Journal of Clinical and Laboratory Medicine
ISSN 2572-9578 | Open Access

RESEARCH ARTICLE

Volume 4 - Issue 1

Assessment of Lipid Profile Pattern in Patients with Hyperthyroidism in a Tertiary Hospital in Kano, North Western Nigeria

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Received: 16 May, 2019 | **Accepted:** 12 Aug, 2019 | **Published:** 22 Aug, 2019

Citation: Yahaya IS, Adimabua OP, Ocheni AP, Adamu GB (2019) Assessment of Lipid Profile Pattern in Patients with Hyperthyroidism in a Tertiary Hospital in Kano, North Western Nigeria. J Clin Lab Med 4(1): dx.doi.org/10.16966/2572-9578.127

Abstract

Background: Hyperthyroidism is an important metabolic disorder associated with multiple biochemical abnormalities that have direct impact on lipid metabolism. The aim of the current study is to assess lipid profile pattern in patients with hyperthyroidism attending Aminu Kano Teaching Hospital, Kano.

Methods: A case control study conducted during the period of November 2015 to December 2017 among 100 hyperthyroidism patients before treatment and 100 apparently healthy individuals as controls with age between 18-70 years. Sixty eight of the patients were females while thirty two were males. Fasting blood was collected from each individual to determine serum TSH, T3 and T4 with quantitative ELISA assay technique, Product of ACCU BIND Inc., USA. Lipid profile was measured by an enzymatic spectrophotometric method and precipitation enzymatic method for HDL-C. SPSS software package version 20 was used for the analysis of data.

Results: The results of the present study showed that the mean values of T3, T4, TG and TG/HDL-C ratio were significantly higher ($p<0.05$) in patients with hyperthyroidism than the control group while TSH, T4/T3 ratio TC, HDL-C and LDL-C were significantly lower ($p<0.05$) in patients with hyperthyroidism than the control group. There were significant ($p<0.05$) and positive correlations between TSH and TC, HDL-C and LDL-C respectively in the patients. There was no significant ($p<0.05$) correlation between TSH and TG in the patients. There were no significant correlations in the control group of the respective analytes.

Conclusion: Our results revealed that hyperthyroidism was associated with decrease total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol and slightly increased triglycerides.

Keywords: Hyperthyroidism; Lipid Profile; Thyroid stimulating hormone; Thyroxine

Introduction

Hyperthyroidism is a term referred to as over activity in tissue within the thyroid gland, resulting in over production and thus an excess of circulating thyroid hormones; Thyroxine (T4), Triiodothyronine (T3) or both [1]. Hyperthyroidism is a relatively common condition in which tissues are stimulated by an increased secretion of thyroid hormones, Triiodothyronine (T3) and/or Thyroxine (T4) [2]. T3 is the biologically active thyroid hormone required for the normal growth, development and functions of nearly all tissues [3]. Human hyperthyroidism is accompanied by multiple abnormalities with increased energy expenditure and excessive mobilization and utilization of metabolic substrates [4]. Assessment of thyroid hormone secretion can be made by measuring either serum or plasma Thyroid Stimulating Hormone (TSH), Thyronine (T3) and Thyroxine (T4) [5]. Lipids are an important source of energy, stored in adipose tissue cells [6], and they play a critical role in almost all aspects of biological life, contribute in the structural components of cells and are involved in metabolic and hormonal pathways [7]. Lipid profile tests are often ordered to determine risk of coronary heart disease. The parameters typically include Total Cholesterol (TC), High Density Lipoprotein Cholesterol (HDL-C), Low Density Lipoprotein Cholesterol (LDL-C) and Triglycerides (TGs) [8]. Alterations in thyroid function result in changes in the composition and transport of lipoproteins [9]. Serum LDL-C and HDL-C were reported by Lee WY, et al. [10] to be decreased in hyperthyroidism. Santamarina-Fojo S, et al. [11] reported that, there are no significant

changes in lipid profile levels in this group of patients. Furthermore Uma T, et al. [12] reported that in hyperthyroidism, there is no change in total cholesterol compared with controls, there is increased in triglycerides compared with controls and there is decreased in HDL-C compared with controls. However, Waleed HA, et al. [1] reported that in hyperthyroidism (new cases), the mean values of the total cholesterol, high density lipoprotein cholesterol and low density lipoproteins cholesterol were significantly decreased in comparison with control groups respectively, while triglycerides slightly increased compared with control group. Lipid profile parameters could represent independent biomarkers for developing complications associated with hyperthyroidism.

