ORIGINAL ARTICLE

A comparative study of Thyroid Hormone levels among the Normal Healthy Persons, Depression and Schizophrenia

Senjam Gojendra Singh*, Sidhartha Debbarma*, N.Heramani Singh*,
Th. Bihari Singh*, R.K.Lenin*, K.Shantibala Devi**
*Department of Psychiatry, Regional Institute of Medical Sciences (RIMS), Manipur;
** J.N.Hospital, Porompat, Manipur.

ABSTRACT:

Background: Thyroid disorders can induce virtually any psychiatric symptom or syndrome, although no consistent associations of specific syndromes and thyroid conditions are found. Abnormal thyroid hormone levels are common in psychiatric disorders

Material & Method: T3, T_4, TSH levels were measured in a sample of 90 (ninety) cases who attended Department of Psychiatry, RIMS hospital. The sample consists 30 (thirty) cases each from three-group viz., Controls consisting of normal healthy persons, Schizophrenia, and Depression. Data was collected for a period of 1 year from the subjects who were fulfilling the DSM IV TR diagnostic criteria of schizophrenia and depression. All the study subjects were evaluated for socio demographic variables on semi structured Proforma. Thereafter the laboratory assessments of T3, T4, TSH levels were conducted in the Dept. of Biochemistry, RIMS.

Result: The blood level of T3 and T4 was seen highest among schizophrenic groups followed by control and depressive groups. Highest level of TSH was noticed in the depressive groups followed by controls and schizophrenia

Conclusion: This study shows that there is an abnormality in thyroid hormone levels in the psychiatric disorders of depression and schizophrenia. In depression, T_3 and T_4 levels are lower but higher in case of schizophrenia. TSH is higher in depression and lower in schizophrenia.

Key Words: Thyroid hormone depression and schizophrenia

INTRODUCTION

Thyroid disorders can induce virtually any psychiatric symptom or syndrome, although no consistent associations of specific syndromes and thyroid conditions are found. Hyperthyroidism is commonly associated with fatigue, irritability, insomnia, anxiety, restlessness, weight loss, and emotional lability; marked impairment in concentration and memory may also be evident. Such states can progress into delirium or mania or they can be episodic. On occasion, a true psychosis develops, with paranoia as a particularly common presenting feature. In some cases,

Correspondence: Dr. S.Gojendra Singh,
Dept. of Psychiatry, Regional Institute of Medical Sciences (RIMS), Manipur.
E-mail: sgojendra@yahoo.co.in

psychomotor retardation, apathy, and withdrawal are the presenting features rather than agitation and anxiety. Symptoms of mania have also been reported following rapid normalization of thyroid status in hypothyroid individuals and may co vary with thyroid level in individuals with episodic endocrine dysfunction. In general, behavioral abnormalities resolve with normalization of thyroid function and respond symptomatically to traditional psychopharmacological regimens.

The psychiatric symptoms of chronic hypothyroidism are generally well recognized. Classically, fatigue, decreased libido, memory impairment, and irritability are noted, but a true secondary psychotic disorder or dementia-like state can also develop. Suicidal ideation is common, and the lethality of actual attempts is profound. In milder, subclinical states of hypothyroidism, the absence of gross signs accompanying endocrine dysfunction can result in its being overlooked as a possible cause of a mental disorder[1].

Unlike in developed countries, endocrine and metabolic disorders are predominantly caused by environmental factors in India and perhaps in other developing countries. Hence their prevalence is several-fold higher in developing countries like India. Kochupillai et al (2000) [2] have reported that thyroid disorders are the most common endocrine and metabolic disorders in India.

Nearly half of all cases of depression just like those with adult onset diabetes, remain undetected for years or inadequately controlled-both of which seen to lag behind hypertension, in which early detection and treatment have significantly reduced complications. Akiskal HS et al (2005)[3] reported that depressive disorders are more common in women, more men than women die of suicide.

Abnormal thyroid hormone levels are common in psychiatric disorders. Subtle abnormality in thyroid hormone levels without any clinical evidence of hypothyroidism have been reported in depression patients slightly higher levels of T4 with lower levels of T3 and TSH[4], decreased T4 along with lower levels of T3 and TSH[5] lower levels of T3 [6] and lower T3 and raised TSH and higher levels of T4 have been reported. Approximately 5 to 10 percent of people evaluated for depression have previously undetected thyroid dysfunction, as reflected by an elevated basal TSH level.

Hyperthyroxemia has been reported in variety of acute psychiatric disorders eg. schizophrenia, functional psychosis, major affective disorders, personality disorders[7].There was a high prevalence of (36.4%) thyroid function test abnormalities in the study of 189 patients in a group of adult psychiatric in patients with chronic schizophrenia[8].

