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Assessment of medication adherence and risk factors for hypothyroidism in South Indian Tertiary care hospital: a cross–sectional study

Abstract

The objective of the study was to assess the risk factors for hypothyroidism and the magnitude of medication adherence and the effects of various co-administered drugs on hypothyroidism treatment in a south Indian tertiary care hospital. A cross-sectional study was conducted in 208 subjects (with or without hypothyroidism) from November 2016 to April 2017 in a general medicine department. Odds ratios were calculated in univariate regression analysis for risk factors and magnitude of medication adherence was assessed using MMAS-8 and BMQ questionnaires and the incidence of various prescription drugs interfering with levothyroxine therapy was assessed. Hypothyroidism was significantly higher in the females (84.6%, P<0.0001) with graduation and above level of education (30.8%, P=0.004), significant family history (90.2%, P<0.0001), habit of taking fruit juices (monthly once) (4.9%, P=0.056), habit of taking soft drinks (weekly once) (11.7%, P=0.002), never work with same efficiency (24%, P=0.009), never with normal sleep pattern (20.4%, P=0.046), never take advantage of their free time (13.5%, P=0.049), never likes to be in relationship with others (14.4%, P=0.001) and who never used cardiovascular drugs (87.5%, P<0.0001) than non-hypothyroid subjects. The overall medication adherence level in subjects was found to be 34.6% according to Morisky-8- item questionnaire and 40.4% according to BMQ. Levothyroxine (100%) was the most widely prescribed drug followed by calcium + vitamin D3 (52.8%), glimepiride + metformin (17.28%), multivitamin + multimineral (11.52%) and iron + folic acid (9.6%). Among 60 drug-drug interactions identified, 23 (38.3%) were major, 35 (58.3%) were moderate and 2 (3.33%) were minor - drug interactions. The present study suggested that female gender, level of education upto graduation and above, significant family history, habit of taking fruit juices (monthly once), habit of taking soft drinks (weekly once), never work with same efficiency, never with normal sleep pattern, never take advantage of their free time, never likes to be in relationship with others and who never used cardiovascular drugs are at risk for hypothyroidism. Magnitude of medication adherence according to MMAS-8 and BMQ questionnaires was slightly low.

Keywords: hypothyroidism, risk factors, medication adherence, mmas-8, BMQ and drug interactions

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Introduction

Thyroid diseases are, arguably, among the commonest endocrine disorders worldwide. India too, is no exception. According to a projection from various studies on thyroid disease, it has been estimated that about 42 million people in India suffer from thyroid diseases.[1] The prevalence of hypothyroidism in the developed world is about 4-5%. The prevalence of subclinical hypothyroidism in the developed world is about 4-15%. In a developing and densely populated country like India, communicable diseases are priority health concerns due to their large contribution to the national disease burden.[2] A correct etiological, anatomical and functional diagnosis of the thyroid problem is absolutely essential for the proper treatment and well being of the patient.[3]

For more than four decades, numerous researches on how to properly measure and quantify medication adherence have been conducted but none of them can be counted as the gold standard. Different tools have been designed and validated for different conditions, in different circumstances. Generally, measurements of medication adherence are categorized by the WHO as subjective and objective measurements. Subjective measurements involve those requiring provider's or patient's evaluation of their medication-taking behavior. Self-report and healthcare professional assessments are the most common tools used to rate adherence to medication. The most common drawback is that patients tend to underreport nonadherence to avoid disapproval from their healthcare providers. In addition to the classification of adherence measures as subjective and objective, many other studies labeled them as direct and indirect respectively. Direct measures include measurement of the drug or its metabolite concentration in body fluids, such as blood or urine and evaluation of the presence of a biological marker given with the drug and direct observation of patient's medication-taking behavior. An ideal medication adherence measure should present low cost and be user friendly, easy to carry out, highly reliable, flexible, and practical. However, there is no single measure that can meet all these gold standards since each has its own drawbacks. Self-report

questionnaires, which have a reasonable predictive power, are more useful in a busy, resource-limited clinical setting with moderate to high literacy population. Patient's interview by clinicians is preferred for low literacy population or acts as an adjunct where patients have already been predicted as low medication adherers. Selecting two (or more) medication adherence measures might allow strengths of one method to help compensate putative weakness and to more accurately capture the information needed to determine adherence levels.[4] Hence we have employed two self - report questionnaires in this study namely, BMQ (Brief Medication Questionnaire) and MMAS-8 (Eight-Item Morisky Medication Adherence Scale) for assessing the medication adherence in hypothyroid patients.

Methodology

Study design and participants

It was a prospective study conducted at both in-patients and out-patients department of Dr. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation, Gannavaram, Andhra Pradesh for a period of 6 months from November 2016 to April 2017. Patients of either sex diagnosed with Hypothyroidism of any duration and some subjects (without Hypothyroidism) were included in the study shown in Figure 1. The protocol for the proposed study was approved by the Institutional Ethics Committee (IEC) of KVSR Siddhartha College of Pharmaceutical Sciences, Vijayawada, Andhra Pradesh.

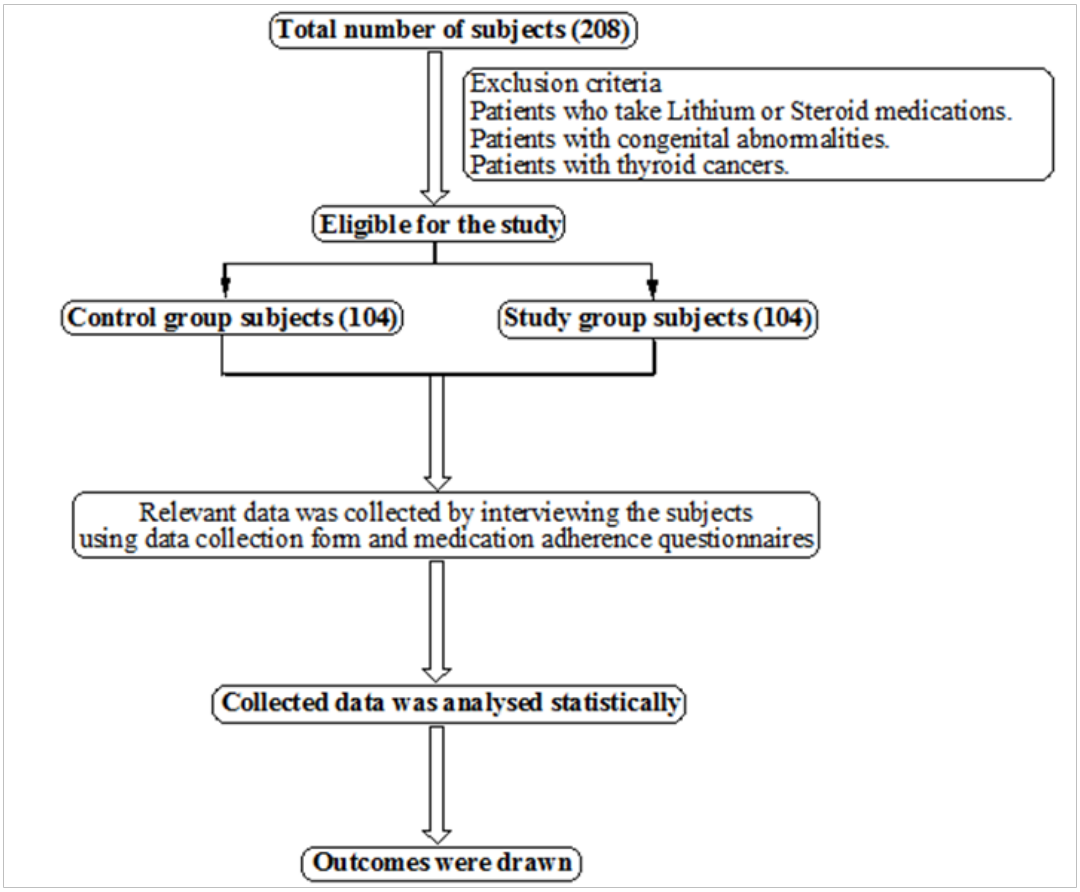

Figure 1 Study design.

Inclusion criteria

- Patients with and without Hypothyroidism.
- Patients with age greater than 18 years
- Patients willing to participate in the study

Exclusion criteria

- Patients who are currently taking Lithium or Steroid medications.
- Patients with congenital abnormalities.
- Patients with thyroid cancers.

Study procedure

Socio-demographic characteristics and risk factors

The total patients (n=208) were divided into Non-Hypothyroid (control, n=104) and Hypothyroid group (n=104). A data collection form for various socio-demographic factors, life style factors, co-morbid conditions and clinical characteristics for hypothyroidism was designed. Patient information sheets containing information regarding the study procedure were designed and provided to the study subjects. Consent from the participants who are willing to participate in the study were obtained by employing informed consent forms.

