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Prevalence of Diabetes Mellitus, Hypertension, Obesity in Hypothyroidism Patients: A Cross Sectional Study

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ABSTRACT

Hypothyroidism is a condition in which the thyroid gland does not operate properly. It can manifest as an overt state of myxedema, end-organ consequences, and multisystem failure, or as a subclinical illness characterized by normal thyroxine and triiodothyronine levels and modestly raised serum thyrotropin levels. Hypothyroidism has been linked to T2DM, obesity, and hypertension, increasing the risk of hypothyroidism in patients with T2DM and/or hypertension, as well as worsening of diabetes and hypertension-related co-morbidities. This study aimed to estimate the Prevalence of Diabetes mellitus, Hypertension, Obesity in Hypothyroidism patients. A Cross sectional study was carried out. This study reveals that prevalence of hypothyroidism is advancing with age and frequency of prevalence was higher in women than men. According to our study the most prominent age group lies between 35-50yrs. As per our study, obesity has higher percentage of prevalence to hypothyroidism than Diabetes and HTN. This study suggests that Calcium channel blockers with Levothyroxine, biguanides with Levothyroxine are more effective against Hypothyroidism with co-morbidities. Based on 3 follow ups, obesity has no significant changes in TSH levels when compared to hypertension and diabetes, thus obesity has higher risk. More research is needed to identify which adverse health events occur after long term levothyroxine therapy.

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INTRODUCTION

Hypothyroidism is a condition in which the thyroid gland does not operate properly. It can manifest as an overt state of myxedema, end-organ consequences, and multisystem failure, or as a subclinical illness characterized by normal thyroxine and triiodothyronine levels and modestly raised serum thyrotropin levels [1]. In the Western world, hypothyroidism affects 4%–5% of the population, but in India, it affects one out of every 10 individuals [2,3]. Hypothyroidism shares an underlying path-physiology with type 2 diabetes mellitus (T2DM) and hypertension. Thyroid disorders (TDs) are common in people with T2DM (12–23 percent) and hypertension (22.5 percent) according to several studies [4–13]. Plasma triiodothyronine (T3) and thyroxine (T4) levels are affected by uncontrolled T2DM [14]. The causes for the link between diabetes and hypothyroidism have been suggested to be hereditary, biochemical, or hormonal in nature [15]. Hypothyroidism and type 1 diabetes mellitus (T1DM) may coexist due to autoimmune etiology similarities. A higher prevalence of TD has also been reported in T2DM patients, with hypothyroidism being the most frequent disease [16]. Thyroid hormone insufficiency may increase total peripheral vascular resistance and hypothyroidism in people with hypertension due to anatomical changes in vascular tissue and changes in the autonomic nervous system. Hypothyroid individuals also have lower dopaminergic activity in the central nervous system, which raises nor-epinephrine levels, contributing to the development of hypertension [17].

Hypothyroidism has been linked to T2DM, obesity, and hypertension, increasing the risk of hypothyroidism in patients with T2DM and/or hypertension, as well as worsening of diabetes and hypertension-related co-morbidities. As a result, screening for hypothyroidism in T2DM and/or hypertension patients can aid in early detection and improved management of hypothyroidism. The goal of this study was to find out how common hypothyroidism is in Indian patients with T2DM and hypertension, as well as how to treat it, including prescribing thyroxine.

METHODOLOGY

Aim of the study: To estimate the Prevalence of Diabetes mellitus, Hypertension, Obesity in Hypothyroidism patients.

Objectives of the study

To assess the Prevalence of DM, HTN, Obesity in Hypothyroidism.

- To associate the Clinical demographic characteristics of patients with Hypothyroidism and risk factors.

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- To evaluate most common co-morbidities associated with Hypothyroidism among the population.
- To assess the variations in BMI, BP, Blood sugar levels in hypothyroidism cases.
- To estimate the thyroid hormone levels in hypothyroidism with T2 DM, HTN and obesity.
- To study the Clinical Association between Hypothyroidism and DM, HTN, Obesity.
- To study the Prescribing pattern of Hypothyroidism with other risk factors.