During the last 30 years a huge number of scientific articles have appeared on the subject of relationships between psychiatric disease and thyroid hormones. These studies have demonstrated the presence of numerous changes in the hypothalamo-pituitary-thyroid (HPT) axis, mainly in patients with depression, but also in patients with other psychiatric diseases[9].

MATERIALS AND METHODS

The present case control study was conducted in the Department of Psychiatry & Biochemistry, RIMS. The data was collected in a period of 1 year period from September 2007 to August 2008.

The study was based on a sample of 90 (ninety) cases who attended Department of Psychiatry, RIMS hospital either in the OPD or those who are admitted in the ward. The sample consists of 30 (thirty) cases each from three-group viz., Controls consisting of normal healthy persons, Schizophrenia, and Depression.

Inclusion criteria

Subjects of both sexes, age range between 18 to 65 years and cases of depression and schizophrenia diagnosed according to DSM-IV TR[10] diagnostic criteria.

Exclusion criteria

Patients with any organic mental disorder, mental retardation, epilepsy, substance use disorders or subjects with concurrent medical illness.

Assessment tools

1. Semi-structured clinical and socio-demographic data sheet

2. DSM-IV-TR criteria for diagnosis of depression
3. DSM-IV-TR criteria for diagnosis of schizophrenia
4. Laboratory assessment of thyroid hormones (T_3, T_4, TSH)

Procedure

All the study subjects who fulfilled our inclusion criteria were assessed properly and the diagnosis of depressive disorder and schizophrenia was made according to DSM- IV TR diagnosic criteria. The diagnosis of all the cases was reconfirmed again by two consultant psychiatrists. An Informed consent was taken from the patient as well from the informants and the nature and purpose of the study was explained to them. A Semi-structured clinical and socio-demographic data sheet was administered to our study groups. The laboratory assessment of thyroid hormones (T_3, T_4, TSH) for all the participants were performed in Dept. of Biochemistry, RIMS. The T_3, T_4, TSH level were compared for the depressive, schizophrenia and matched control groups.

Analysis of data:

The data was analyzed by using *independent sample t-test* and *person* x^2*-test* whenever found suitable and necessary and interpretation was done accordingly. All tests were based on two-tailed and $P < 0.05$ and $P < 0.01$ were taken as significant and highly significant levels of significance respectively.

RESULT

The socio demographic characteristics of the subjects are summarized in table 1-6.

Majority of the patients in depression are belonged to 18-25 years age range whereas schizophrenia and controls are in the 25-35 years of age group. In our study population the average age of depression, schizophrenia and controls are 32.20 yrs, 33.96 yrs and 32.70 yrs respectively. Females constitute a majority (63.33%) in depressive group whereas in schizophrenia and control groups, males constituted majority of cases (60%) and (56.66%). Majority of patients in depression, schizophrenia and controls were Hindus (86.66%, 83.33% and (96.66%) and are married (63.33%, 50% and 53.33%). Most of the patients of depression and controls group have completed high school (66.66% & 73.33%) but only 36.66% of schizophrenic groups have passed the exam. The patients in all the groups were having income in the range of Rs 5,000-10,000/- per month.

Table-1. Age-wise distribution

Age in years	Group			Total
	Control	Schizophrenia	Depression	
18 - 25	6	4	9	19
25 - 35	13	13	8	34
35 - 45	9	8	8	25
45 - 55	2	5	5	12
Total	30	30	30	90

$\chi 2=5.051$; df=6; P=.537

Table-2.Religion-wise distribution

Religion	Group			Total
	Control	Schizophrenia	Depression	
Hindu	29	25	26	80
Muslim	1	2	1	4
Christian	0	3	3	6
Total	30	30	30	90

$\chi 2=3.825$; df=4; P=.43

Table-3. Sex-wise distribution

Sex	Group			Total
	Control	Schizophrenia	Depression	
Male	17	18	11	46
Female	13	12	19	44
Total	30	30	30	90

$\chi 2=3.824$; df=2; P=.148

Table-4. Marital status-wise distribution

Marital status	Group			Total
	Control	Schizophrenia	Depression	
Unmarried	14	13	11	38
Married	16	15	19	50
Divorce	0	1	0	1
Widow	0	1	0	1
Total	30	30	30	90

$\chi 2=4.888$; df=6; P=.558

Table-5. Literacy-wise distribution

Literacy status	Group			Total
	Control	Schizophrenia	Depression	
Illiterate	0	1	1	2
Under metric	4	15	9	28
Intermediate	4	3	0	7
Metric	6	9	10	25
Graduate	16	2	10	28
Total	30	30	30	90

$\chi 2$=4.888; df=6; P=.558

Table-6 .Income-wise distribution

Income in group	Group			Total
	Control	Schizophrenia	Depression	
Below 5000	1	9	11	21
5000 - 10000	15	14	11	40
10000 - 15000	7	4	4	15
15000 - 20000	2	3	4	9
20000 - 25000	5	0	0	5
Total	30	30	30	90