Citation: Annavarapu K, Borra HL, Chakka RS, et al. Assessment of medication adherence and risk factors for hypothyroidism in South Indian Tertiary care hospital: a cross–sectional study. *J Diabetes Metab Disord Control.* 2019;6(3):60–79. DOI: 10.15406/jdmdc.2019.06.00184

Assessment of Medication Adherence using MMAS – 8 & BMQ questionnaires

Magnitude of medication adherence was assessed by interviewing the subjects using medication adherence questionnaires.[5]

Statistical analysis

In the descriptive statistical analysis, the categorical variables were expressed as percentages. The univariate analysis was done using chi–square test to determine the strength of association between the variables and hypothyroidism. The risk for the development of hypothyroidism was evaluated by calculating the odds ratio (OR) at 95% CI. P-value <0.05 was considered significant. Statistical analyses were performed using graph pad prism software (version 7.0).

Results

A total of 208 patients were included in the study, 104 patients were without hypothyroidism and 104 patients were with hypothyroidism. Socio-demographic characteristics, food and life style characteristics, psychological domain, social and medication domain of patients with and without hypothyroidism were analyzed (Tables 1–4). Univariate regression analysis was performed for modifiable and non-modifiable risk factors of hypothyroidism and results presented in the Table 5.

Table 1 Socio-demographic characteristics of patients with or without hypothyroidism

Variables	Patients without hypothyroidism N (%)	Patients with hypothyroidism N (%)	P-value
Gender			
Male	44 (42.3)	16 (15.4)	
Female	60 (57.7)	88 (84.6)	<0.0001
Age			
18-27	7 (6.7)	23 (22.1)	
28-37	5 (4.8)	23 (22.1)	0.749
38-47	25 (24)	28 (26.9)	0.037
48-57	31 (29.8)	16 (15.4)	0.0004
58-67	23 (22.1)	10 (9.6)	0.0004
>67	13 (12.5)	4 (3.8)	0.0006
Marital status			
Unmarried	7 (6.7)	13 (12.6)	
Married	97 (93.3)	90 (87.4)	0.166
Level of education			
Illiterate	37 (35.9)	16 (15.4)	
Primary level	21 (20.4)	27 (26)	0.0095
Secondary level	22 (21.4)	29 (27.9)	0.0097
Graduation and above	23 (22.3)	32 (30.8)	0.004
BMI (Kg/m^2)			
<25	25 (24)	27 (26)	
>25	79 (76)	77 (74)	0.873
Body weight (Kgs)			
<50	9 (8.7)	7 (6.7)	
50-70	35 (33.7)	45 (43.3)	0.4171
>70	60 (57.7)	52 (50)	>0.9999
Occupation			
Farmer	9 (8.7)	4 (3.8)	
Daily wage worker	4 (3.8)	6 (5.8)	0.222
Unemployed	5 (4.8)	5 (4.8)	0.417
Government employee	3 (2.9)	3 (2.9)	0.617
Private employee	22 (21.2)	14 (13.5)	0.743
Retired	12 (11.5)	1 (1)	0.322
Housewife	45 (43.3)	64 (61.5)	0.076
Student	4 (3.8)	7 (6.7)	0.217

Table Continued...

Variables	Patients without hypothyroidism N (%)	Patients with hypothyroidism N (%)	P-value
Locality			
Rural	51 (49)	44 (42.3)	
Urban	53 (51)	60 (57.7)	0.404
Monthly income			
Sufficient	44 (43.1)	55 (53.4)	
Barely sufficient	36 (35.3)	40 (38.8)	0.7602
Not sufficient	22 (21.6)	8 (7.8)	0.0067
Co-morbidities			
No co-morbidities	7 (6.7)	60 (57.7)	
Hypertension	7 (6.7)	13 (12.5)	0.0151
Type 2 Diabetes Mellitus	68 (65.4)	14 (13.5)	<0.0001
Cerebrovascular diseases	2 (1.9)	2 (1.9)	0.076
Pregnancy	1 (1)	1 (1)	0.22
Hyperlipidemia	4 (3.8)	3 (2.9)	0.008
Heart disease	10 (9.6)	6 (5.8)	<0.0001
Clinical history of family			
Not significant	74 (87.1)	10 (9.8)	
Significant	11 (12.9)	92 (90.2)	<0.0001

BMI, Body mass index

Table 2 Food and life style characteristics of patients with or without hypothyroidism

Variables	Patients without hypothyroidism N (%)	Patients with hypothyroidism N (%)	P-value
Food habits			
Vegetarian	11 (10.6)	16 (15.4)	
Mixed	93 (89.4)	88 (84.6)	0.41
Physical activity			
No	70 (67.3)	58 (55.8)	
Yes	34 (32.7)	46 (44.2)	0.117
Habit of smoking			
No	88 (84.6)	99 (96.1)	
Yes	12 (11.5)	3 (2.9)	0.016
Past smoker	4 (3.9)	1 (1)	0.196
Habit of drinking alcohol			
No	93 (89.4)	97 (94.2)	
Yes	8 (7.7)	4 (3.9)	0.373
Past alcoholic	3 (2.9)	2 (1.9)	0.679
Habit of taking junk foods			
No	66 (63.5)	68 (65.4)	
Daily	4 (3.8)	5 (4.8)	>0.9999
Once weekly	5 (4.8)	6 (5.8)	>0.9999
Once in a month	1 (1)	3 (2.9)	0.62
Occasionally	28 (26.9)	22 (21.2)	0.508

Citation: Annavarapu K, Borra HL, Chakka RS, et al. Assessment of medication adherence and risk factors for hypothyroidism in South Indian Tertiary care hospital: a cross–sectional study. *J Diabetes Metab Disord Control.* 2019;6(3):60–79. DOI: 10.15406/jdmdc.2019.06.00184

Table Continued...

Variables	Patients without hypothyroidism N (%)	Patients with hypothyroidism N (%)	P-value
Habit of taking fruits/fruit juices			
No	16 (15.5)	7 (6.7)	
Daily	32 (31.1)	39 (37.5)	0.055
Once weekly	19 (18.4)	23 (22.1)	0.073
Once in a month	1 (1)	5 (4.9)	0.056
Occasionally	35 (34)	30 (28.8)	0.226
Habit of taking soft drinks			
No	59 (56.7)	50 (48.5)	
Once in a week	1 (1)	12 (11.7)	0.002
Once in a month	1 (1)	3 (2.9)	0.34
Occasionally	43 (41.3)	38 (36.9)	>0.9999
Habit of taking tea/coffee			
No	14 (13.5)	18 (17.3)	
Occasionally	6 (5.8)	6 (5.8)	0.746
Once or twice a day	62 (59.6)	67 (64.4)	0.697
Thrice a day and above	22 (21.2)	13 (12.5)	0.145
Situation at working places			
No stress	59 (56.7)	55 (52.9)	
Stress	45 (43.3)	49 (47.1)	0.676
Fruits			
Daily	55 (55.6)	58 (57.4)	
Weekly	36 (36.4)	31 (30.7)	0.54
Monthly	8 (8.1)	12 (11.9)	0.628
Cereals			
Daily	25 (25.4)	32 (30.8)	
Weekly	55 (56.1)	61 (58.7)	0.746
Monthly	18 (18.4)	11 (10.6)	0.17
Green leafy vegetables			
Daily	36 (35.3)	43 (41.3)	
Weekly	65 (63.7)	60 (57.7)	0.391
Monthly	1 (1)	1 (1)	>0.9999

Table 3 Psychological domain of patients with or without hypothyroidism

Variables	Patients without hypothyroidism N (%)	Patients with hypothyroidism N (%)	P-value
Feels sleep turbulent and disturbance			
Always	15 (14.4)	24 (23.1)	
Sometimes	35 (33.7)	23 (22.1)	0.04
Never	54 (51.9)	57 (54.8)	0.351
Feels nervous			
Always	5 (4.9)	19 (18.3)	
Sometimes	24 (23.3)	36 (34.6)	0.129
Never	74 (71.8)	49 (47.1)	0.0006

Table Continued...

