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Study of Thyroid Function and Lipid Profile in Depression Patients

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ABSTRACT

Background: Depression is a common mental disorder, associated with a global increase in disabilities and suicidality. Different factors are responsible for depression in which thyroid dysfunction and dyslipidemia are the biological causes. This study aimed to find the association and alteration of thyroid function tests and lipid profiles among patients with depressive disorders.

Methods: A case-control study was performed on patients being managed for depressive disorder visiting the Psychiatry Department of Tribhuvan University Teaching Hospital, Kathmandu, Nepal. The blood samples were collected from 40 newly diagnosed cases of depressive disorder not under any drugs and 80 from healthy individuals. Thyroid hormones and lipid profile parameters were analyzed in Johnson and Johnson, ECI Vitros 3600, US, Ortho Clinical Diagnostics, and BT-1500. Data were collected and statistical analysis was done using SPSS version 22.

Results: Among the 40 patients with depressive disorders, 27.5% had thyroid dysfunction with sub-clinical hypothyroidism, overt hypothyroidism, and hyperthyroidism among 12.5%, 12.5%, and 2.5% respectively. Similarly, dyslipidemia was observed in 37.5% of participants. About 52.5% of patients managed for depressive patients were found to have anxiety as well. Despite an alteration of thyroid hormones, there was no significant correlation between thyroid hormones and lipid parameters in patients being managed for depressive disorder.

Conclusions: This study concludes that thyroid dysfunction and dyslipidemia are seen among depressive patients with unclear reasons. For proper diagnosis and treatment of depression, it is better to carry out thyroid function tests and lipid profiles.

Keywords: Depressive disorder; dyslipidemia; thyroid dysfunction.

INTRODUCTION

Hormonal imbalances, like thyroid dysfunction, and metabolic factors, like lipid alteration, are common in depressive disorder,[1-3] and affect neurotransmitter function.[4,5]

Symptoms of thyroid dysfunction like fatigue, weight changes, dry skin, disturbed sleep, and tachycardia are similar to depressive disorder,[6,7] causing confusion between two conditions. The hypothalamic-pituitary-thyroid axis responsible for circulating THs is affected in depressive disorder.[8,9] Individuals with thyroid disorders are vulnerable to depression and subtle thyroid abnormalities may accompany depressive states.[10]

Lipids, crucial for neurological function,[11] also observed altered in depressive disorders. [12,13] The significant role of cholesterol and lipid molecules in depression isn't established yet,[14] but the genetics association between HDL-C and depressive disorder had been identified.[15] Lipid abnormalities are associated with cognitive

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impairment, increased suicidality, and cardiovascular risks among depressive patients.[16-19]

This study aims to explore the relationship between thyroid and lipid profiles in depressive disorders, as both hormonal and metabolic imbalances are implicated in its pathophysiology. Understanding these associations could provide insights into potential biomarkers and therapeutic targets for depression. This study attempts to explore the relationship between thyroid and lipid profiles in individuals with depressive disorders.

METHODS

This was a case-control study among 80 healthy individuals who visited a general OPD and 40 newly diagnosed patients with depressive disorder who visited the Psychiatry OPD from December 2020 to May 2021 at Tribhuvan University Teaching Hospital (TUTH), Maharajgunj, Kathmandu.

After written informed consent, patients diagnosed with depressive disorder by a psychiatrist were selected for the study. Patients taking any kind of lipid-altering drugs, hormone replacement therapy, thyroid dysfunction treatment, or patients with autoimmune thyroid disease were excluded from the study.

Depression was diagnosed following the criteria Hamilton Depression Rating Scale (HDRS). Patients were categorized into various groups of depression after taking a history by the psychiatrist. A total of 80 patients who were declared healthy by general practitioners were enrolled in the study. Written informed consent was taken, either from the patient or their visitors. Fasting blood samples were collected by the aseptic vein-puncture technique. Then, the serum was separated by centrifugation at 3000 rpm for 5 minutes (Centrifuge 5702, Eppendorf, Germany). Thyroid hormones were estimated by the Enhanced Chemiluminescent Immuno Assay (ECI) technique (Johnson and Johnson, ECI Vitros 3600, US, Ortho Clinical Diagnostics). The lipid parameters (Total Cholesterol, HDL-C Cholesterol, and Triglycerides) were estimated by an enzymatic method in a semi-automated analyzer BT 1500, Italy. And LDL-C Cholesterol was determined by Friedwald's equation.

