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ORIGINAL RESEARCH ARTICLE

ASSOCIATION OF METABOLIC SYNDROME AND SUBCLINICAL HYPOTHYROIDISM PATIENTS ATTENDING CHITWAN MEDICAL COLLEGE

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ABSTRACT

Background: Metabolic syndrome is characterized by a cluster of cardiovascular risk factors such as abdominal obesity, dyslipidemia, hyperglycemia, and hypertension. Subclinical hypothyroidism is defined as an increase in serum levels of thyroid stimulating hormone (TSH) above the normal range, without alteration of total T4 concentrations has been associated with various metabolic alterations. The study aimed to investigate association between metabolic syndrome and subclinical hypothyroidism patients attending Chitwan Medical College.

Methods: This cross-sectional study consisted of 250 randomly selected individuals visiting OPD in the Department of Medicine of Chitwan Medical College 10ml of blood sample was drawn from antecubital vein following overnight fasting. Fasting blood sugar, lipid profile and thyroid profile etc. were analyzed via chemiluminescence Analyzer at Hospital Laboratory and was statistically analyzed.

Results: The association of BMI with T4 and TSH was found to be positively correlated and was significant at P<0.05 but the association of systolic blood pressure (SBP) with T3 was not significant but there was negatively significant correlation of SBP with T4 and TSH. The correlation of diastolic blood pressure (DBP), TG, HDL, fasting blood sugar were not significant with T3, T4 and TSH at p<0.05. BMI was positively correlated with T4 and TSH (r = 0.12, P<0.05 and r=0.81, P<0.001) whereas SBP was negatively correlated with T4 and TSH (r = -0.12, P<0.05 and r=-0.16, P<0.001 respectively).

Conclusions: From our study it was concluded that the association of BMI with T4 and TSH was found to be positively correlated in subclinical hypothyroidism subjects.

INTRODUCTION

Thyroid hormones has important role in multiple metabolic processes. Subclinical hypothyroidism is defined as an increased serum thyroid-stimulating hormone (TSH) level with normal free thyroid hormone concentrations.[1] The worldwide prevalence of subclinical hypothyroidism ranges from 1 to 10%.[2] Patients with subclinical hypothyroidism are usually asymptomatic having cardiac dysfunction, elevated low-density lipoprotein, and neuropsychiatric symptoms as well.[3]

The pathogenesis appears to be mostly due to insulin resistance, with fatty acid flux being implicated. The syndrome is most likely caused by a proinflammatory state. The primary strategy is to lose weight and increase physical activity; nevertheless, pharmacological treatment may be necessary to reduce the risk of diabetes, thyroid disease, and cardiovascular disease. The Metabolic syndrome involves clustered cardiovascular risk factors, including abnormal lipids (LDL, TG, Cholesterol), insulin resistance, and hypertension.[4]

Metabolic syndrome is a very frequent condition occurring in 20–25% of the world's adult population.[5] Thyroid functions affect metabolic syndrome parameters including HDL cholesterol, triglycerides, blood pressure and plasma glucose. Both overt and subclinical hypothyroidism unfavorably affects biochemical parameters.[6] Because the majority of persons with subclinical hypothyroidism have few symptoms or none at all, and components of Metabolic syndrome have been reported to be closely related to hypothyroidism or SCH.[7,8]Furthermore, SCH increases cholesterol, blood pressure, and visceral fat levels, so the study was aimed to have correlative study with regard to Association of Metabolic Syndrome and Subclinical Hypothyroidism in patients visiting Chitwan Medical College.

METHODS

The study was a cross sectional study carried out in 250 subjects at Department of Biochemistry in collaboration with department of medicine from 24 January 2022 to 30 March 2022. The ethical committee of Chitwan Medical College (CMC-IRC/078/079-085) has approved this research work.

For the identification of the syndrome the classification of the

National Cholesterol Education Panel of the National Treatment Program for Adults III (NCEP-ATP III) with specific cutoff points was used.

With Consent under aseptic condition 10ml of blood sample was drawn from antecubital vein following overnight fasting. The blood sample was collected in plain, fluoride and EDTA vacutainers. The blood sample was centrifuged for 10 min. at 3000 rpm at room temp. The serum was stored at 4oC for biochemical investigations. The standard screening procedures such as fasting blood sugar, lipid profile and thyroid profile etc. were the parameters taken into account for the research work. The general otherwise healthy adult population and studies that define the status of metabolic syndrome in groups of subclinical hypothyroidism and euthyroid state were included in the study. The patients receiving medication that may alter thyroid functions or lipid levels, pregnant women, and patients with a cardiovascular disease, corticosteroid use, active liver disease, and renal dysfunction were excluded. Data were presented as Median ± Standard Deviations for continuous variables. Bivariate logistic regression analyses were done to investigate the possible associations among Metabolic syndrome and thyroid profile parameters in subclinical hypothyroidism subjects. Statistical analysis was done via SPSS version 22.

RESULTS

Table 1: Descriptive analysis of various parameters considered for metabolic syndrome and subclinical hypothyroidism subjects

S.No	Parameters	Statistics (Median/IQR)	SD	Range		Normality Test
				Minimum	Maximum	
1	BMI	24(2)	2.8	22	26	Not normal
2	DBP	80(15)	8.25	60	100	Not normal
3	SBP	130(15)	10.74	100	150	Not normal
4	FBS	95(8)	8.5	60	110	Not normal
5	TG	175(9)	9.7	170	198	Not normal
6	HDL	42(5)	4.8	30	64	Not normal
7	T3	2.5(1)	0.74	2.5	3.0	Not normal
8	T4	1.4(1)	0.37	0.9	2.0	Not normal
9	TSH	6.5(2)	1.5	6	8	Not normal

-Normality test was done through Kolmogorov-Smirnov Test at 5% level of significance.
-IQR denotes interquartile range.