Variables	Patients without hypothyroidism N (%)	Patients with hypothyroidism N (%)	P-value
Feels disturbing dreams(nightmares)			
Always	8 (7.8)	19 (18.3)	
Sometimes	36 (35)	29 (27.9)	0.038
Never	59 (57.3)	56 (53.8)	0.054
Feels distress of stomach			
Always	6 (5.8)	8 (7.8)	
Sometimes	32 (30.8)	45 (43.7)	>0.999
Never	66 (63.5)	50 (48.5)	0.397
Feels tired quickly			
Always	15 (14.6)	29 (27.9)	
Sometimes	47 (45.6)	43 (41.3)	0.065
Never	41 (39.8)	32 (30.8)	0.023
Feels discomfort while waiting			
Always	14 (13.6)	21 (20.2)	
Sometimes	31 (30.1)	40 (38.5)	0.835
Never	58 (56.3)	43 (41.3)	0.081
Concentrate thinking in action			
Always	20 (19.2)	27 (26)	
Sometimes	35 (33.7)	35 (33.7)	0.455
Never	49 (47.1)	42 (40.4)	0.281
Sweating in cold days			
Always	6 (5.8)	16 (15.5)	
Sometimes	23 (22.1)	19 (18.4)	0.063
Never	75 (72.1)	68 (66)	0.038
Headache			
Always	6 (5.8)	27 (26)	
Sometimes	63 (60.6)	51 (49)	0.0002
Never	35 (33.7)	26 (25)	0.0004
Feels anxious for worthless things			
Always	4 (3.8)	16 (15.5)	
Sometimes	37 (35.6)	39 (37.9)	0.024
Never	63 (60.6)	48 (46.6)	0.003
A tense person			
Always	6 (5.8)	18 (17.3)	
Sometimes	52 (50)	54 (51.9)	0.041
Never	46 (44.2)	32 (30.8)	0.005
Feels sad			
Always	6 (5.8)	17 (16.3)	
Sometimes	51 (49)	48 (46.2)	0.037
Never	47 (45.2)	39 (37.5)	0.019
Feels pessimistic about the future			
Always	7 (6.8)	14 (13.6)	
Sometimes	28 (27.2)	46 (44.7)	0.801
Never	68 (66)	43 (41.7)	0.029

Table Continued...

Variables	Patients without hypothyroidism N (%)	Patients with hypothyroidism N (%)	P-value
Disappointed in themselves			
Always	6 (5.8)	18 (17.3)	
Sometimes	28 (26.9)	41 (39.4)	0.222
Never	70 (67.3)	45 (43.3)	0.002
Loss interest in people			
Always	6 (5.9)	17 (16.3)	
Sometimes	20 (19.6)	30 (28.8)	0.3
Never	76 (74.5)	57 (54.8)	0.007
Works with same efficiency			
Always	73 (70.9)	58 (55.85)	
Sometimes	19 (18.4)	21 (20.2)	0.372
Never	11 (10.7)	25 (24)	0.009
Normal sleep pattern			
Always	74 (71.2)	63 (61.2)	
Sometimes	20 (19.2)	19 (18.4)	0.856
Never	10 (9.6)	21 (20.4)	0.046
Tired more quickly than usual			
Always	15 (14.4)	30 (29.1)	
Sometimes	67 (64.4)	48 (46.6)	0.005
Never	22 (21.2)	25 (24.3)	0.208
Appetite is not good as before			
Always	4 (3.8)	13 (12.6)	
Sometimes	28 (26.9)	33 (32)	0.162
Never	72 (69.2)	57 (55.3)	0.018

Table 4 Social and medication domain of patients with or without hypothyroidism

Variables	Patients without hypothyroidism N (%)	Patients with hypothyroidism N (%)	P-value
Do you take advantage of your free time			
Always	44 (42.3)	27 (26)	
Sometimes	52 (50)	63 (60.6)	0.034
Never	8 (7.7)	14 (13.5)	0.049
Participate in social activities			
Always	12 (11.5)	10 (9.6)	
Sometimes	66 (63.5)	54 (51.9)	>0.9999
Never	26 (25)	40 (38.5)	0.227
Do you like to be relationships with others			
Always	74 (71.8)	62 (59.6)	
Sometimes	27 (26.2)	27 (26)	0.63
Never	2 (1.9)	15 (14.4)	0.001
Do you deal easily with your colleagues			
Always	64 (71.1)	60 (58.3)	
Sometimes	23 (25.6)	32 (31.1)	0.258
Never	3 (3.3)	11 (10.7)	0.047

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Table Continued...

Variables	Patients without hypothyroidism N (%)	Patients with hypothyroidism N (%)	P-value
Are increasing problems during menstrual period			
Always	6 (7.1)	14 (14.4)	
Sometimes	15 (17.6)	16 (16.5)	0.25
Never	64 (75.3)	67 (69.1)	0.15
Feel anxiety when you stay at home			
Always	2 (1.9)	14 (13.5)	
Sometimes	54 (52.4)	53 (51)	0.006
Never	47 (45.6)	37 (35.6)	0.002
Prefer to stay at home away			
Always	6 (5.8)	18 (17.3)	
Sometimes	62 (60.2)	68 (65.4)	0.046
Never	35 (34)	18 (17.3)	0.001
Medication domain			
Antacid drugs			
Always	21(20.2)	13 (12.6)	
Sometimes	31 (29.8)	26 (25.2)	0.52
Never	52 (50)	64 (62.1)	0.118
Iron and its products			
Always	10 (9.6)	8 (7.7)	
Sometimes	30 (28.8)	31 (29.8)	0.79
Never	64 (61.5)	65 (62.5)	0.802
Cardiovascular drugs			
Always	41 (39.8)	11 (10.6)	
Sometimes	5 (4.9)	2 (1.9)	0.643
Never	57 (55.3)	91 (87.5)	<0.0001

Table 5 Univariate regression analysis of modifiable and non-modifiable risk factors for hypothyroidism

Variables	OR (95% CI)	P-value
Female	4.033 (2.041 - 7.548)	<0.0001
Marital status		
Unmarried	Ref	
Married	0.500 (0.196 - 1.236)	0.166
Level of education		
Illiterate	**Ref**	
Primary level	2.973 (1.287 - 6.794)	0.0095
Secondary level	3.048 (1.352 - 6.811)	0.0097
Graduation and above	3.217 (1.466 - 7.018)	0.004
BMI (Kg/m2)		
<25	Ref	
>25	0.903 (0.481 - 1.677)	0.873

Table Continued...

Variables	OR (95% CI)	P-value
Body weight (Kgs)		
<50	Ref	
50-70	1.653 (0.568 - 4.466)	0.4171
>70	1.114 (0.399 - 2.939)	>0.9999
Occupation		
Farmer	**Ref**	
Daily wage worker	3.375 (0.544 - 19.68)	0.222
Unemployed	2.25 (0.433 - 11.59)	0.417
Government employee	2.25 (0.371 - 12.79)	0.617
Private employee	1.432 (0.384 - 4.809)	0.743
Retired	0.188 (0.014 - 1.639)	0.322
Housewife	3.2 (0.907 - 9.776)	0.076
Student	3.938 (0.699 - 22.04)	0.217
Locality		
Rural	**Ref**	
Urban	1.312 (0.763 - 2.277)	0.404
Monthly income		
Sufficient	**Ref**	
Barely sufficient	0.889 (0.482 - 1.64)	0.7602
Not sufficient	0.291 (0.122 - 0.687)	0.0067
Co-morbidities		
No co-morbidities	**Ref**	
Hypertension	0.217 (0.065 - 0.714)	0.0151
Type 2Diabetes Mellitus	0.024 (0.010 - 0.067)	<0.0001
Cerebrovascular diseases	0.117 (0.017 - 0.878)	0.076
Pregnancy	0.117 (0.006 - 2.516)	0.22
Hyperlipidemia	0.088 (0.020 - 0.401)	0.008
Heart disease	0.07 (0.022 - 0.278)	<0.0001
Clinical history of family		
Not significant	**Ref**	
Significant	61.89 (24.55 - 144.4)	<0.0001
Food habits		
Vegetarian	**Ref**	
Mixed	0.651 (0.301 - 1.413)	0.41
Physical activity		
No	**Ref**	
Yes	1.633 (0.922 - 2.825)	0.117
Habit of smoking		
No	**Ref**	
Yes	0.222 (0.066 - 0.732)	0.016
Past smoker	0.222 (0.018 - 1.388)	0.196

Table Continued...

Variables	OR (95% CI)	P-value
Habit of drinking alcohol		
No	**Ref**	
Yes	0.479 (0.157 - 1.522)	0.373
Past alcoholic	0.639 (0.112 - 3.195)	0.679
Habit of taking junk foods		
No	**Ref**	
Daily	1.213 (0.343 - 4.089)	>0.9999
Once weekly	1.165 (0.319 - 3.566)	>0.9999
Once in a month	2.912 (0.422 - 38.32)	0.62
Occasionally	0.763 (0.407 - 1.477)	0.508
Habit of taking fruits/fruit juices		
No	**Ref**	
Daily	2.786 (1.061 - 7.045)	0.055
Once weekly	2.767 (0.903 - 7.559)	0.073
Once in a month	11.43 (1.465 - 141.1)	0.056
Occasionally	1.959 (0.730 - 4.995)	0.226
Habit of taking soft drinks		
No	**Ref**	
Once in a week	14.16 (2.383 - 154.1)	0.002
Once in a month	3.54 (0.509 - 46.65)	0.34
Occasionally	1.043 (0.592 - 1.831)	>0.9999
Habit of taking tea/coffee		
No	**Ref**	
Occasionally	0.778 (0.232 - 2.657)	0.746
Once or twice a day	0.841 (0.397 - 1.845)	0.697
Thrice a day and above	0.460 (0.185 - 1.212)	0.145
Situation at working places		
No stress	**Ref**	
Stress	1.168 (0.678 - 2.021)	0.676
Green leafy vegetables		
Daily	**Ref**	
Weekly	0.773 (0.447 - 1.378)	0.391
Monthly	0.837 (0.043 - 16.31)	>0.9999
Feels sleep turbulent and disturbance		
Always	**Ref**	
Sometimes	0.411 (0.174 - 0.983)	0.04
Never	0.660 (0.303 - 1.426)	0.351
Feels nervous		
Always	**Ref**	
Sometimes	0.395 (0.147 - 1.193)	0.129
Never	0.174 (0.068 - 0.504)	0.0006

Table Continued...