$\chi 2$=20.517; df=8; P=.009

The comparison of mean±SD of age, income, T3, T4, and TSH among the groups showed that the patients belonged to schizophrenia groups are older (33.96 yr.) than that of depression (32.20 yr.) and controls (30.70 yr.). The patients of controls group has higher monthly income (average = Rs. 10533.33) than that of schizophrenia (Rs. 6633.33), and depression (Rs. 6433.33). It was observed that schizophrenia group has higher mean T3 (1.31) which is followed by control (1.03) and lowest (0.86) belongs to depression group. A similar trend is witnessed in case of T4 too as schizophrenia group maintains highest (7.91) followed by control (5.86) and depression (5.40) respectively. On the contrary, depression group has highest mean TSH (4.58) and next to highest is 4.57 for control group and lowest 1.62 pertains to schizophrenia (Table 7).

Table-7. Comparison of Mean±SD of parameters of age, income, T3, T4, and TSH

Parameters	Control	Schizophrenia	Depression	Total
	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Age (yr.)	30.70±8.90	33.96±9.44	32.20±9.55	32.28±9.30
Monthly Income(Rs.)	10533.33±5399.44	6633.33±3995.54	6433.33±4076.28	7866.66±4870.11
T3	1.033±.20	1.31±.62	.86±.86	1.07±.44
T4	5.86±1.29	7.91±3.18	5.40±1.30	6.39±2.37
TSH	4.57±2.06	1.62±1.74	4.58±1.60	3.59±2.27

est (7.91) followed by control (5.86) and depression (5.40) respectively. On the contrary, depression group has highest mean TSH (4.58) and next to highest is 4.57 for control group and lowest 1.62 pertains to schizophrenia (Table 7).

Table 8. Comparison of Mean±SD of thyroid hormone levels between control and schizophrenia

Parameter	Control		Schizophrenia		t-value	d.f.	P
	No. of cases	Mean±SD	No. of cases	Mean±SD			
T3	30	1.033±.20	30	1.31±.62	-2.288	58	.026
T4	30	5.86±1.29	30	7.91±3.18	-3.268	58	.002
TSH	30	4.57±2.06	30	1.62±1.74	5.976	58	.000

The comparison of thyroid hormone level between control and depression groups have shown that there is a highly significant difference of T3 levels exist between the groups whilst no significant difference is observed for T4 as well as for TSH levels. These statements are supported by the corresponding P-values (Table 9).

Table 9. Comparison of Mean±SD of thyroid hormone levels between control and depression

Parameter	Control		Depression		t-value	d.f.	P
	No. of cases	Mean±SD	No. of cases	Mean± SD			
T3	30	1.033±.20	30	.86±.86	2.667	58	.010
T4	30	5.86±1.29	30	5.40±1.30	1.380	58	.173
TSH	30	4.57±2.06	30	4.58±1.60	-.018	58	.986

The comparison thyroid hormones between schizophrenia and depression groups have shown that there is a significant difference of T3, T4, and TSH between them which is supported by the corresponding highly significant P-values (shown in the table 10.).

Table 10. Comparison of Mean±SD of thyroid hormone levels between schizophrenia and depression

Parameter	Schizophrenia		Depression		t-value	d.f.	P
	No. of cases	Mean±SD	No. of cases	Mean± SD			
T3	30	1.31±.62	30	.86±.86	3.556	58	.001
T4	30	7.91±3.18	30	5.40±1.30	4.004	58	.000
TSH	30	1.62±1.74	30	4.58±1.60	-6.851	58	.000

From the status wise distribution of thyroid hormone, it is observed that there are 1, 3 and 5 no of cases of T3 level falls outside normal range for control, schizophrenia, and depression groups whereas in case of T4 level, 3 cases each in schizophrenia and depression falls outside the normal range while none exists in control group. In case of TSH, 4 no of cases are noticed outside the normal range in the controls whilst 2 cases in the schizophrenia group and only single case was found in the depressive groups. However, each test value suggests that the variation of outside normal cases among the groups is not significant statistically which is true for all thyroid hormone levels.

Table 11. Thyroid hormone status-wise distribution

Parameters		Type of groups			χ^2	d.f.	P
		Control	Schizophrenia	Depression			
StatusT3	Within normal	29	27	25	2.963	2	.227
	Outside normal	1	3	5			
StatusT4	Within normal	30	27	27	3.214	2	. 200
	Outside normal	0	3	3			
Status TSH	Within normal	26	28	29	2.169	2	.338
	Outside normal	4	2	1			

Discussion

Thyroid hormones are involved in the regulation of nearly every organ system, particularly those integral to the metabolism of food and the regulation of temperature, and are responsible for optimal development and function of all body tissues. In addition to its prime endocrine function, TRH has direct effects on neuronal excitability, behavior, and neurotransmitter regulation. During the last 30 years a huge number of scientific articles have appeared on the subject of relationships between psychiatric disease and thyroid hormones. These studies have demonstrated the presence of numerous changes in the hypothalamo-pituitary-thyroid (HPT) axis, mainly in patients with depression, but also in patients with other psychiatric diseases[9].

