATISTICAL ANALYSIS: was done using Microsoft Office "Excel" and Windows 10 operating system. We have analyzed with the IBM SPSS 21.0 statistical software package.

RESULTS

The 650 total subjects had an average range of 20-80 years. The highest number 29.4% were in the age group 45-54 years (figure 1). 53.4% were males and 46.6% females (figure 2). 40.9% subjects were housewives, 15.5% labourers and 10.9% Businessmen (figure 3). 83.7% were above the poverty line (APL). 98.5% were non-vegetarians and 76.9% had an active life style (figure 4).

THYROID FUNCTION TESTS:

Based on the above definition of thyroid status abnormal TSH concentration was found in 10.6 % of subjects (figure 5). An elevated TSH concentration (hypothyroidism) was seen in 8.6% subjects. A low TSH concentration (hyperthyroidism) was seen in 2% of subjects. The highest numbers of subjects with hyperthyroidism (46%) were seen in the age group 35-44 years (table 1). The highest numbers of subjects with hypothyroidism were seen in the age groups 45-54 years (32%) and 55-64 years (27%).

This was statistically significant (p=0.002) (Table 1).

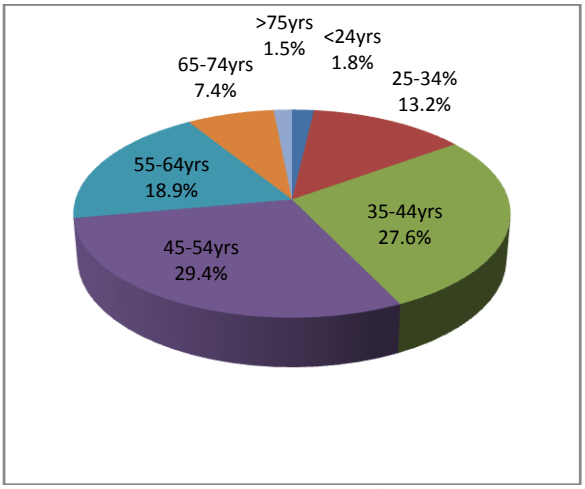

Figure 1: Age wise distribution of the subjects:

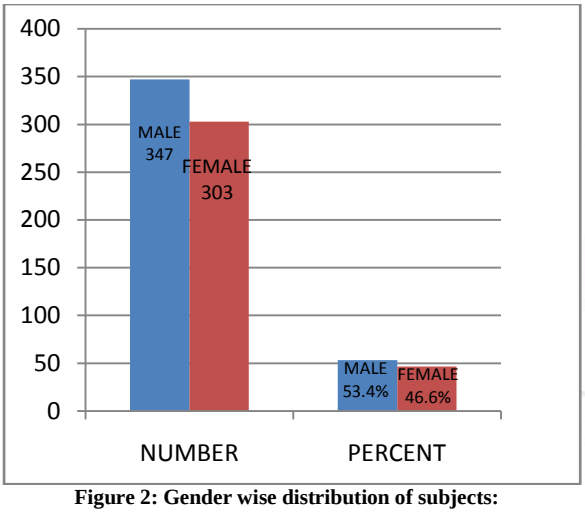

Figure 2: Gender wise distribution of subjects:

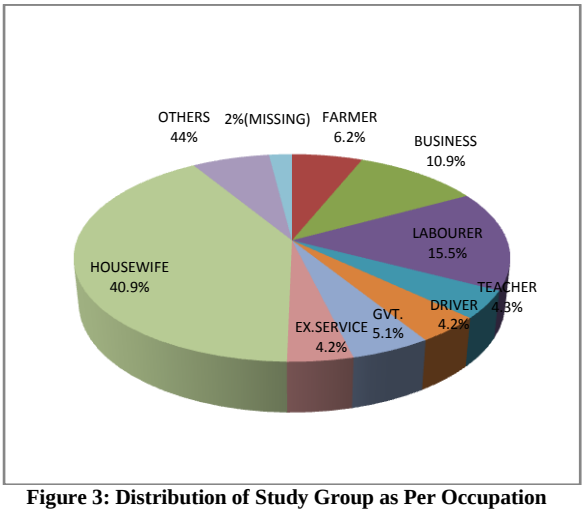

Figure 3: Distribution of Study Group as Per Occupation

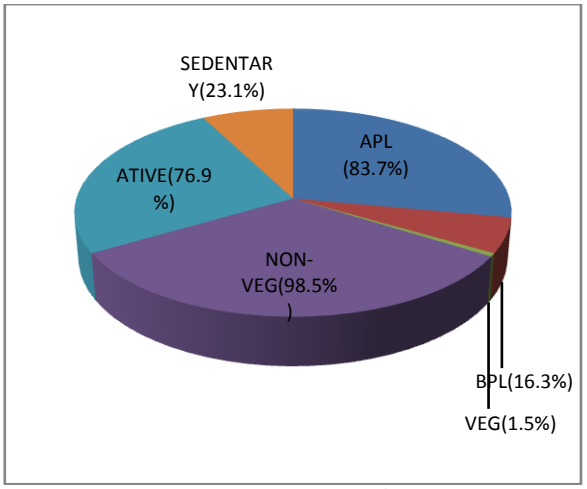

Figure 4: Other demographic details of the study group:

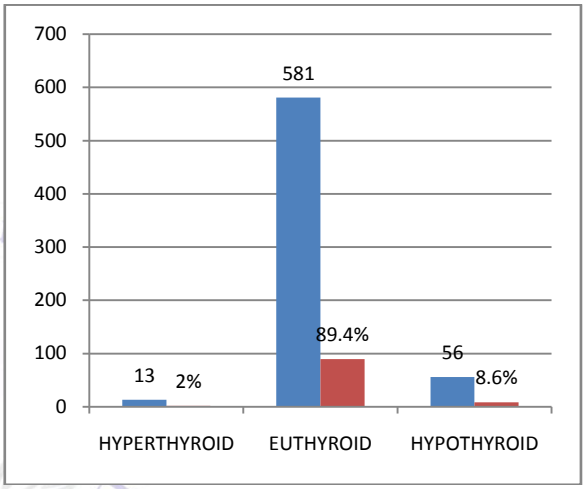

Figure 5: Thyroid status in the study group:

Men were more euthyroid than women (93.6%vs 84.0%). The percentage of women who were hypothyroid was 13.2% as against 4.6 % for men. The percentage of women with hyperthyroidism was also greater as compared to men (2.3% vs. 1.7%). This was statistically significant (p=0.000). (Table 2) The majority of women with hypothyroidism (58%) was seen in the age group 45-64 years and the majority of men (44%) were in the age group 45-54 years (table 3). The majority of men with hyperthyroidism (50%) and women (57%) were in the age group 35-44 years. (table 4).The thyroid status was also analyzed as per the occupation of the study group. 14.6% of housewives were hypothyroid. This was not statistically significant (p=0.063) (Table5). There was no statistically significant difference in thyroid status between the two economically

different study groups (Table 6). Thyroid dysfunction was seen mainly amongst those on a non-vegetarian diet (Table7). This was not statistically significant as the number of vegetarians was low. The life style of the study group did not significantly affect the thyroid status (Table 8).

Table 1: Thyroid Status at Different Age Groups

Age group	Thyroid status		
	Hyperthyroid	Euthyroid	Hypothyroid
<24yrs	1	11	0
25-34yrs	1	78	7
35-44yrs	6	164	10
45-54yrs	0	173	18
55-64yrs	3	105	15
65-74yrs	0	43	5
>75yrs	2	7	1
Total	13	581	56

P value = 0.002

Table 2: Gender wise distribution of the thyroid status in the study group:

	Male		Female	
Thyroid status	Number	Percent	Number	Percent
Hyperthyroid	6	1.7	7	2.3
Euthyroid	325	93.6	256	84
Hypothyroid	16	4.6	40	13.2

P value= 0.000

Table 3: Distribution of hypothyroidism amongst men and women at different age groups