Variables	OR (95% CI)	P-value
Feels disturbing dreams(nightmares)		
Always	**Ref**	
Sometimes	0.339 (0.129 - 0.916)	0.038
Never	0.400 (0.167 - 0.956)	0.054
Feels distress of stomach		
Always	**Ref**	
Sometimes	1.055 (0.315 - 3.122)	>0.9999
Never	0.568 (0.180 - 1.845)	0.397
Feels tired quickly		
Always	**Ref**	
Sometimes	0.473 (0.229 - 1.019)	0.065
Never	0.404(0.191-0.857)	0.023
Feels discomfort while waiting		
Always	**Ref**	
Sometimes	0.860 (0.373-1.88)	0.835
Never	0.494 (0.231 - 1.076)	0.081
Concentrate thinking in action		
Always	**Ref**	
Sometimes	0.741 (0.354 - 1.511)	0.455
Never	0.635 (0.323 - 1.294)	0.281
Sweating in cold days		
Always	**Ref**	
Sometimes	0.310 (0.096 - 0.932)	0.063
Never	0.34 (0.129 - 0.938)	0.038
Headache		
Always	**Ref**	
Sometimes	0.180 (0.072 - 0.444)	0.0002
Never	0.165 (0.060 - 0.468)	0.0004
Feels anxious for worthless things		
Always	**Ref**	
Sometimes	0.267 (0.090 - 0.865)	0.024
Never	0.191 (0.066 - 0.587)	0.003
A tense person		
Always	**Ref**	
Sometimes	0.346 (0.130 - 0.955)	0.041
Never	0.232 (0.083 - 0.614)	0.005
Feels sad		
Always	**Ref**	
Sometimes	0.332 (0.122 - 0.870)	0.037
Never	0.293 (0.106 - 0.77)	0.019
Feels pessimistic about the future		
Always	**Ref**	
Sometimes	0.821 (0.319 - 2.275)	0.801
Never	0.316 (0.125 - 0.810)	0.029

Table Continued...

Variables	OR (95% CI)	P-value
Disappointed in themselves		
Always	**Ref**	
Sometimes	0.488 (0.171 - 1.333)	0.222
Never	0.214 (0.081 - 0.588)	0.002
Loss interest in people		
Always	**Ref**	
Sometimes	0.529 (0.172 - 1.622)	0.3
Never	0.265 (0.100 - 0.722)	0.007
Works with same efficiency		
Always	**Ref**	
Sometimes	1.391 (0.672 - 2.737)	0.372
Never	2.861 (1.348 - 6.109)	0.009
Normal sleep pattern		
Always	**Ref**	
Sometimes	1.116 (0.560 - 2.335)	0.856
Never	2.467 (1.082 - 5.533)	0.046
Tired more quickly than usual		
Always	**Ref**	
Sometimes	0.358 (0.171 - 0.729)	0.005
Never	0.568 (0.237 - 1.286)	0.208
Appetite is not good as before		
Always	**Ref**	
Sometimes	0.363 (0.120 - 1.171)	0.162
Never	0.244 (0.084 - 0.797)	0.018
Do you take advantage of your free time		
Always	**Ref**	
Sometimes	1.974 (1.081 - 3.554)	0.034
Never	2.852 (1.073 - 7.885)	0.049
Participate in social activities		
Always	**Ref**	
Sometimes	0.982 (0.409 - 2.524)	>0.9999
Never	1.846 (0.684 - 4.546)	0.227
Do you like to be relationships with others		
Always	**Ref**	
Sometimes	1.194 (0.637- 2.24)	0.63
Never	8.952 (2.257 - 40.26)	0.001
Do you deal easily with your colleagues		
Always	**Ref**	
Sometimes	1.484 (0.789 - 2.789)	0.258
Never	0.256 (0.074 - 0.908)	0.047

Table Continued...

Variables	OR (95% CI)	P-value
Are increasing problems during menstrual period		
Always	**Ref**	
Sometimes	0.457 (0.142 - 1.523)	0.25
Never	0.449 (0.164 - 1.182)	0.15
Feel anxiety when you stay at home		
Always	**Ref**	
Sometimes	0.140 (0.031 - 0.583)	0.006
Never	0.113 (0.025 - 0.486)	0.002
Prefer to stay at home away		
Always	**Ref**	
Sometimes	0.366 (0.140 - 0.978)	0.046
Never	0.171 (0.056 - 0.510)	0.001
Antacid drugs		
Always	**Ref**	
Sometimes	0.738 (0.327 - 1.742)	0.52
Never	1.988 (0.92 - 4.324)	0.118
Iron and its products		
Always	**Ref**	
Sometimes	1.292 (0.466 - 3.953)	0.79
Never	1.27 (0.488 - 3.446)	0.802
Cardiovascular drugs		
Always	**Ref**	
Sometimes	1.491 (0.266 - 9.097)	0.643
Never	5.951 (2.776 - 12.86)	<0.0001

Gender

The incidence of hypothyroidism was higher in females (84.6%) compared to males (15.4%) and is statistically significant (P <0.0001). The present study results revealed that there is a significant association between gender and hypothyroidism. Females are at high risk (OR, 4.033; 95% CI, 2.041 – 7.548; P <0.0001) for hypothyroidism when compared to males.

Age

The risk of hypothyroidism was higher in age group of 38 - 47 (26.9%) compared to age group of 18 - 27 (22.1%) and is statistically significant (P = 0.037). The present study results revealed that there was a significant association between age and hypothyroidism.

Marital status

The incidence of hypothyroidism was higher in married people (87.4%) when compared to unmarried people (12.6%) but it is statistically not significant (P = 0.166). The present study results revealed that there was a significant association between marital status and hypothyroidism.

Level of education

With increasing the level of education there was a significant increase in the risk of hypothyroidism. Primary level (26%, P=0.0095), secondary level (27.9%, P = 0.0097), graduation level and above (30.8%, P = 0.004) when compared to patients who are uneducated 16 (15.4%). The present study results revealed that there was a significant association between level of education and hypothyroidism. People who received graduation and above are at high risk (OR, 3.217; 95% CI, 1.466 – 7.018; P = 0.004) than people with secondary level education (OR, 3.048; 95% CI, 1.352 – 6.811; P = 0.0097). The risk was also increased in people with primary level education (OR, 2.973; 95% CI, 1.287 – 6.794; P = 0.0095) for hypothyroidism when compared to uneducated.

BMI

The incidence of hypothyroidism was higher in people with BMI > 25 Kg/m^2 (74%) when compared to people with < 25 Kg/m^2 (26%) but statistically not significant (P = 0.873).

Body weight

According to the results obtained, with increasing body weight there was an increased incidence of hypothyroidism. People with >70 Kgs showed high incidence (50%) than those of 50–70 Kgs (43.3%) who in turn showed high incidence when compared to those people < 50 Kgs (6.7%). But the results are statistically not significant. The present study result reveals that there is a significant association between body weight and hypothyroidism. People > 70 Kgs are at high risk (OR, 1.653; 95% CI, 0.568 – 4.466; P > 0.9999) than 50–70 Kgs people who in turn are at high risk (OR, 1.653; 95% CI, 0.568

– 4.466; P = 0.4171) when compared to people of < 50 Kgs body weight.

TFT

The incidence of SCH (TSH < 5.5) is higher (54.3%) than clinical or overt hypothyroidism (TSH > 5.5) (45.6%).

TSH

Incidence of people with TSH < 5.5 is 54.3% and in the range of 5.5 – 10 is 30.1% and those with above 10 were 15.5%.

Total serumT4

The incidence of people with total serum T4 in the range of 0 – 4.6 were 42.9% and 4.6 – 12 were 57.1% and > 12 were 0%.

Total serum T3

The incidence of people with total serum T3 in the range of 0 – 80 were 76.7% and 80 – 180 were 23.3% and > 180 were 0%.

Occupation

The incidence of hypothyroidism was found to be higher in housewives (61.5%) when compared to farmers (3.8%), daily wage workers (5.8%), unemployed people (4.8%), government employees (2.9%), private employees (13.5%), retired people (1%) and students (6.7%). But the results are statistically not significant (P = 0.076). The present study results revealed that there is a significant association between occupation and hypothyroidism. Housewives are at increased risk (OR, 3.2; 95% CI, 0.907 – 9.776; P = 0.076) for hypothyroidism when compared to others.