Table 2: Correlation between metabolic syndrome and subclinical hypothyroidism subjects

S.No.	Variables	Spearman Rank Correlation	P-value
1.	BMI Vs T3	0.1	-1.04
	BMI Vs T4	0.04*	0.12
	BMI Vs TSH	0.00**	0.81
2	DBP Vs T3	0.09	0.1
	DBP Vs T4	0.08	-.17
	DBP Vs TSH	0.93	-0.1
3	SBP Vs T3	0.07	0.17
	SBP Vs T4	0.05*	-0.12
	SBP Vs TSH	0.01**	-0.16
4	FBS Vs T3	0.83	-0.13
	FBS Vs T4	0.12	-0.10
	FBS Vs TSH	0.06	0.12
5	TG Vs T3	1.73	-0.08
	TG Vs T4	0.46	0.48
	TG Vs TSH	0.42	-0.05
6	HDL Vs T3	0.59	-0.03
	HDL Vs T4	0.57	-0.03
	HDL Vs TSH	0.27	0.07

*Significant at (P<0.05), **Highly Significant at (P<0.001)

It was found from the study that association of BMI with T4 and TSH was found to be positively correlated and it was significant at P<0.05 but the association of systolic blood pressure (SBP) with T3 was not significant but there was negatively significant correlation of SBP with T4 and TSH. The correlation of diastolic blood pressure (DBP), TG, HDL, fasting blood sugar was not significant with T3, T4 and TSH at p<0.05. BMI was positively correlated with T4 and TSH (r = 0.12, P<0.05 and r=0.81,P<0.001) whereas SBP was negatively correlated T4 and TSH (r = -0.12, P<0.05 and r=-0.16, P<0.001 respectively).

DISCUSSION

Metabolic Syndrome is a cluster of three or more of the following metabolic risk factors such as abdominal obesity, hyperglycemia, hypertension, reduced high-density lipoprotein cholesterol, and elevated triglycerides. Our cross-sectional study demonstrates that BMI in the upper normal range with 24±2.8 (Median ± SD) with high systolic blood pressure 130±10.4 (Median ± SD) are associated with SCH which indicates serum concentrations of TSH and FT4 may be routinely screened for these kinds of subjects.

The findings of our study in association with systolic blood pressure with T3 was not significant (P>0.05).The finding of our study was negatively correlated with the findings of Jiaji He

et al. 2021 [9], Kun Tang et al. 2000 [10] and Chia-Hsuin Chang et al.2017.[11]The reason behind this might be due to dyslipidemia which is a major risk factor for cardiovascular diseases in hypothyroid subjects.

The balance of glucose ingestion and gluconeogenesis, as well as glucose excretion and metabolism in target tissues, determines blood glucose levels. Thyroid hormones boost the production of glucose transporters at rest, so overt and subclinical hypothyroidism is linked to impaired glucose transport on the cell surface, which affects intracellular glucose uptake in myocytes as well.[12]

The hypothalamus integrates impacts on appetite regulation as well as peripheral effects on critical targets such brown (BAT) and white (WAT) adipose tissue, liver, muscle, and pancreaticβcells. Thyroid hormones participate in all aspects of lipid metabolism, including synthesis, mobilization and degradation. The influence of decreased thyroid function on the body weight may be the impact of abdominal fat on thyroid function mediated by adipocytokines. A positive association between Subclinical Hypothyroidism and body mass index in presence of Metabolic Syndrome might be due to an elevated TSH and its role in regulating cholesterol and triglyceride metabolism, lipolysis, adipocyte differentiation and adipogenesis.[13, 14] On the other side thyroid dysfunction has a distinct impact on body weight; overt hypothyroidism is associated with an increase in body weight, owing to edema, whereas hyperthyroidism causes weight loss, owing to catabolic effects on adipose and muscular tissue. Despite the fact that BMI does not reflect individual adipose mass or adipose tissue distribution, visceral obesity and consequent adipocyte dysfunction are important factors in the development of the metabolic syndrome.[15]

In our study, the TSH level of metabolic syndrome patients was in the upper normal range, indicating that CVD risk factors are present in subclinical hypothyroidism patients. TSH was shown to increase triglyceride accumulation and thus induce obesity by activating glycerol-3- phosphate- acyltransferase-3 (GPAT3)[16] and inhibiting the adipose triglyceride lipase.[12] TSH increased liver triglyceride content by up-regulating sterol regulatory element binding protein 1c (SREBP-1c) [17], suggesting a role of elevated TSH in the pathogenesis of NAFLD as well.

The results do not represent the overall number of subclinical hypothyroidism patients in Nepal because the study was conducted in only one tertiary care center and with a small number of patients. Furthermore, because the study only included patients who were admitted to the hospital, the findings cannot be generalized because they may not be representative of the broader community. As a result, more research in the topic is required to obtain complete results.

CONCLUSION

In this cross sectional study morbid obesity was not present among the subjects included, suggesting that increased TSH could not be considered as a consequence of obesity. Subclinical hypothyroidism and the concentrations of TSH were linked with the lipid profile and the association of BMI with T4 and TSH was found to be positively correlated. Further research is required to determine if maintaining TSH levels within the normal range can reduces the risk for metabolic factors or not.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

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