Place of study:

ACSR Govt. Hospital, Nellore.

Study Design:

A Cross-sectional study

Period of study:

6months

Study population:

92 patients

Patient enrolment:

Patients were enrolled based on eligibility criteria.

a. Inclusion criteria

• Age about 20-65yrs were included.

• Gender – both Males & Females

• Patients who are willing to participate in the study were included.

• Patients with co-morbidities like HTN, T2 DM, Obesity in hypothyroidism were only included in this study.

• Patients with alcohol, smoking and other physical activity were included.

b. Exclusion criteria

• Patients with age less than 18yrs and more than 65yrs were not included in the study.

• Patients with other comorbid conditions like hepatic, cardiovascular, gastrointestinal, neurological disorders are not included.

• Patients with multiple comorbid conditions in hypothyroidism are not included in this study. • Patients with hyperthyroidism condition are not included.

• Pregnancy and lactating mothers are not included in this study.

• Patients who are not willing to participate are not included.

Study materials

Patient data collection form & Questionnaire; A well-structured patient data collection form was prepared in which patient details were recorded; Patient Inform Consent form Patient details were collected after taking the consent from the patient/care taker.

Method of study:

Patients were included in the study based on eligibility criteria. Data regarding demographic details, lab reports, treatment were collected through data collection form and Questionnaire'. Each follow up were conducted for every 2months. During each follow up, the association of hypothyroidism with HTN, T2 DM, and obesity was assessed. Physical examination and laboratory values were monitored for each follow up. Prevalence (expressed as percentage) of HTN, T2DM, Obesity in Hypothyroidism was calculated based on age, gender, BMI, BP levels, HbA1c levels. Results were obtained and formulated and reported.

Statistical Analysis:

Prevalence and ANOVA has been used.

RESULTS

In a study population of 92, Age Wise Categorization were distributed in Fig 01 and based on gender, the distribution of hypothyroidism among the study population comprises of about 25 male subjects which amounts to 27.1% and 67 female subjects constitutes about 72.8% depicted in Fig 02. The co-morbid conditions of the study subjects were noticed using case collection reports and the distribution is as follows are represented in Table 01.

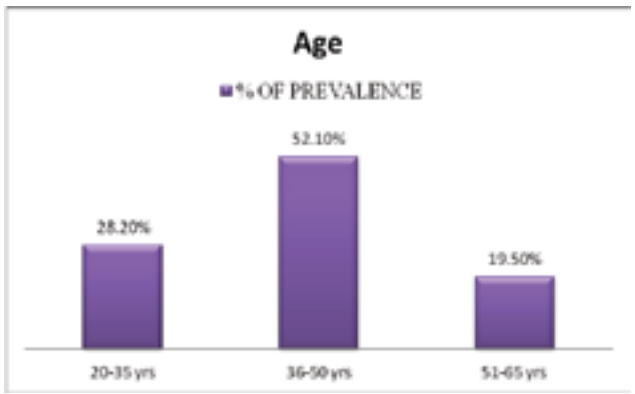

Figure 1: Age Wise Categorization.

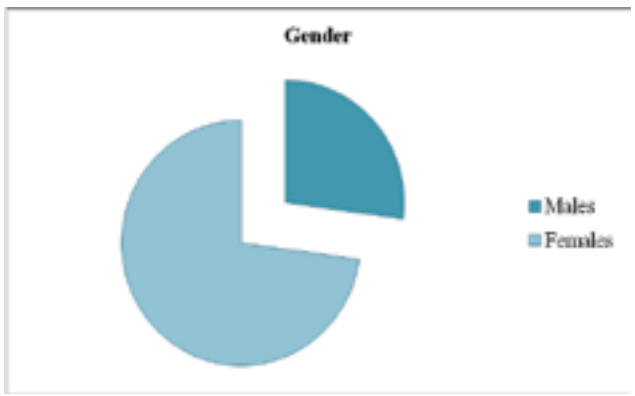

Figure 2: Gender Wise Categorization.

co-morbidities	Study Population (N=92)	% of Prevalence
Only hypothyroidism	24	26%
Hypothyroidism with DM	21	22.8%
Hypothyroidism with HTN	18	19.5%
Hypothyroidism with Obesity	29	31.5%

Table 01: Based on co-morbidities.