AGE GROUP	GENDER		TOTAL
	MALE	FEMALE	
25.0-34.0	0	7	7
35.0-44.0	3	7	10
45.0-54.0	7	11	18
55.0-64.0	3	12	15
65.0-74.0	3	2	5
75.0+	0	1	1
TOTAL	16	40	56

P value= 0.213

Table 4: Distribution of hyperthyroidism amongst men & women at different age groups

AGE GROUP	GENDER		TOTAL
	MALE	FEMALE	
25.0-34.0	1	0	1
35.0-44.0	3	4	7
45.0-54.0	0	0	0
55.0-64.0	2	1	3
65.0-74.0	0	2	2
75.0+	0	0	0
TOTAL	6	7	13

P value= 0.292

Table 5: Thyroid status as per occupation:

OCCUPATION	Hyperthyroid	Euthyroid	Hypothyroid
FARMER	0	38	2
BUSINESS	2	65	4
LABOURER	2	93	6
TEACHER	0	27	1
DRIVER	0	26	1
GOVT	0	31	2
EX.SERVICE	1	25	1
HOUSEWIFE	7	220	39
OTHERS	1	43	0

P value= 0.063

Table 6: Thyroid status as per different economic status:

	APL	BPL
HYPERTHYROID	10	3
EUTHYROID	488	93
HYPOTHYROID	46	10

P value – Not significant (0.751)

Table 7: Thyroid status as per diet:

	Vegetarian	Nonvegetarian
HYPERTHYROID	0	13
EUTHYROID	10	571
HYPOTHYROID	0	56

P value not significant (0.547)

Table 8: Thyroid status as per the life style of the subjects:

	ACTIVE	SEDENTARY
HYPERTHYROID	11	2
EUTHYROID	444	137
HYPOTHYROID	45	11

P value not significant (0.641)

SERUM LIPID CONCENTRATIONS:

The total cholesterol level was higher in the hypothyroid group as compared to the euthyroid and hyperthyroid group with a down ward trend across the three thyroid status. The triacylglycerol and HDL levels were within the normal range in all three states. LDL levels were within the normal range in the hypothyroid and euthyroid subjects but were slightly increased in the hyperthyroid subjects (Table 9). Women had higher serum total cholesterol levels across all three thyroid states as compared to men. On the other hand triacylglycerol levels were lower in women as compared to men across the three thyroid states. This data was not statistically significant. (Table 10)

DIABETES:

8.3% of total subjects were pre-diabetic and 13.9% diabetic (Table 11). 5.5% of men were pre-diabetic and 8.2% diabetic as compared to 2.8% women (pre-diabetic) and 5.7% women (diabetic) (Table 12). 7.1 % of hypothyroids were pre-diabetic and 12.5% diabetic. 7.1% of hyper thyroids were pre-diabetic and 24.4% had diabetes (Table 13). Amongst 7 diabetics in the hypothyroid group 3 were women and amongst the 3 diabetics in hyperthyroid group, 3 were women. This distribution was not statistically significant (Table 14).

Table 9: Mean levels of total cholesterol (TC), Triglycerides (TG), High Density Lipoprotein (HDL) and Low Density Lipoprotein (LDL) at different thyroid states.

THYROID STATUS	TC	TG	HDL	LDL
HYPOTHYROID	210.4	113.3	43.5	144.2
EUTHYROID	204.8	114.5	43.3	139.6
HYPERTHYROID	195	91.7	43.5	179

Table 10: Gender wise Distribution Of thyroid Status & Their Mean Lipid Levels

		TC	TG	HDL	LDL
HYPOTHYROID	Male	207	127	43	139
	Female	212	108	44	147
EUTHYROID	Male	201	130	43	138
	Female	210	95	44	142
HYPERTHYROID	Male	183	111	45	192
	Female	208	79	42	149

P value not significant

Table 11: Status of diabetes:

DIABETES STATUS	NUMBER	PERCENT
NORMAL	506	77.8
PREDIABETIC	54	8.3
DIABETIC	90	13.9

Table 12: Status of diabetes in the study group amongst males & females:

	Male		Female	
DIABETES STATUS	Number	%	Number	%
NORMAL	258	39.7	248	38.1
PREDIABETIC	36	5.5	18	2.8
DIABETIC	53	8.2	37	5.7

Table 13: States of diabetes and thyroid function in the study group:

THYROID STATUS	NORMAL BLOODSUGAR		PREDIABETIC		DIABETIC	
	Number	%	Number	%	number	%
HYPOTHYROID	45	80.4	4	7.1	7	12.5
EUTHYROID	452	77.8	49	8.4	80	13.8
HYPERTHYROID	9	69.2	1	7.1	3	24.4

Table 14: Gender wise distribution of diabetes & thyroid function in the study group:

THYROID STATUS	GENDER	NORMAL	PREDIABETIC	DIABETIC	P VALUE
HYPOTHYROID	MALE	11	1	4	0.121
	FEMALE	35	3	3	
EUTHYROID	MALE	243	34	49	0.08
	FEMALE	209	15	31	
HYPERTHYROID	MALE	5	1	0	0.09
	FEMALE	4	0	3	

DISCUSSION

From this study abnormal TSH concentration was seen in 10.6% of subjects. The Colorado study [14] reported 11.7% subjects with abnormal TSH concentration which is close to what we have obtained from our study. In a cross sectional surveys in central Kerala Usha et al. have reported thyroid function abnormalities in 19.6% of population. [15] The prevalence of thyroid dysfunction among young females in a South Indian population was 12.5%. [16] In an earlier study on the prevalence of thyroid disorders in women of Pondicherry 15.8% had thyroid dysfunction. [17]

An elevated TSH concentration (hypothyroidism) was seen in 8.6% of subjects. This is within the range seen in literature and is consistent with other findings in an iodine replete population. [14-17] A low TSH concentration (hyperthyroidism) was seen in 2% of subjects. The prevalence of hyperthyroidism has been reported in several studies. In an epidemiological study from Cochin, subclinical and overt hyperthyroidism was present in 1.6% and 1.3% of subjects participating in a community Survey. [15] In a hospital based study of women from Pondicherry hyperthyroidism was seen in 1.8% of subjects. [17] In another study from South India low TSH was seen in 1.5% of young females. [16] Our values are very similar to the Colorado study [14] where 2.2% of their subjects had TSH<0.3 µIU/ml. In the Wickham Survey thyrotoxicosis was seen in 1.6% of the total subjects. [18] In more recent reports Hoogendorn reported thyrotoxicosis in 1.2% subjects [19] and Hallowell et al. in their (NHANES III) study an incidence of 1.3%. [20]

In our study the percentage of subjects with high serum TSH concentration was higher in women (13.2%) than men (4.6%). This has been corroborated by other studies. [14,21- 22] The percentage of subjects with hyperthyroidism was also greater in women (2.3%) as compared to men (1.7%). The highest proportion of subjects with

hypothyroidism was seen in the age group 45-54 years (27.5%) and 55-64 yrs (50%). A number of papers have reported an elevated TSH level with advancing age particularly in women. [17, 20-21] Interestingly 44% of men with hypothyroidism was in the age group 45-54yrs (table 3). The majority of men (50%) and women (57%) with hyperthyroidism were seen in the age group 35-44yrs. Hyperthyroidism (62%) was largely seen in the age group 45 years and below. (table 4) Only 0.8% of total subjects who had hyperthyroidism were above the age of 45 years. Other reports have given a prevalence value of 2% in the elderly. [22, 23]

SERUM LIPID CONCENTRATION:

Thyroid disorders are known to influence lipid metabolism. Hypothyroidism is most frequently associated with disorders of lipid metabolism. The total cholesterol level was higher in the hypothyroid group as compared to the euthyroid and hyperthyroid groups (table 9). It has been reported that overt and subclinical hypothyroidism is associated with hypercholesterolemia. [14,24] The triacylglycerol and HDL levels were within the normal range. No significant change in serum TG and HDL has also been previously reported. [14] LDL levels were within the normal range in the hypothyroid and euthyroid subjects but were slightly increased in the hyperthyroid subjects. Other studies have reported an increase in LDL in overt hypothyroidism and a decrease in LDL and total cholesterol levels in hyperthyroidism. [24] We have observed a decrease in cholesterol in hyperthyroid subjects (table 9). This has been attributed to increased bile excretion of cholesterol. [25] Triacylglycerol levels were relatively decreased as compared to euthyroid and hypothyroid states but there was no change in HDL levels. Women had higher serum total cholesterol and LDL levels across all three states as compared to men (table10). This has also been observed by Canaris and co-workers in the Colorado study. [14]

THYROID STATUS AND DIABETES:

There is a deep underlying relationship between diabetes mellitus and thyroid dysfunction. Of the 90 patients who were diabetic 12.5% were hypothyroid and 24.4% were hyperthyroid. Makandar et al. [26] have reported 22% of diabetics to be hypothyroid and 10% to be hyperthyroid. The overall prevalence of diabetes in our study group was 13.9%. Palmer et al. [27] have reported an overall prevalence of 14.7% in their studies. Both Hypothyroidism and hyperthyroidism was more prevalent amongst female diabetics.

CONCLUSION

This is the first report of thyroid status in this region of north Kerala, India. 8.6% of total subjects were hyperthyroid and 2% of the total subjects were hyperthyroid. A higher percentage of women were both hyperthyroid and hypothyroid. Hypothyroidism in women was more marked in the age group 45-64 years. Hyperthyroidism was mainly seen in the age group <45years. The total cholesterol level was higher in the hypothyroid group as compared to the hyperthyroid group with women having a higher total cholesterol level as compared to men. More number of men were diabetic as compared to women but more females with thyroid dysfunction had associated Diabetes mellitus.

The above data indicates that thyroid dysfunction, particularly in women and in the age group 45-64 years is very high in this region. Screening for thyroid disease should be considered mandatory during routine evaluation of this susceptible group. This should be followed with appropriate treatment as possible aggravation of classical risk factors such as hypertension and dyslipidemia can lead to an increased cardiovascular risk in these patients. Associated diabetes mellitus with thyroid dysfunction seen particularly in women also merits early detection and initiation of treatment.