Materials and Methods

This is a case control study conducted at Aminu Kano Teaching Hospital, Kano, Nigeria. We employed a systematic random sampling technique during the period of November 2015 to December 2017. The research proposal was approved by The Research Ethical Committee of Aminu Kano Teaching Hospital, Kano.

We enrolled 68 females and 32 males referred to Endocrinology unit of AKTH, Kano before commencing treatment. One hundred apparently healthy volunteers with age range between 18-70 years with both age (± 5) and sex matched were used as controls. The serum thyroid stimulating hormone (TSH), total triiodothyronine (tT3) and total thyroxine (tT4) were assayed using the technique described by ELISA Product of ACCU BIND Inc., USA. Total cholesterol was measured by the enzymatic colorimetric method [13], triglycerides by the glycerol phosphate oxidase method [14], high-density lipoprotein cholesterol (HDL-C) by the enzymatic colorimetric method [15] and low-density lipoprotein cholesterol (LDL-C) was calculated using Friedewald formula [16]. Atherogenic indices were defined by TC/HDL-C and TG/HDL-C.

Ethical clearance was sought for and obtained from the Ethics and Research Committee of the Aminu Kano Teaching Hospital, Kano with a Reference number AKTH/MAC/SUB/12A/P-3/VI/1552 and there search was conducted in accordance with the Helsinki Declaration. The purpose and the procedure of the study were explained to all participants and a written informed consent was obtained prior to participation.

Five millilitres (5 mls) of whole blood was collected using monovette vacutainer syringe from each patient and apparently healthy controls by venepuncture with minimum stasis, after 8-12 hour fast. The blood samples were dispensed into clean plain container, allowed to clot within 30 minutes of collection. It was centrifuged at 3000 rpm for five minutes to obtain neat serum and then transferred into specimen container labelled accordingly. The serum samples were stored at -40°c before use.

Data were analyzed using IBM SPSS Statistics version 20.0 statistical software (SPSS Inc., Chicago, Illinois, USA). Continuous variables with normal distribution are presented as mean ± SD using independent t-test to compare between mean of patients and controls. Correlation was performed by Pearson's Correlation Coefficient. Statistical significance was set at $P<0.05$.

Results

The results obtained from the present study are presented in tables 1 to 3. Table 1 shows the TSH, T3, T4 and T4/T3 ratio in patients with hyperthyroidism and control group. The mean values of TSH, T4/T3 ratio were significantly lower ($P<0.05$) in the patient group when compared with the controls, while T3 and T4 mean values were significantly higher ($P<0.05$) in the patient group than the controls. Table 2 shows the lipid profile parameters in patients with hyperthyroidism and control group. The mean values of TC, HDL and LDL-C were significantly lower ($P<0.05$) in the patient group than the controls. The atherogenic indices using TC/HDL-C and LDL-C/HDL-C revealed lower risk in patients with hyperthyroidism, while that using TG/HDL-C revealed higher risk in patients with hyperthyroidism. Correlation between TSH and lipid profile among participants was shown in table 3. There were significant ($p<0.05$) correlations between TSH and TC, HDL-C and LDL-C respectively. There was no significant correlation between TSH and TG and the control group showed no significant correlation between TSH and TC, HDL-C, TG and LDL-C respectively.

Table 1: Mean values of TSH, T3, T4 and T4/T3 ratio in patient with hyperthyroidism and Control group.

Parameter	(n)	Patient	Control	t-value	P-Value
TSH (µlU/ml)	100	0.27 ± 0.25	1.38 ± 0.41	22.96	0.00*
T_3(nmol/L)		8.61 ± 5.57	1.63 ± 0.42	12.50	0.00*
T_4(nmol/L)		371.16 ± 99.70	97.53 ±13.62	27.19	0.00*
T_4/T_3 Ratio		45.80 ± 17.90	59.83 ± 32.43	3.79	0.00*

p<0.05 (significant of t-test) for patient *vs.* Control for Analysis*; TSH=Thyroid Stimulating Hormones; T3=Triiodothyronine; T4=Thyroxine; N=Number of Subject

Discussion

Hyperthyroidism is associated with various metabolic abnormalities, due to the effects of thyroid hormones on nearly all major metabolic pathways [17]. Thyroid function regulates a wide array of metabolic parameters. Thyroid function significantly affects lipoprotein metabolism as well as some Cardiovascular Disease (CVD) risk factors [5,18]. In the present study, there is significant decrease in TSH and increase in T3 and T4 in hyperthyroid patients. This is in agreement with previous reports [1,19-21]. This is because the pituitary gland releases less TSH to the thyroid gland to slow production of these excess thyroid hormones [22,23].