Among the study population,13 subjects are underweighted which constitutes to 14.1%,50 subjects come under normal weight which constitutes about 54.3%,in a total of 29 patients with obesity 21 subjects are overweight with 22.8%,and the other class -1,2,3 obese subjects are of 4,3,1 Comprises of 4.3%,3.2%,1.0% respectively. Among 21 patients with diabetes mellitus, levels of FBS, RBS, PPBS, GTT were represented in Table 02. In a total of 18 patients with hypertension, BP levels were distributed in Table 03. Analysis of demographic Characteristics represented in Table 04. Treatment wise categorization was represented in Table 05. Subjects enrolled in treatment follow ups depicted in Fig 03.

Based upon the analysis, the above table states that the hypothyroidism with Obesity population was more with higher demographic characteristics when compared to other population.

Blood Sugar levels	Study Population (N=21)	% of Prevalence
FBS (110-200 mg/dl)	7	33.3%
RBS (130-250 mg/dl)	3	14.2%
PPBS (140-250 mg/dl)	9	42.8%
GTT (140-200 mg/dl)	2	9.5%

Table 02: Blood Sugar levels wise Categorization.

Blood Pressure levels	Study Population (N=18)	% of Prevalence
120/80-150/90 mm of Hg	6	33.3%
150/90-200/90 mm of Hg	9	50%
200/90-250/90 mm of Hg	3	16.6%

Table 03: Blood Pressure wise Categorization.

Demographic Characteristics	Only hypothyroidism (N=24)	Hypothyroidism with DM (N=21)	Hypothyroidism with HTN (N=18)	Hypothyroidism with Obesity (N=29)
1.GENDER				
a. Males	5	6	5	9
b. Females	19	15	13	20
2.AGE				
a. 20-35 yrs	8	5	4	9
b. 36-50 yrs	13	10	9	16
c. 51-65 yrs	3	6	5	4
3.EDUCATION				
a. Diploma	2	1	1	2
b. PG	1	1	0	1
c. UG	3	3	4	4
d. SSLC	5	4	3	6
e. <SSLC	7	5	5	8
f. NIL	6	7	5	8
4.SOCIAL HABITS				
a. Smoking	2	1	3	1
b. Alcohol	1	2	1	3
c. Hans/betel	4	2	4	5
5.DIET				
a. Veg	5	3	2	6
b. Nonveg/mixed	19	18	16	23

Table 04: Analysis of demographic Characteristics.

Condition	Treatment	No. of patients
Hypothyroidism only	Levothyroxine (LT)	24
Hypothyroidism +HTN	a.calcium channel blockers (CCB'S)+Levothyroxine (LT)	10
	b.Diuretics+Levothyroxine(LT)	5
	c.Other anti-hypertensive drug +Levothyroxine (LT)	3
Hypothyroidism +DM	a.Biguanides+Levothyroxine	15
	b.Sulfonylureas+Levothyroxine	6
Hypothyroidism +OBESITY	a.Diet control+Levothyroxine	18
	b.Without diet control+ Levothyroxine	11

Table 05: Treatment wise Categorization.