Locality

The incidence of hypothyroidism was higher in urban people (57.7%) when compared to people living in rural areas (42.3%) but it is statistically not significant (P = 0.404). According to the results of this study, there is significant association between living locality and hypothyroidism. People living in urban areas are at high risk (OR, 1.312; 95% CI, 0.763 – 2.277; P = 0.404) for hypothyroidism when compared to those living in rural areas.

Monthly income

According to the results obtained, the incidence of hypothyroidism was found to be higher in people with sufficient monthly income (53.4%) than barely sufficient (38.8%) and not sufficient (7.8%) people. The results obtained are statistically significant (P = 0.0067). The present study results revealed that there is significant association between monthly income and hypothyroidism. People with no sufficient monthly income are not at risk (OR, 0.291; 95% CI, 0.122 – 0.687; P = 0.0067) for hypothyroidism when compared to those with sufficient and barely sufficient monthly income.

Co-morbidities

The incidence of hypothyroidism was found to be higher in people with no co-morbidities (57.7%) when compared to people with T2DM (13.5%), hypertension (12.5%), heart disease (5.8%), hyperlipidemia (2.9%), cerebrovascular diseases (1.9%) and pregnants (1%) but the results obtained are statistically not significant. The present study revealed that there is no significant association between co-morbid conditions and hypothyroidism. People with no co morbidities are not at risk for hypothyroidism when compared to those having T2DM (OR, 0.024; 95% CI, 0.010 – 0.067; P < 0.0001), hypertension (OR, 0.217; 95% CI, 0.065 – 0.714; P = 0.0151), hyperlipidemia (OR, 0.088; 95% CI, 0.020 – 0.401; P = 0.008), heart disease (OR, 0.07; 95% CI, 0.022 – 0.278; P < 0.0001), cerebrovascular disease (OR, 0.117; 95% CI, 0.017 – 0.878; P = 0.076) and pregnancy (OR, 0.117; 95% CI, 0.006 – 2.516; P = 0.220).

Clinical history of family

The incidence of hypothyroidism is higher in people with a significant family history of hypothyroidism (90.2%) when compared to those with no significant family history (9.8%) and the results obtained are statistically significant (P < 0.0001). The present study reveals that there is significant association between clinical history of family and hypothyroidism. People with significant family history are at high risk (OR, 61.89; 95% CI, 24.55 – 144.4; P < 0.0001) for hypothyroidism when compared to those without significant family history.

Duration of thyroid disease

The incidence of people with thyroid disease since < 1 year were 21.2%, 1 – 5 years were 44.2%, 6 – 10 years were 22.1%, 11 – 15 years were 3.8%, 16 – 20 years were 4.8% and > 20 years were 3.8%.

Duration of hypothyroidism treatment

The incidence of people who take hypothyroidism treatment since < 1 year were 21.1%, 1 – 5 years were 43.3%, 6–10 years were 22.1%, 11 – 15 years were 3.8%, 16 – 20 years were 4.8% and > 20 years were 3.8%.

Food habits

The incidence of hypothyroidism is higher in those people who take mixed diet (84.6%) when compared to vegetarians (15.4%) but the results obtained are not statistically significant (P = 0.410). The results revealed that there is significant association between food habits and hypothyroidism. People who take mixed diet are at risk (OR, 0.651; 95% CI, 0.301 – 1.413; P = 0.410) for hypothyroidism when compared to vegetarians.

Green leafy vegetables

The incidence of hypothyroidism is higher in those who take green leafy vegetables weekly (57.7%) than those who take daily (41.3%) and monthly (1%). But the results obtained are statistically not significant. The results revealed that those who take green leafy vegetables weekly (OR, 0.773; 95% CI, 0.447 – 1.378; P = 0.391) and monthly (OR, 0.837; 95% CI, 0.043 – 16.31; P > 0.9999) are not at risk for hypothyroidism when compared to those who take daily.

Fruits

The incidence of hypothyroidism is higher in those who take fruits daily (57.4%) than those who take weekly (30.7%) and monthly (11.9%). But the results obtained are statistically not significant.

Cereals

The incidence of hypothyroidism is higher in those who take cereals weekly (58.7%) than those who take daily (30.8%) and monthly (10.6%) but results are not statistically significant.

Physical activity

The incidence of hypothyroidism is higher in those people with no physical activity (55.8%) when compared to those with physical activity (44.2%) but results are statistically not significant (P = 0.117).

The results revealed that there is no significant association between physical activity and hypothyroidism. People with physical activity are not at risk (OR, 1.633; 95% CI, 0.922 – 2.825; P = 0.117) for hypothyroidism when compared to those with no physical activity.

Habit of smoking

The incidence of hypothyroidism is higher in people who does not smoke (96.1%) when compared to smokers (2.9%) and past smokers (1%) and is statistically significant. There is significant association between smoking habit and hypothyroidism. People with smoking habit (OR, 0.222; 95% CI, 0.066 – 0.732; P = 0.016) and who are past smokers (OR, 0.222; 95% CI, 0.018 – 1.388; P = 0.196) are not at risk for hypothyroidism when compared to non – smokers.

Habit of drinking alcohol

The incidence of hypothyroidism is higher in people who are non – alcoholic (94.2%) when compared to alcoholics (3.9%) and past alcoholics (1.9%). The results obtained are statistically not significant. The results revealed that there is significant association between habit of drinking alcohol and hypothyroidism. People who drink alcohol (OR, 0.479; 95% CI, 0.157 – 1.522; P = 0.373) and who are past alcoholics (OR, 0.639; 95% CI, 0.112 – 3.195; P = 0.679) are not at risk for hypothyroidism when compared to non – alcoholics.

Habit of taking junk foods

Incidence of hypothyroidism is higher in people who don't take junk foods (65.4%) when compared to those who take daily (4.8%), once weekly (5.8%), once in a month (2.9%) and occasionally (21.2%) but the results are not statistically significant. The results revealed that those who take junk foods once in a month (OR, 2.912; 95% CI, 0.422 – 3.32; P = 0.620) and once a day (OR, 1.213; 95% CI, 0.343 – 4.089; P > 0.999) and once weekly (OR, 1.165; 95% CI, 0.319 – 3.566; P > 0.999) and occasionally (OR, 0.763; 95% CI, 0.407 – 1.477; P = 0.508) are not at risk for hypothyroidism when compared to those who do not take junk foods.

Habit of taking soft drinks

Incidence of hypothyroidism is higher in people who don't take soft drinks (48.5%) when compared to those who take occasionally (36.9%), once a week (11.7%) and once a month (2.9%). The results obtained are statistically significant. The present study results revealed that those who take soft drinks once a week (OR, 14.16; 95% CI, 2.383 – 154.1; P = 0.002), once a month (OR, 3.54; 95% CI, 0.509 – 46.65; P = 0.340), occasionally (OR, 1.043; 95% CI, 0.592 – 1.831; P > 0.999) are not at risk for hypothyroidism when compared to those who do not take soft drinks.

Habit of taking fruits / fruit juices

The incidence of hypothyroidism is higher in people who take fruits / fruit juices daily (37.5%) when compared to those who take occasionally (28.8%), once weekly (22.1%), who do not take (6.7%), who take once in a month (4.9%). The results obtained are statistically significant. The results revealed that those who take fruits / fruit juices once in a month (OR, 11.43; 95% CI, 1.465 – 141.1; P = 0.056), daily (OR, 2.786; 95% CI, 1.061 – 7.045; P = 0.055), once weekly (OR, 2.767; 95% CI, 0.903 – 7.559; P = 0.073) and occasionally (OR, 1.959; 95% CI, 0.730 – 4.995; P = 0.226) are at high risk for hypothyroidism than those who do not take fruits / fruit juices.

Habit of taking tea / coffee

The incidence of hypothyroidism is higher in those who take tea / coffee once / twice a day (64.4%) when compared to those who do not take (17.3%), who take thrice a day and above (12.5%) and those who take occasionally (5.8%) bur the results are statistically not significant. The results showed that those who take tea / coffee once / twice a day (OR, 0.841; 95% CI, 0.397 – 1.845; P = 0.697), who take occasionally (OR, 0.778; 95% CI, 0.232 – 2.657; P = 0.746) and those who take thrice a day and above (OR, 0.460; 95% CI, 0.185 – 1.212; P = 0.145) are at risk for hypothyroidism when compared to those who do not take tea / coffee.

Situation at working places

The incidence of hypothyroidism is higher in those without stress (52.9%) than those with stress (47.1%) at working places. But the results obtained are not statistically significant. The results revealed that those who have stressful situations at working places are not at risk (OR, 1.168; 95% CI, 0.678 – 2.021; P = 0.676) for hypothyroidism than those without stressful situations at working places

Feels sleep turbulent and disturbance

The incidence of hypothyroidism was higher in people who never feels sleep turbulent and disturbance (54.8%) compared to people who feels sleep turbulent and disturbance always (23.1%), sometimes (22.1%) but statistically not significant. The present study results revealed that there is no significant association between people who never feels sleep turbulent and disturbance with hypothyroidism. When compared to people who feels their sleep turbulent and disturbing always, patients who never feels so (OR = 0.660; 95% CI = 0.303 – 1.426, P=0.351) and sometimes feels so (OR = 0.411; 95% CI = 0.174 – 0.983, P=0.040) are not at risk for hypothyroidism.