Patients with thyroid hormones (FT3=4.26-8.1 pmol/L, FT4=10.2-28.2 pmol/L and TSH=0.46-4.68 mIU/L) and lipid parameters (TC= 3.5-5.1 mmol/L, HDL-C=0.8-1.6 mmol/L, LDL-C<4.0 mmol/L and TG=0.5-1.8 mmol/L) were considered as normal. Patients with normal FT3 and FT4 and elevated TSH (above 4.68 mIU/L) were diagnosed with sub-clinical hypothyroidism. Patients with normal or decreased FT3, decreased FT4<10.2 pmol/L and increased TSH were concluded with overt hypothyroidism. [20] Similarly, patients with increased FT3, FT4 and TSH<0.46 mIU/L were diagnosed with hyperthyroidism. While altered lipid parameters either increased or decreased than normal levels were considered as dyslipidemic.

Data were analyzed using IBM Statistical Package for Social Sciences (SPSS version 22.0) (IBM Corp., Armonk, NY, USA). The normality of data was evaluated using the Shapiro-Wilk test. Categorical variables (male and female in control and case population) were reported in numbers and percentages. Continuous variables (Thyroid Hormones and Lipid parameters) were interpreted as mean and standard deviation. An Independent t-test was used to find out the significance of thyroid hormones and lipid parameters between the control and case population and depressive patients with/without anxiety. While analysis of variances (ANOVA) along with Tukey's posthoc analysis was applied to find the differences in the mean value of thyroid hormones and lipid parameters among different subgroups of depressive patients. Pearson's correlation was used to find the association between thyroid hormones and lipid parameters among the patients being managed for depressive disorders. Group association was determined using the Chi-square test. The level of significance was set at *p*-value <0.05.

RESULTS

Out of 120 participants, 83 individuals were females and 37 were males which included 40 patients managed for depressive disorder (case) and 80 healthy individuals (control). Among 40 cases, 26 (65.00%) were female and 14 (35.00%) were male as shown in **Table 1.**

The mean age of the study population was 44.09±15.31 years. FT3 (4.88 vs. 4.24) and FT4 (14.23 vs. 12.17) of cases and controls respectively showed significant differences with $p<0.05$ in **Table 2.**

Figure 1 shows the lipid profile status among which 15 (37.50%) showed dyslipidemia among patients being managed for depressive disorders.

Figure 2 illustrates the thyroid status among depression patients. Euthyroid patients were found in greater percentage (72.5%), followed by sub-clinical hypothyroidism (12.5%), overt hypothyroidism (12.5%), and hyperthyroidism (2.5%).

Out of 40 patients, 27 (67.5%) were found with moderate depression followed by 7 (17.5%) with severe depression, and 3 (7.5%) in each with mild and very severe depression according to HDRS criteria. Mean values of thyroid hormones and lipid parameters among the patients with mild, moderate, severe, and very severe depression, were not significantly different among patients shown in **Table 3.**

Depression with anxiety was seen in 21 (52.50%) participants and depression without anxiety was observed in 19 (47.50%) participants. Thyroid hormones and lipid parameters among depression patients with or without anxiety are presented in **Table 4**. However, none of the parameters showed a significant difference.

Despite alterations visible in the thyroid hormones, there was no significant correlation seen between thyroid hormones and lipid parameters, but FT3 and FT4, both were negatively correlated with TC, LDL-C, and TG. Similarly, TSH was negatively correlated with TG without statistical significance which is presented in **Table 5.**

Table 1. Demographic characteristics of the study population.

Gender	Study population		Total N (%)	p-value*
	Case n (%)	Control n (%)		
Female	57 (71.25)	26 (65.00)	83 (69.17)	0.485
Male	23 (23.75)	14 (35.00)	37 (30.83)	
Total	80 (100.00)	40 (100.00)	120 (100.00)	

**The Chi-square test, p<0.05 was considered statistically significant.*

Table 2. Comparison of TFT and lipid profile among patients being managed for depressive disorders and healthy control.