REFERENCES

1. Heuck CC, Kallner A, Kanagasabapathy A S, Riesen W , Diagnosis & monitoring of the disease of the thyroid . WHO Document 2000; 8-9
2. Delange F. The disorders induced by iodine deficiency. Thyroid 1994 ;4:107-28.
3. Laurberg P, Pedersen KM, Hreidarsson A, Sigfusson N, Iversen E, Knudsen PR.Iodine intake and the pattern of thyroid disorders: a comparative epidemiologicalstudy of thyroid abnormalities in the elderly in Iceland and in Jutland, Denmark.J Clin Endocrinol Metab 1998 ;83:765-9.
4. Kochupillai N,Clinical Endocrinology in India. Curr Sci 2000;79:1061-7
5. Vanderpump MP, Tunbridge WM. Epidemiology and prevention of clinical and subclinical hypothyroidism. Thyroid 2002; 12:839-47.
6. Tunbridge WM, Vanderpump MP. Population screening for autoimmune thyroid disease. Endocrinol Metab Clin North Am 2000 ;29:239-53
7. Liberopoulos EN, Elisaf MS. Dyslipidemia in patients with thyroid disorders. Hormones 2002;1(4):218-23.
8. Chen G, Wu J, Lin Y, Huang B, Yao J, Jiang Q, Wen J, Lin L. Associations between cardiovascular risk, insulin resistance, beta-cell function and thyroid dysfunction: a cross-sectional study in She ethnic minority group of Fujian Province in China. Eur J Endocrinol 2010;163:775-82.
9. Green ED, Baenziger JU. Asparagine-linked oligosaccharides on lutropin, follitropin, and thyrotropin. II. Distributions of sulfated and sialylated oligosaccharides on bovine, ovine, and human pituitary glycoprotein hormones. J Biol Chem 1988 ;263:23-25.
10. Trinder P. Determination of blood glucose using an oxidase-peroxidase system with a non-carcinogenic chromogen. J Clin Pathol 1969 ;2:158-61.
11. Allain CC, Poon LS, Chan CS, Richmond W, Fu PC. Enzymatic determination of total serum cholesterol. Clin Chem 1974 ;20:470-5.
12. Fossati P, Prencipe L. Serum triglycerides determined colorimetrically with an enzyme that produces hydrogen peroxide. Clin Chem 1982 ;28:2077-80.
13. Naito H K. High-density lipoprotein (HDL) cholesterol. Kaplan A et al. Clin Chem The C.V. Mosby Co. St Louis. Toronto. Princeton 1984; 1207-1213 and 437
14. Canaris GJ, Manowitz NR, Mayor G, Ridgway EC. The Colorado thyroid disease prevalence study. Arch Intern Med 2000 28;160:526-34.
15. Usha Menon V, Sundaram KR, Unnikrishnan AG, Jayakumar RV, Nair V, Kumar H.High prevalence of undetected thyroid disorders in an iodine sufficient adult south Indian population. J Indian Med Assoc 2009;107:72-7.
16. Velayutham K, Selvan SS, Unnikrishnan AG. Prevalence of thyroid dysfunction among young females in a South Indian population. Indian J Endocrinol Metab 2015;19:781-4.
17. Abraham R, Srinivasa Murugan V, Pukazhvanthen P, Sen SK. Thyroid disorders in women of Puducherry. Indian J Clin Biochem 2009 ;24:52-9.
18. Tunbridge WM, Evered DC, Hall R, Appleton D, Brewis M, Clark F, Evans JG,Young E, Bird T, Smith PA. The spectrum of thyroid disease in a community: the Whickham survey. Clin Endocrinol (Oxf) 1977;7:481-93.
19. Hoogendoorn EH, Hermus AR, de Vegt F, Ross HA, Verbeek AL, Kiemeney LA,Swinkels DW, Sweep FC, den Heijer M. Thyroid function and prevalence of anti-thyroperoxidase antibodies in a population with borderline sufficient iodine intake: influences of age and sex. Clin Chem 2006; 52:104-11
20. Hollowell JG, Staehling NW, Flanders WD, Hannon WH, Gunter EW, Spencer CA,Braverman LE. Serum TSH, T(4), and thyroid antibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III). J Clin Endocrinol Metab 2002 ;87:489-99.
21. Unnikrishnan AG, Menon UV. Thyroid disorders in India: An epidemiological perspective. Indian J Endocrinol Metab 2011 ;15:S78-81.
22. Vanderpump MP. The epidemiology of thyroid disease. Br Med Bull 2011;99:39-51.
23. Gussekloo J, van Exel E, de Craen AJ, Meinders AE, Frölich M, Westendorp RG.Thyroid status, disability and cognitive function, and survival in old age. JAMA 2004 ;292:2591-99.

24. Liberopoulos EN, Elisaf MS. Dyslipidemia in patients with thyroid disorders.Hormones (Athens) 2002;1:218-23.
25. Regmi A, Shah B, Rai BR, Pandeya A. Serum lipid profile in patients with thyroid disorders in central Nepal. Nepal Med Coll J 2010;12:253-6
26. Mahander A,Sonagra AD, Shafi N. Study of thyroid function in type 2 diabetic and non-diabetic population. Int J Med Sci Public Health 2015;4:769-772
27. Catia Cristina Silva Sousa Vergara Palma, Marco Pavesi, Veronica Guedes Nogueira , Eliete Leao Silva Clemente et al. Diabetology and Metab olic syndrome 2013;5:58

How to cite this article: Joice SV, Abraham R, Kumar D et al. Thyroid dysfunction in a rural region of north Kerala, India-its association with dyslipidemia and diabetes mellitus. International Journal of Research and Review. 2017; 4(7):1-8.

******