Feels nervous

The incidence of hypothyroidism was higher in patients who never feels nervous (47.1%) compared to patients who feels nervous always (18.3%) and sometimes (34.6%) and statistically significant. The present study results revealed that there is a significant association between patients who never feels nervous and hypothyroidism. When compared to people who feels nervous always, patients who never feels nervous (OR, = 0.174; 95% CI = 0.068-0.504, P=0.0006) are at risk and sometimes feels nervous (OR = 0.395; 95% CI = 0.147 – 1.193, P=0.129) are not at risk for hypothyroidism.

Feels disturbing dreams

The incidence of hypothyroidism was higher in patients who never feels disturbing dreams (nightmares) (53.8%) compared to patients who feels disturbing dreams (nightmares) always (18.3%) and sometimes (27.9%) and statistically significant. The present study results revealed that there is a significant association between patients who never feels disturbing dreams (nightmares) and hypothyroidism. When compared to people who feels disturbing dreams always, patients who sometimes feels disturbing dreams (OR, = 0.339; 95% CI = 0.129 -0.916, P= 0.038) are at risk and those who never feels disturbing dreams (OR = 0.400; 95% CI = 0.161 – 0.956, P=0.054) are not at risk for hypothyroidism.

Feels distress of stomach

The incidence of hypothyroidism was higher in patients who never feels distress of stomach (48.5%) compared to patients who feels distress of stomach always (7.8%) and sometimes (43.7%) but statistically not significant (P = 0.397). The present study results revealed that there is no significant association between patients who never feels distress of stomach and hypothyroidism. When compared to people who feels distress of stomach always, patients who never feels distress of stomach (OR, = 0.568; 95% CI = 0.180 – 1.845,

P=0.397) and sometimes feels distress of stomach (OR = 1.055; 95% CI = 0.315 – 3.122, P> 0.999) are not at risk for hypothyroidism.

Feels tired quickly

The incidence of hypothyroidism was higher in patients who sometimes feels tired quickly (41.3%) compared to patients who feels tired quickly always (27.9%) and never (30.8%) and is statistically significant. The present study results revealed that there is a significant association between patients who never get tired quickly and hypothyroidism. Patients who sometimes feels that they get tired quickly (OR = 0.473; 95% CI =0.229-1.091, P=0.065) and those who never feels tired quickly (OR = 0.404; 95% CI =0.191 – 0.857, P= 0.023) are not at risk when compared to people who always feels that they are tired quickly.

Feels discomfort while waiting

The incidence of hypothyroidism was higher in patients who never feels discomfort while waiting (41.3%) compared to patients who feels discomfort while waiting always (20.2%) and sometimes (38.5%) but statistically not significant. The present study results revealed that there is no significant association between patients who never feels discomfort while waiting and hypothyroidism. Patients who never feels discomfort while waiting (OR = 0.494; 95% CI = 0.231 – 1.076, P=0.081) and sometimes feels discomfort while waiting (OR = 0.860; 95% CI = 0.373 – 1.88, P= 0.835) are not at risk when compared to people who always feels discomfort while waiting.

Concentrate thinking in action

The incidence of hypothyroidism was higher in patients who never had concentrate thinking in action (40.4%) compared to patients who feels concentrate thinking in action always (26%) and sometime (33.7%) but statistically not significant. The present study results revealed that there is no significant association between patients who never had concentrate thinking in action and hypothyroidism. Patients who never had concentrate thinking in action (OR= 0.635; 95% CI= 0.323-1.294, P=0.281) and sometimes had concentrate thinking in action (OR= 0.741; 95% CI= 0.354 -1.511, P=0.455) are not at risk when compared to people who always had concentrate thinking in action.

Sweating in cold days

The incidence of hypothyroidism was higher in patients who never have sweating in cold days (66%) compared to patients who have sweating in cold days always (15.5%) and sometimes (18.4%) and is statistically significant. The present study results revealed that there is a significant association between patients who never have sweating in cold days and hypothyroidism. Patients who never have sweating in cold days (OR = 0.34; 95% CI = 0.129-0.938, P=0.038) and those who sometimes have sweating in cold days (OR = 0.310; 95% CI = 0.096 -0.932, P= 0.063) are not at risk when compared to people who always have sweating in cold days.

Headache

The incidence of hypothyroidism was higher in patients who had headache sometimes (49%) when compared to patients who had headache always (26%) and never (25%) and is statistically significant. The present study results revealed that there is a significant association between patients who had headache and hypothyroidism. Patients who sometimes had headache (OR = 0.180, 95% CI = 0.072-0.444, P=0.0002) and those who never had headache (OR = 0.165, 95% CI = 0.060 -0.468, P= 0.0004) are not at risk when compared to people who always had headache.

Feels anxious

The incidence of hypothyroidism was higher in patients who never feels anxious for worthless things (46.6%) compared to patients who feels anxious for worthless things always (15.5%) and sometimes (37.9%) and is statistically significant. The present study results revealed that there is a significant association between patients who never feels anxious for worthless things and hypothyroidism. Patients who never feels anxious for worthless things (OR = 0.191; 95% CI = 0.066-0.587, P=0.003) and sometimes feels anxious for worthless things (OR = 0.267; 95% CI = 0.090 - 0.865, P=0.024) are not at risk when compared to people who always feels anxious for worthless things.

Feels tensed

The incidence of hypothyroidism was higher in patients who feels tensed sometimes (51.9%) compared to patients who feels tensed always (17.3%), never (30.8%) and statistically significant. The present study results revealed that there is a significant association between patients who sometimes feels tensed and hypothyroidism. Patients who sometimes feels tensed (OR = 0.346; 95% CI = 0.130-0.955, P=0.041) and those who never feels tensed (OR = 0.232; 95% CI = 0.083 - 0.614, P= 0.005) are not at risk when compared to people who always feels tensed.

Feels sad

The incidence of hypothyroidism was higher in patients who feels sad sometimes (46.2%) when compared to patients who feels sad always (16.3%), never (37.5%) and is statistically significant. The present study results revealed that there is a significant association between patients who sometimes feels sad and hypothyroidism. Patients who sometimes feels sad (OR = 0.332; 95% CI= 0.122-0.870, P=0.037) and those who never feel sad (OR = 0.293; 95% CI= 0.106 -0.77, P=0.019) are not at risk when compared to people who always feels sad.

Feels pessimistic about future

The incidence of hypothyroidism was higher in patients who feels pessimistic about the future sometimes (44.7%) compared to patients who feels pessimistic about the future always (13.6%), never (41.7%) and is statistically significant. The present study results revealed that there is a significant association between patients who sometimes feels pessimistic about the future and hypothyroidism. Patients who sometimes feels pessimistic about the future (OR= 0.821; 95% CI = 0.319-2.275, P=0.801) and those who never feel pessimistic about the future (OR = 0.316; 95% CI = 0.125 – 0.810, P=0.029) are not at risk when compared to people who always feels pessimistic about the future.

Disappointed in themselves

The incidence of hypothyroidism was higher in patients who never feels disappointed in themselves (43.3%) when compared to patients who feels disappointed in themselves always (17.3%) and sometimes (39.4%) and is statistically significant. The present study results revealed that there is a significant association between patients who never feels disappointed in themselves and hypothyroidism. Patients who never feels disappointed in themselves (OR = 0.214; 95% CI = 0.081-0.588, P=0.002) and those who sometimes feels disappointed

in themselves (OR = 0.488; 95% CI = 0.171 – 1.333, P= 0.222) are not at risk when compared to people who always feels disappointed in themselves.

Lose interest in people

The incidence of hypothyroidism was higher in patients who never lose interest in people (54.8%) compared to patients who lose interest in people always (16.3%) and sometimes (28.8%) and is statistically significant. The present study results revealed that there is a significant association between patients who never lose interest in people with hypothyroidism. Patients who never lose interest in people (OR= 0.265; 95% CI = 0.100-0.722, P=0.007) and those who sometimes lose interest in people (OR= 0.529; 95% CI = 0.172 – 1.622, P=0.300) are not at risk when compared to people who always lose interest in people.

Work with same efficiency

The incidence of hypothyroidism was higher in patients who always feels that they work with same efficiency (55.85%) when compared to patients who feels that they work with same efficiency never (24%) and sometimes (20.2%) and is statistically significant. The present study results revealed that there is a significant association between patients who feels that they never work with same efficiency and hypothyroidism. When compared to people who works with same efficiency always, patients who never works with same efficiency (OR = 2.861; 95% CI = 1.348-6.109, P=0.009) and sometimes works with same efficiency (OR = 1.391; 95% CI = 0.672 - 2.737, P=0.372) are at risk for hypothyroidism.