In the present study we found that majority of the subjects are from Hindu background perhaps it may be due to the existence of the institute in the heart of the Hindu dominated area and the sex-composition is almost similar in all the groups despite some variations. Majority of our cases in depression group are females and this consistent with other studies for unipolar depression. This gender difference begins in early adulthood, is most pronounced in people between the ages of 30 and 45 years[11]. Derik Herman et al 2004 [12] noticed that patients with thyroid disease were more likely to be female than male (82% vs 54%). The majority of patients belong to lower group of income. This findings are consistent with that of Zoltan Rihmer et al (2005)[11] and Robert W. Buchanan et al (2005)[13]who also found that the lower socio economic status and lower income as well as a rate of unemployment are common in schizophrenia and depression, irrespective of their thyroid profile.

In our study, schizophrenia group has higher T_3 level which is followed by control and lowest among depressions. A similar trend is witnessed in case of T_4 level as schizophrenia group maintain highest followed by control and depression respectively. This finding is consisted with other findings of Parshad O et al (1989) [14], Turianitsa I.M et al (1991)[15], Smirnova LK et al (1993)[16] who also reported that T_4 & T_3 is high in schizophrenia. We also found that in depression, there is lower in level of T_3 & T_4 which is consistent with findings from other studies[4, 5, 17, 18, 19, 20].

In the present study we have seen that in depressive groups the level of TSH is highest followed by control and lowest levels case of schizophrenia. This finding is consistent with other finding that TSH is high in depression by Wahby et al (1989) [19] and Roca RP et al, (1990)[21]. We also noted that TSH level is decreased in schizophrenia which also supported by other studies like Parshad et al, (1988)[14]. The difference of means of thyroid hormones level between control and schizophrenia also shows that normal healthy person has certainly lower levels of T_3 and T_4 than that of those who are having schizophrenia but TSH level is lower in schizophrenia than control group. Similar finding has also been reported by Parshad et al, (1988) [14].

The comparison of thyroid hormone levels between control and depression shows that there is a highly significant difference of T_3 levels between two groups (Table-9). The study did not report statistically any significant difference of T_4 as well as for TSH level between the groups. This findings is supported by Baumgartner et al, (1992) [4] and Bauer et al, (1994)[5] studies.

The comparison of mean of all thyroid hormone levels between schizophrenia and depression groups also do not show any significant difference of T_3, T_4 & TSH between the groups. In the group of schizophrenia the levels of T_3 and T_4 is higher than depression group which is supported by other studies by Sim K et al, (2002)[8] and Baumgartner A. et al, (2000)[22]. The present study found that depressive groups have low levels of T_3 and T_4 which is well supported by Gambi F et al, (2005) [23], Kierkegaard C et al, (1991) [9] and Baumgartner A et al, (1992)[4]. Our finding of high level of TSH levels in depressive group is also reported by Hickle I et al, (1996)[24] and decreased in schizophrenia is also found by Othman SS et al, (1995)[25].

In this study, it is observed that the schizophrenia group has 3 cases (10%) outside the normal range for thyroid hormone for T_3, 3 cases of T4 (10%) outside the normal range and another 2 cases for TSH (6.66%) outside the normal range. This finding is consistent with other findings observed by Kelly DL et al (2005)[26] who reported that in schizophrenia the percentages of randomized patients with abnormal values were 18% for T_3, 13% TSH and 9% for T_4. In case of depression with findings was 5 cases (16.66%) were found outside the normal range for T_3, 3 cases (10%) for T_4 and 1 case in the TSH level (3.33%). Herman et al (2004)[12] observed the alteration of TSH in mood disorders; TSH was elevated in 5.6%. There was no literature available regarding the percentage of abnormality in T_3 & T_4 levels. In the group of control, one case (3.33%) falls outside the range for T_3 level, 4 cases (13.33%) for T_4 and no cases observed in the case of T_4 levels. However, each test values suggest that the variations of outside normal cases among the groups are not significant statistically which is true for all thyroid hormone levels.

This study shows that there is an abnormality in thyroid hormone levels in the psychiatric disorders of depression and schizophrenia. In depression, T_3 and T_4 levels are lower but higher in levels in the case of schizophrenia. TSH it is higher level in depression patients and lowers in level in schizophrenia patients. Therefore, thyroid dysfunction is common in psychiatric disorders. Early detection of thyroid abnormality should be considered for appropriate management of psychiatric disorders especially in depression and schizophrenia.

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