Averages of Hormones in Hypothyroidism represented in Table 06. The follow up was conducted among hypothyroidism population during treatment and averages/means of T3, T4 &TSH was calculated and distributed in Table 07. Among calculated averages T3, T4 are slightly increases from baseline to 3rd follow up where as TSH slightly decreases from baseline to 3rd follow up. The follow up was conducted among hypothyroidism with DM population during treatment and averages of T3, T4 &TSH was calculated and distributed in Table 08. Among calculated averages, T3, T4 increases from baseline to 3rd follow up where as TSH decreases. The follow up was conducted among hypothyroidism with Obesity population during treatment and averages of T3, T4 &TSH was calculated and represented in Table 09. Among calculated averages, T3, T4 increases from baseline to 2nd follow up and slightly decreases at 3rd follow up where as TSH increases from baseline to 1st follow up and decreases at 2nd & 3rd follow up's.

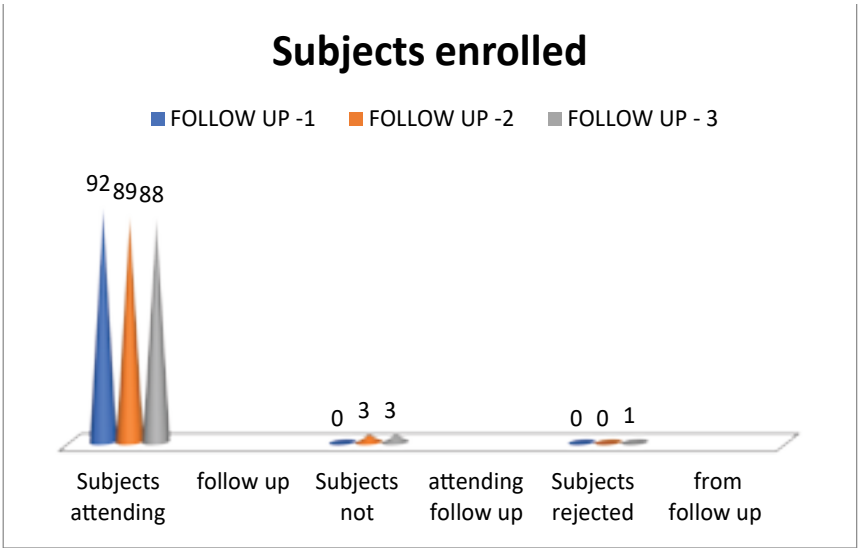

Figure 3: Subjects enrolled in treatment follow ups.

Condition	Baseline	1st Follow up	2nd Follow up	3rd Follow up
Hypothyroidism	T3 - 1.5	T3 - 1.74	T3 - 1.96	T3 - 2.0
	T4 - 9.16	T4 - 1.94	T4 - 10.21	T4 - 11.2
	TSH - 5.42	TSH - 5.19	TSH - 4.79	TSH - 3.62

Table 06: Averages of Hormones in Hypothyroidism.

Condition	Baseline	1st Follow up	2nd Follow up	3rd Follow up
Hypothyroidism +HTN	T3 - 1.01	T3 - 1.49	T3 - 1.74	T3 - 1.18
	T4 - 7.49	T4 - 7.24	T4 - 9.65	T4 - 12.41
	TSH - 6.91	TSH - 5.62	TSH - 5.17	TSH - 3.98

Table 07: Averages of Hormones in Hypothyroidism+ Hypertension.

Condition	Baseline	1st Follow up	2nd Follow up	3rd Follow up
Hypothyroidism +DM	T3 - 1.47	T3 - 1.62	T3 - 1.98	T3 - 1.98
	T4 - 8.69	T4 - 9.47	T4 - 9.91	T4 - 10.89
	TSH - 4.43	TSH - 4.27	TSH - 3.26	TSH - 1.09

Table 08: Averages of Hormones in Hypothyroidism+ DM.