Normal sleep pattern

The incidence of hypothyroidism was higher in patients who always had normal sleep pattern (61.2%) when compared to patients who never had normal sleep pattern (20.4%) and sometimes had normal sleep pattern (18.4%) and is statistically significant. The present study results revealed that there is a significant association between patients who never had normal sleep pattern and hypothyroidism. Patients who never had normal sleep pattern (OR= 2.467; 95% CI = 1.082-5.533, P=0.046) and those who sometimes had normal sleep pattern (OR= 1.116; 95% CI = 0.560 – 2.335, P= 0.856) are at high risk when compared to people who always had normal sleep pattern.

Feels tired more quickly than usual

The incidence of hypothyroidism was higher in patients who sometimes feels tired more quickly than usual (46.6%) when compared to patients who feels tired more quickly always (29.1%) and never (24.3%) and is statistically significant. The present study results revealed that there is a significant association between patients who sometimes feels tired more quickly than usual and hypothyroidism. Patients who never feels tired more quickly than usual (OR= 0.568, 95% CI = 0.237 – 1.286, P=0.208) and sometimes feels tired more quickly than usual (OR= 0.358, 95% CI = 0.171-0.729, P=0.005) are not at risk when compared to people who always feels tired more quickly than usual.

Appetite is not as good as before

The incidence of hypothyroidism was higher in patients who never feels that their appetite is not as good as before (55.3%) when compared to patients who feels that their appetite is not as good as before always (12.6%) and sometimes (32%) and is statistically significant. The present study results revealed that there is a significant association between patients who never feels that their appetite not as good as before and hypothyroidism. Patients who never feels their appetite is not as good as before (OR = 0.244; 95% CI = 0.084-0.797, P=0.018)and sometimes feels that their appetite is not as good as before (OR = 0.363; 95% CI = 0.120 – 1.171, P=0.162) are not at risk when compared to people who always feels that their appetite is not as good as before.

Take advantage of free time

The incidence of hypothyroidism was higher in patients who sometimes take advantage of free time (60.6%) when compared to patients who take advantage of free time always (26%) and never (13.5%) and is statistically significant. Patients who sometimes take advantage of free time (OR = 1.974; 95% CI = 1.081-3.554, P=0.034) and those who never take advantage of their free time (OR = 2.852; 95% CI = 1.073 – 7.885, P=0.049) are at high risk when compared to people who always take advantage of their free time.

Participate in social activities

The incidence of hypothyroidism was higher in patients who sometimes participate in social activities (51.9%) when compared to patients who participate in social activities always (9.6%) and never (38.5%) but statistically not significant. The present study results revealed that there is no significant association between patients who participate in social activities and hypothyroidism. Patients who sometimes participate in social activities are not at risk (OR=0.982; 95% CI = 0.409-2.524, P >0.999) and those who never participate in social activities (OR=1.846; 95% CI = 0.684 – 4.546, P = 0.227) when compared to people who always participate in social activities.

Likes to be in relationship with others

The incidence of hypothyroidism was higher in patients who always likes to be in relationship with others (59.6%) compared to patients who likes to be in relationship with others never (14.4%) and sometimes (26%) and is statistically significant. The present study results revealed that there is a significant association between patients who never likes to be in relationship with others and hypothyroidism. Patients who never likes to be in relationship with others are at high risk (OR = 8.952; 95% CI = 2.257-40.26, P=0.001) and those who sometimes likes to be in relationship with others are at risk (OR = 1.194; 95% CI = 0.637–2.24, P= 0.630) when compared to people who always likes to be in relationship with others.

Deal easily with colleagues

The incidence of hypothyroidism was higher in patients who always deal easily with colleagues (58.3%) compared to patients who likes to deal easily with colleagues never (10.7%) and sometimes (31.1%) and is statistically significant. The present study results revealed that there is a significant association between patients who never deal easily with colleagues and hypothyroidism. Patients who never deal easily with colleagues are not at risk (OR = 0.256; 95% CI = 0.074-0.908, P=0.047) and who sometimes deal easily with colleagues (OR = 1.484; 95% CI = 0.789 – 2.789, P=0.258) are at risk when compared to people who always deal easily with colleagues.

Increasing problems during menstrual period

The incidence of hypothyroidism was higher in patients who never have increasing problems during menstrual period (69.1%) compared to patients who have increasing problems during menstrual period always (14.4%) and sometimes (16.5%) but statistically

not significant. The present study results revealed that there is no significant association between patients who have increasing problems during menstrual period and hypothyroidism. Patients who never increasing problems during menstrual period (OR = 0.449, 95% CI = 0.164-1.182, P=0.150) and those who sometimes have increasing problems during menstrual period (OR = 0.457, 95% CI = 0.142 -1.523, P=0.250) are not at risk when compared to people who always have increasing problems during menstrual period.

Anxiety while staying at home

The incidence of hypothyroidism was higher in patients who sometimes feels anxiety while staying at home (51%) compared to patients who feels anxiety while staying at home always (13.5%) and never (35.6%) and is statistically significant. The present study results revealed that there is a significant association between patients who sometimes feels anxiety while staying at home and hypothyroidism. Patients who sometimes feels anxiety when staying at home (OR = 0.140, 95% CI = 0.031-0.583, P=0.006) and who never feels anxiety while staying at home (OR = 0.113, 95% CI = 0.025 - 0.486, P=0.002) are not at risk when compared to people who always feels anxiety while staying at home.

Prefer to stay at home away

The incidence of hypothyroidism was higher in patients who sometimes prefer to stay at home away (65.4%) compared to patients who prefer to stay at home away always (17.3%) and never (17.3%) and is statistically significant. The present study results revealed that there is a significant association between patients who sometimes prefer to stay at home away and hypothyroidism. Patients who sometimes prefer to stay at home away (OR = 0.366, 95% CI = 0.140-0.976, P = 0.046) and those who never prefer to stay at home away (OR = 0.171, 95% CI = 0.056 -0.510, P = 0.001) are not at risk when compared to people who always prefer to stay at home away.

Use of antacids

The incidence of hypothyroidism was higher in patients never using antacid drugs (62.1%) when compared to patients using antacid drugs always (12.6%) and sometimes (25.2%) but statistically not significant. The present study results revealed that there is no significant association between patients using antacid drugs and hypothyroidism. Patients who never use antacids are at risk (OR = 1.988, 95% CI = 0.92-4.324, P=0.118) and who sometimes use antacids are not at risk (OR = 0.738, 95% CI = 0.327 – 1.742, P=0.520) when compared to people who always use antacid drugs.

Use of iron and its products

The incidence of hypothyroidism was higher in patients who never use iron and its products (62.5%) when compared to patients who use iron and its products always (7.7%) and sometimes (29.8%) but statistically not significant. The present study results revealed that there is no significant association between patients who use iron and its products and hypothyroidism. Patients who never use iron and its products (OR = 1.27, 95% CI = 0.488-3.446, P=0.802) and who sometimes use iron and its products (OR = 1.292, 95% CI = 0.466 - 3.953, P= 0.790) are at risk when compared to people who always use iron and its products.

Use of cardiovascular drugs

The incidence of hypothyroidism was higher in patients who never use cardiovascular drugs (87.5%) when compared to patients who use cardiovascular drugs always (10.6%) and sometimes (1.9%) and is statistically significant. The present study results revealed that there is a significant association between patients who never use cardiovascular drugs and hypothyroidism. Patients who never use cardiovascular drugs are at high risk (OR = 5.951, 95% CI = 2.776-12.86, P <0.0001) and those who sometimes take cardiovascular drugs are at risk (OR = 1.491, 95% CI = 0.266 – 9.097, P = 0.643) when compared to people who always use cardiovascular drugs.

Medication Adherence

Medication adherence in hypothyroidism patients was assessed using MMAS – 8 and BMQ questionnaires presented in Table 6. According to MMAS – 8 questionnaires, adherence rate was high in 34.6%, moderate in 36.5% and low in 28.8% of the subjects. In BMQ questionnaire, 3 screens were employed for assessing medication adherence in hypothyroidism patients. According to regimen screen, adherence rate was 40.4% and non-adherence rate was 59.6%. As per belief screen adherence rate was 57.3% and non-adherence rate was 42.7%. In recall screen adherence rate was 43.3% and non-adherence rate was 56.7%.

Table 6 Medication adherence according to MMAS-8 and BMQ questionnaire

Variables	Patients with hypothyroidism N (%)
Medication adherence according to MMAS-8 item questionnaire	
High adherence	36 (34.6)
Medium adherence	38 (36.5)
Low adherence	30 (28.8)
Medication adherence in regimen screen in BMQ questionnaire	
Adherence	42 (40.4)
Non-adherence	62 (59.6)
Medication adherence in belief screen in BMQ questionnaire	
Adherence	59 (57.3)
Non-adherence	44 (42.7)
Medication adherence in recall screen in BMQ questionnaire	
Adherence	45 (43.3)
Non-adherence	59 (56.7)

Drug–Drug Interactions

A total of 39 moderate drug interactions were observed in study population and presented in the Table 7. The interaction between calcium/vitamin D3 and levothyroxine was identified in 18 (46.15%) prescriptions followed by the interaction between iron and levothyroxine in 8 (20.51%), rabeprazole and levothyroxine in 7 (17.94%), pantoprazole and levothyroxine in 6 (15.38%).