Variables	Case (n=40)	Control (n=80)	Total (N=120)	p-value*
Age	37.80±14.86	39.95±11.04	44.09±15.31	0.370
FT3 (pmol/L)	4.88±1.42	4.24±0.49	4.46±0.96	**0.001**
FT4 (pmol/L)	14.23±5.77	12.17±1.43	12.86±3.64	**0.003**
TSH (mIU/L)	2.77±2.58	2.67±1.45	2.70±1.89	0.778
TC (mmol/L)	4.38±1.37	4.38±0.68	4.38±0.96	0.979
HDL (mmol/L)	1.07±0.38	1.07±0.23	1.07±0.29	0.961
LDL (mmol/L)	2.95±0.98	2.70±0.77	2.82±0.87	**0.018**
TG (mmol/L)	1.62±0.93	1.45±0.60	1.51±0.73	0.250

*Abbreviation:- FT3: free Triiodothyronine, FT4: Thyroxine, TSH: Thyroid Stimulating Hormone, TC: Total Cholesterol, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, TG: Triglyceride, * Independent t-test, p<0.05 was considered as statistically significant.*

Table 3. TFT and lipid profile among different subgroups of depressive patients as per HDRS criteria.

Variables	Mild n (%) = 3 (7.50%)	Moderate n (%) = 27 (67.50%)	Severe n (%) = 7 (17.50%)	Very severe n (%) = 3 (7.50%)	p-value*
FT3 (pmol/L)	5.05±1.01	4.90±1.52	4.47±1.54	5.41±0.40	0.80
FT4 (pmol/L)	12.56±0.90	14.08±6.65	14.02±3.96	17.70±1.99	0.73
TSH (mIU/L)	1.18±0.20	2.90±2.56	3.09±3.45	2.50±2.10	0.73
TC (mmol/L)	3.93±1.32	4.48±1.44	4.21±1.36	4.26±1.15	0.90
HDL (mmol/L)	0.97±0.11	1.13±0.40	0.96±0.40	0.93±0.23	0.61
LDL (mmol/L)	2.20±1.15	2.61±1.02	2.51±1.05	2.45±0.52	0.91
TG (mmol/L)	1.56±0.90	1.67±1.00	1.34±0.70	1.80±1.01	0.85

*Abbreviation:- FT3: free Triiodothyronine, FT4: Thyroxine, TSH: Thyroid Stimulating Hormone, TC: Total Cholesterol, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, TG: Triglyceride,*Tukey Post Hoc One-Way ANOVA test, p<0.05 was considered as statistically significant.*

Table 4. TFT and lipid profile among depressive patients with or without anxiety under HDRS under criteria F41.2.

Variables	Depression with anxiety n (%) = 21 (52.50%)	Depression without anxiety n (%) = 19 (47.50%)	p-value*
FT3 (pmol/L)	4.85±1.03	4.91±1.75	0.89
FT4 (pmol/L)	15.32±4.78	13.13±6.55	0.23
TSH (mIU/L)	2.45±2.28	3.09±2.87	0.44
TC (mmol/L)	4.59±1.26	4.17±1.46	0.33
HDL (mmol/L)	1.06±0.36	1.09±0.40	0.81
LDL (mmol/L)	2.79±0.76	2.31±1.13	0.13
TG (mmol/L)	1.57±0.92	1.67±0.96	0.73

*Abbreviation:- FT3: free Triiodothyronine, FT4: Thyroxine, TSH: Thyroid Stimulating Hormone, TC: Total Cholesterol, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, TG: Triglyceride, *Independent sample t-test, p<0.05 was considered as statistically significant.*

Table 5. Correlation between Thyroid hormones and Lipid parameters in depressive patients.

Variables		TC (mmol/L)	HDL-C (mmol/L)	LDL-C (mmol/L)	TG (mmol/L)
FT3 (pmol/L)	r	-0.16	0.13	-0.14	-0.19
	p-value*	0.29	0.40	0.36	0.22
FT4 (pmol/L)	r	-0.10	0.06	-0.09	-0.18
	p-value*	0.50	0.70	0.55	0.24
TSH (mIU/L)	r	0.03	0.00	0.13	-0.03
	p-value*	0.82	0.98	0.40	0.85

*Abbreviation:- FT3: free Triiodothyronine, FT4: Thyroxine, TSH: Thyroid Stimulating Hormone, TC: Total Cholesterol, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, TG: Triglyceride, *Pearson's Correlation, p<0.05 was considered as statistically significant.*