Condition	Baseline	1st Follow up	2nd Follow up	3rd Follow up
Hypothyroidism +Obesity	T3 - 1.52	T3 - 1.76	T3 - 1.88	T3 - 1.39
	T4 - 9.74	T4 - 10.02	T4 - 10.99	T4 - 10.69
	TSH - 3.99	TSH - 5.02	TSH - 4.91	TSH - 4.63

Table 09: Averages of Hormones in Hypothyroidism+ Obesity.

DISCUSSION

The present study explains the association of risk factors with hypothyroidism. Based on age wise categorization, 36-50age group patients are more prone to hypothyroidism than other groups. As per statistical analysis, there was a significant clinical association between hypothyroidism and age groups. Our study was supported by Thenmalar Vadiveloo and peter T. Donnan et.al., studies [18].Based on gender, females are more prone to hypothyroidism than males. As per statistical analysis, there was significant clinical association between hypothyroidism and gender. Our study was supported by Thenmalar Vadiveloo and peter T. Donnan et.al., studies [18].

Based on hypothyroidism with other co-morbidities study population are more prone to hypothyroidism with obesity than hypothyroidism with diabetes and hypothyroidism with hypertension. As per statistical analysis, there was significant clinical association between hypothyroidism with obesity and other co-morbidities. Our study was supported by T.Arirudainambi and S. Kannan et.al., studies [19]. According to BMI ranges, over weight patients are more prone to hypothyroidism than class-1,2,3 obese patients. As per statistical analysis, there was a significant clinical association between hypothyroidism and BMI. Ourstudy was supported by Bernadette Biondi studies [20]. Based on blood sugar levels, PPBS levels are increased more among study population than FBS, RBS levels. As per statistical analysis, there was a significant clinical association between hypothyroidism and blood sugar levels. Our study was controversial toRakeshnair studies, Shriraam Mahadevan et.al., studies [21].

Based on blood pressure levels, 150/90 to200/90mm of Hg ranges are more prone than other BP ranges. Asper statistical analysis, there was no significant clinical association between hypothyroidism and blood pressure levels. Our study was supported by Richard, Fadovskyet.at., studies [22]. Based on demographic characteristics, hypothyroidism with obesity constitutes more than hypothyroidism + diabetes, hypothyroidism+ hypertension. As per statistical analysis,

there was clinical association between demographic characteristic and hypothyroidism with obesity. Our study was supported by A.Anandhasayanam , S.Kannan et.al., studies [19].

Considering combination therapy, calcium channel blockers + levothyroxine and Biguanides+ levothyroxine are mostly used by the subjects. As per statistical analysis, there was significant clinical association between hypertension, diabetes in hypothyroidism and its combination therapy. Our study was supported by vasiliu, Dobrovie and Bernadette biondi et.al., studies. Based on observational follow up's, TSH levels are higher in baseline and lower in third follow up. As per statistical analysis, there was a strong clinical association between hypothyroidism and TSH averages. Our study was supported by Dr. Rama mohan sir. Based on observational follow up's, TSH levels are higher in baseline and lower in third follow up. As per statistical analysis, there was strong clinical association between hypothyroidism with hypertension and TSH averages. Our study was supported by Dr. Rama Mohan sir.

CONCLUSION

The study presents an update on the prevalence of hypothyroidism and examines the association between hypothyroidism and other co-morbidities. This study provides an intimate interaction of thyroid hormones with all components of the metabolic syndromes. This study reveals that prevalence of hypothyroidism is advancing with age and frequency of prevalence was higher in women than men. According to our study the most prominent age group lies between 35-50yrs. As per our study, obesity has higher percentage of prevalence to hypothyroidism than Diabetes and HTN. This study suggests that Calcium channel blockers with Levothyroxine, biguanides with Levothyroxine are more effective against Hypothyroidism with co-morbidities. Based on 3 follow ups, obesity has no significant changes in TSH levels when compared to hypertension and diabetes, thus obesity has higher risk. More research is needed to identify which adverse health events occur after long term levothyroxine therapy.

Conflict of Interest

Authors declared that there is no conflict of Interest.

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