Table 7 Moderate drug interactions identified with levothyroxine

S. No	Moderate drug interaction	N (%)	Mechanism	Reference
1	Calcium/vitamin D3 + Levothyroxine	18(46.15)	Calcium salts chelate oral thyroid hormones within the GI tract leads to decreased thyroid hormone absorption.	Singh et al., 2001
2	Iron + Levothyroxine	8(20.51)	Iron chelate oral thyroid hormones within the GI tract leads to decreased thyroid hormone absorption.	Shenandoah et al., 2011
3	Rabeprazole + Levothyroxine	7(17.94)	Increases in TSH levels in patients with hypothyroidism	Ananthakrishnan et al., 2008
4	Pantoprazole + Levothyroxine	6(15.38)	Increases in TSH levels in patients with hypothyroidism	Ananthakrishnan et al., 2008

Discussion

Saranya et al. conducted study on Assessment of medication adherence among patients with thyroid dysfunction in a tertiary care centre –A prospective observational study and interviewed 273 patients who attended the OPD of General Medicine, Govt. Medical College, Thiruvananthapuram using Morisky-8-item and Brief Medication questionnaires for a period of six months. Most of the patients were females (93.8%) and belongs to the age group of 21-50 years. The overall adherence level was found to be 30% according to Morisky-8- item questionnaire and 30.4% according to BMQ.[5] In the present study female gender (84.6%), of age group 38 – 47 years (26.9%) are more significantly associated with hypothyroidism. The overall adherence level was found to be 34.6% according to Morisky-8-item questionnaire and 40.4% according to BMQ.

Perumal et al. conducted a study on Health information seeking behaviour among hypothyroid patients at saveetha medical college and hospital and concluded that majority of participants were females (71%) with an average age of 38 years (SD= 12) and median age of 39.5 years.[6] More than half of the participants were married (71%). There was not demonstrable difference in locational distribution of the participants (urban=52%; rural=48%). 23% were educated up to graduation and above with the highest incidence of hypothyroidism being observed in population educated up to secondary level (40%) and 38% of the study population having an annual income between 1,00,001-5,00,000 Indian National Rupee (INR). Majority (44%) were diagnosed with hypothyroidism in the past 1-5 years, 35% of the participants had hypothyroidism from more than 5years and 21% participants diagnosed to have hypothyroidism within the recent 1 year. In the present study results revealed that majority of participants were females (84.6%) within the age group of 38 – 47 years (26.9%). More than half of the participants were married (87.4%). There was a demonstrable difference in locational distribution of the participants (urban=57.7%; rural=42.3%). Majority 44.2% were diagnosed with hypothyroidism in the past 1-5 years, 34.5% of the participants had hypothyroidism from more than 5years and 21.2%participants diagnosed to have hypothyroidism within the recent 1 year. In the present study the following results are in disagreement with the above study. 30.8% of study participants were educated upto graduation and above. 38.8% of study population are having barely sufficient monthly income and highest incidence of hypothyroidism being 53.4% in sufficient monthly income group. Ngiap et al. conducted a study, primary hypothyroidism in the community: Lower daily dosages of levothyoxine replacement therapy for asian patients and concluded that 79% of study population were females, 79.5% were married and 34.9% were educated up to graduation and above with the highest incidence of hypothyroidism being observed in population educated up to secondary level (40.2%).[7] In the present study the majority of participants were females (84.6%).More than half of the participants were married (87.4%). 30.8% of study participants were educated up to graduation and above.

Ahmed et al. conducted a study on assessment of risk factors related to hypothyroidism for adult patient at Bagdad teaching hospitals and concluded that the majority of the study samples for hypothyroidism (96%) were females.[8] 70% of the study group occupation is housewife & 38% are having barely sufficient monthly income. Regarding residence, majority (88%) of the study population live in urban setting. The finding of the study group showed that (56%) of the patients had family history for hypothyroidism. Finding about psychological domain stated that there was predominance of Major depressive disorder 24.2%, followed by anxiety disorders (23%). The p-value of the comparison between the case and the control patients is 0.0001 which is highly significant. The mean of score of social domain for hypothyroidism patients are high on item (Are increasing problems during menstrual cycle days?) and item (Prefer to stay at home away from the eyes of the people).The mean of score is moderate on item (Do take advantage of your free time?), Item (Feel anxiety when you stay at home) and low on the remaining items. The mean of score of medication domain for hypothyroidism patients are high on item (Iron and product), item (Anti-thyroid drugs), item (Cardiovascular drugs) and item (Diuretic drugs).The mean of score is moderate item (Antacids drugs), item (Contraceptive drugs) and item (Sedatives and opiates). In the current study, the majority of the study samples for hypothyroidism (84.6%) were females. 61.5% of the study group occupation is housewife & 38.8% are having barely sufficient monthly income. Regarding residence, 57.7% of the study population live in urban setting. The finding of the study group showed that majority (90.2%) of the patients had family history for hypothyroidism. In Psychological domain of study group the percentages are high on items (Feels nervous, 52.9%; Feels distress of stomach, 51.5%; Feels tired quickly, 69.2%; Feels discomfort while waiting, 58.7%; Concentrate thinking in action, 59.7%; headache, 75%; Feels anxious for worthless things, 53.4%; A tense person, 69.2%; Feels sad, 62.5%; Feels pessimistic about the future, 58.3%; Disappointed in themselves, 56.7%; Works with same efficiency, 76.05%; Normal sleep pattern, 79.6%; Tired more quickly than usual, 75.7%)In social domain of study group the percentages are high on items (Take advantage of free time, 86.6%; Participate in social activities, 61.5%; Like to be in relationship with others, 85.6%; Deal easily with your colleagues, 89.4%; Feel anxiety when you stay at home, 64.5%; Prefer to stay at home away, 82.7%)

Marjorie et al. conducted a study on co morbidities, concomitant medications, and diet as factors affecting levothyroxine therapy:

Results of the control surveillance project and concluded that81.6% were females and use of dietary supplements (51.8%, primarily calcium and iron) in the study population.[9] In the present study, 84.6% were females and use of calcium + vitamin D3 and iron + folic acid was 62.4% in the study population. Unnikrishnan et al. conducted a study on Prevalence of hypothyroidism in adults: an epidemiological study in 8 cities in India and concluded that female gender (53.7%) is significant risk factor for hypothyroidism.[2] In the current study female gender (84.6%) is more significantly associated with Hypothyroidism. Brigitte et al. conducted an observational study of the initial management of hypothyroidism in France: the ORCHIDEE study and concluded that female gender (84%) is significant risk factor for hypothyroidism.[10] In the current study female gender (84.6%) is more significantly associated with Hypothyroidism. In the present study a total of 39 moderate drug interactions were observed in study population and presented in the Table 7. Till now, there are no supportive studies discussing the various drug interactions in the prescriptions of hypothyroid patients.

Conclusion

Hypothyroidism is a most common problem in India and worldwide. The present study results revealed that female gender, level of education up to graduation and above, significant family history, habit of taking fruit juices (monthly once), habit of taking soft drinks (weekly once), never work with same efficiency, never with normal sleep pattern, never take advantage of their free time, never likes to be in relationship with others and who never used cardiovascular drugs are at risk for hypothyroidism. Though therapy is available, the magnitude of medication adherence according to MMAS-8 and BMQ questionnaires was slightly low because TSH levels are variable in the study population and other co-morbid conditions.

Key findings

Incidence of hypothyroidism was significantly higher in females compared to males ($P < 0.0001$).

Hypothyroidism was significantly higher in subjects receiving graduation and above level of education ($P = 0.004$).

Risk of hypothyroidism was predominantly higher in subjects with a significant family history ($P < 0.0001$).

Patients with female gender, level of education upto graduation and above, significant family history, habit of taking fruit juices (monthly once), habit of taking soft drinks (weekly once), never work with same efficiency, never with normal sleep pattern, never take advantage of their free time, never likes to be in relationship with others, patients who never used cardiovascular drugs were found to be risk factors for the development of hypothyroidism.

Age, marital status, BMI, body weight, occupation, monthly income, co-morbidities, food habits, physical activity, habit of taking junk foods, habit of taking coffee, habit of taking alcohol, situation at working places were not associated with hypothyroidism.

The overall medication adherence level in subjects was found to be 34.6% according to Morisky-8- item questionnaire and 40.4% according to BMQ. Magnitude of medication adherence was slightly low.

The interaction between calcium/vitamin D3 and levothyroxine was identified in 18 (18.72%) prescriptions followed by the interaction between iron and levothyroxine in 8 (8.32%), rabeprazole and levothyroxine in 7 (7.28%), pantoprazole and levothyroxine in 6 (6.24%).

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Conflicts of interest

The authors declare that this research does not have any conflicts of interest with anyone or any institute.

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