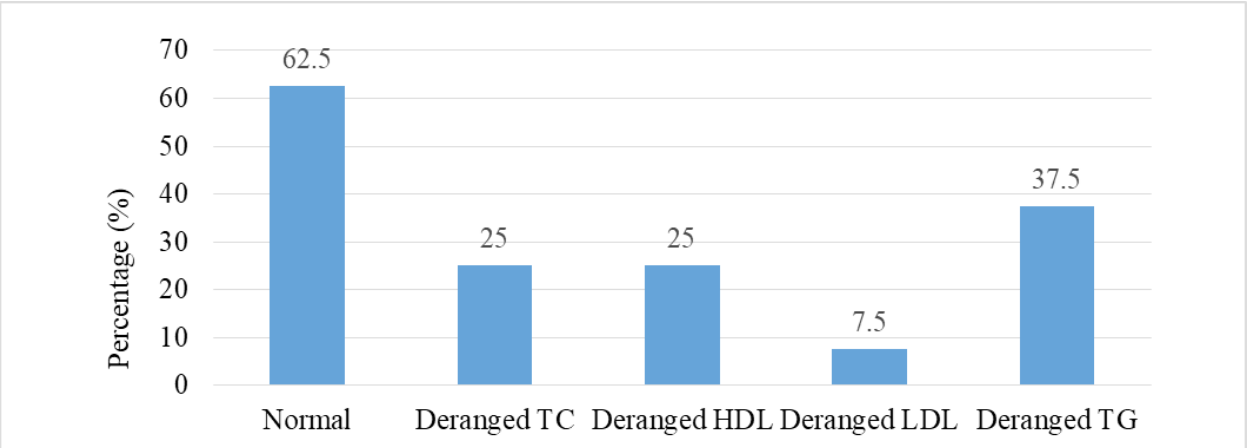

Figure 1. Lipid profile status among the depressive patients. (n=40)

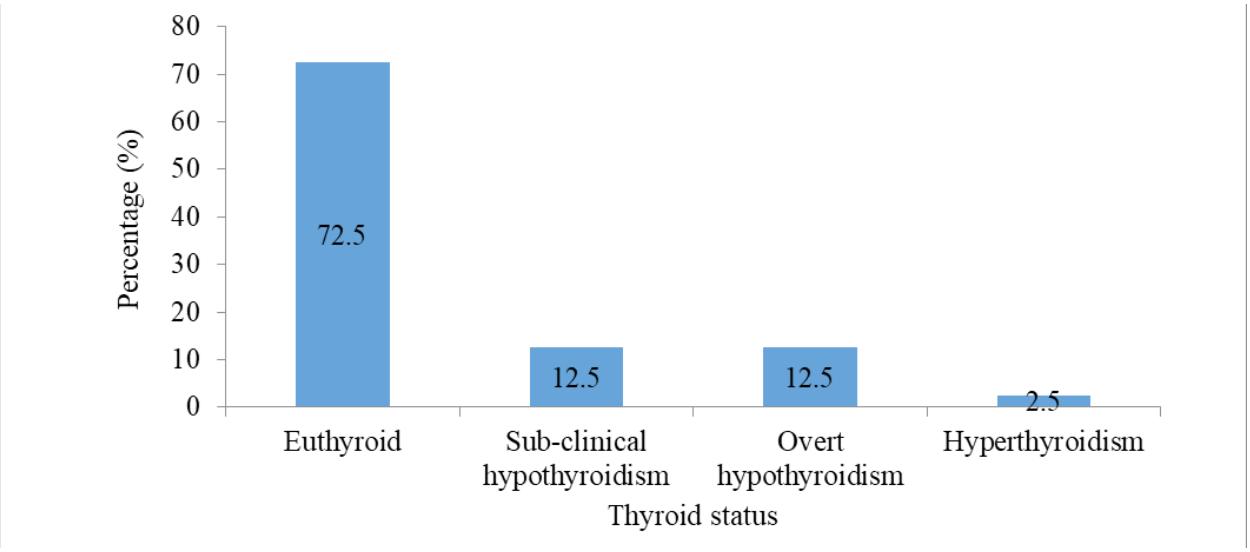

Figure 2. Distribution of Thyroid status among patients managed for depressive disorder. (n=40)

DISCUSSION

The association of thyroid function tests and lipid profiles with patients being managed for depressive disorders is not well established yet. It is important to understand the changes in human cognition in thyroid dysfunction, altered lipid profile, and depression. For the diagnosis of frank depression, thyroid dysfunction, and altered lipid profile must be included. The changes in thyroid hormones and lipid profiles were also observed after people had depression. Thus in this study, the changes in thyroid function tests and lipid profiles in patients with depressive disorder were investigated.

From our study, it can be inferred that a significantly higher portion of females (n=26, 65.0%) experienced depression compared to males (n=14, 35.0%). The study of MM Weismann et al. also showed females had a twofold greater prevalence of depression as compared to males. [3] The gender-varied prevalence of depression may be due to different concentrations of female sex hormones and testosterone levels among females and males. [3]

This study showed that 25 (62.5%) depressive patients had normal lipid profiles while 15 (37.5%) had altered lipid profile levels. The reason behind the altered lipid profile in depression is a result of long-term dietary intake along with lipid-regulating hormones and thyroid abnormalities as quoted by the studies of Muller CP et al. [5] and Rizos C et al. [21] respectively.

This study showed abnormal thyroid in 11 (27.5%) depressive patients, with 5 (12.5%) overt hypothyroidism, 5 (12.5%) subclinical hypothyroidism, and 1 (2.5%) with overt hyperthyroidism. Our study is supported by the study of Kafle et al., which showed among 263 patients with depression, 69 (26.2%) had abnormal thyroid status with the most common being subclinical hypothyroidism 32 (12.2%), 13 (4.9%) overt hypothyroidism, and 7 (2.7%) overt hyperthyroidism. [10] The study of Dayan CM et al. strongly established the relationship between hypothyroidism and depression which is in concord with our study.[22] This study also supports the study of Marian G. et al. which showed hyperthyroidism as a cause of depression. [23] The circulating thyroid hormone level is affected in depression, also altering the neurotransmission as shown by a study by Bahls et al. and Fekete et al. [8,9]

This study showed a significantly higher level of FT3 (4.88±1.42) and FT4 (14.23±5.77) among depressive patients. This study agrees with Zhou et al. [24] but disagrees with KN et al. [25] which showed a normal level of FT3 and FT4. In our study, only LDL (2.55±0.98) was significantly higher in depressive patients' lipid profiles than control population, supporting the study of Zhang et al.[26]

In this study, patients with moderate depressive symptoms were in greater percentage 27 (67.5%) though only 13 (32.5%) had mild, severe, and severe depressive symptoms. Mild depressive patients show less intense symptoms than moderate and severe ones. [27] That's why a majority of patients seem to be visiting hospitals with moderate depressive episodes. Our study showed no significant difference in thyroid function test and lipid profile with types of depression. There seem to be yet

not any relations established between TFTs and lipid profile except in major and severe depression. [24]

Anxiety is usually found in conjunction with patients with depression disorder and vice versa. The prevalence of depressive disorder with anxiety and depressive disorder without anxiety was 21 (52.5%) and 19 (47.5%). The study of Hirschfeld et al. also found that more than 50.0% of patients with depressive disorder are also associated with anxiety disorders. [28] The study conducted by Risal et al. in Nepal had only 5.9% co-morbid anxiety and depression according to the Hospital anxiety and depression scale. [29] According to our analysis, TFTs and lipid profiles with depression with anxiety and depression without anxiety did not show any significance.

TFT values had no significant correlation with the lipid profile parameters. Both FT3 and FT4 values were negatively correlated with TC, LDL-C, and TG through weak correlation. Similarly, TSH was negatively correlated with TG only. However, these correlations were not statistically significant ($p>0.05$). The study performed on elderly depressive patients also presented a similar result of no significant correlation between TFT values and lipid profile in depression patients. [17] Therefore, it is recommended to perform the study in larger groups of population. Also we could not follow-up the patients to track down the long-term sequelae of thyroid disorders.

CONCLUSIONS

There is an alteration in thyroid hormones and lipid profile in patients being managed for depressive disorder. For the proper risk stratification and to avoid future complications regular monitoring of these parameters is recommended in patients being managed for depressive disorder.

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CONFLICT OF INTEREST

The author(s) declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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