In the current study, the mean values of the TC, HDL-C and LDL-C were significantly decreased in comparison with control groups respectively, while TGs was slightly increased compared with control group. This is also in agreement with the reports from earlier studies [1,24-27]. However, contrast with the reports of Khan FA, et al. [26], who reported low HDL-C with no significant changes in TC, TGs and LDL-C. The reason for these findings may be due to increased cholesteryl transfer protein mediated transfer of cholesteryl esters from HDL to VLDL and the probability of the patients being on hyperthyroidism drugs which may affect the lipid metabolism. Mahmud I, et al. [28] observed low TGs levels in patients with hyperthyroidism than the control subjects. This may be due to the increased oxidative stress associated with hyperthyroidism which accelerates the catabolism of triglycerides where as Yavuz DZ, et al. [29], Regmi A, et al. [30] and Uma T, et al. [12] reported no changes in the concentration of lipid profile parameters in patients with hyperthyroidism compared to controls subjects. The explanation for our findings may be due to changes in hepatic lipase activity which in turn up regulate the activity of cholesteryl transfer protein and hepatic triglyceride lipase activity leading to increased bile excretion of the analytes.

The current findings show that significantly positive correlations were observed between serum TSH and TC, TSH and HDL-C, TSH and

Table 2: Mean values of lipid profile parameters in patients with hyperthyroidism and Control group.

Parameter	(n)	Patients	Controls	t-value	P-Value
TC (mmol/L)	100	3.20 ± 0.92	4.13 ± 0.75	7.84	0.00*
HDL-C (mmol/L)		0.85 ± 0.28	1.11 ± 0.20	7.56	0.00*
TG (mmol/L)		1.30 ± 0.62	1.11 ± 0.28	2.79	0.01*
LDL-C (mmol/L)		1.74 ± 0.82	2.50 ± 0.57	7.61	0.00*
TC/HDL-C Ratio		3.77 ± 3.29	3.72 ± 3.75	0.10	0.92
TG/HDL-C Ratio		1.53 ± 2.21	1.00 ± 1.40	2.03	0.04*
LDL-C/HDL-C Ratio		2.05 ± 2.93	2.25 ± 2.85	0.49	0.63

P ≤ 0.05 (significant of t-test) for patient *vs.* Control for Analysis *;
N=Number of Subject; TC=Total cholesterol; TG=Triglyceride; HDL-C=High Density Lipoprotein Cholesterol; LDL-C=Low density lipoprotein Cholesterol; BMI=Body Mass Index; Yrs=Years.

Table 3: Correlation of TSH with lipid profile parameters among study participants.

Parameters	Patient group r (Pearson)	CI (95%)	P Value#	Control group r (Pearson)	CI (95%)	P Value#
TSH & TC	0.999	0.999	0.0001*	0.153	-0.045-0.339	0.1292
TSH & HDL-C	0.931	0.931	0.0001*	-0.001	-0.206-0.187	0.9227
TSH & TG	0.058	0.058	0.5666	0.135	-0.063-0.323	0.1802
TSH & LDL-C	0.996	0.996	0.0001*	0.172	-0.025-0.356	0.0872

#=determined by pearsons correlation; *P=Correlation is significant at ≤0.05 levels (2-tailed); CI=95% Confidence Interval; r=strength of correlation; (-)=inversely correlation; (+)=proportional correlation; N=Number of Subject; TSH=Thyroid Stimulating Harmone; TC=Total Cholesterol; TG=Triglyceride; HDL-C=High Density Lipoprotein Cholesterol; LDL-C=Low Density Lipoprotein Cholesterol; BMI=Body Mass Index; &=and.

LDL and negative correlation, but not significant between TSH a pond TGs. These findings are similar with the report of Shashi A and Sharma N [31]. They reported positive correlations between serum TSH and TC, TSH and LDL, TSH and HDL, but not with TSH and TG. On the other hand, Waleed HA, et al. [1] reported that TSH had proportional correlation with TC, LDL-C and HDL-C respectively, while TSH and TGs had negative correlation. Attaullah S, et al. [32] reported positive correlation between TSH and LDL-C and TSH and TG while TSH and TC and TSH and HDL-C had positive correlation but not significant in patients with hyperthyroidism. Pinkney JH, et al. [33] investigated the relationships of TSH in newly diagnosed hyperthyroid patients, and observed positive correlations between TSH and lipid profile. Singla G, et al. [34] reported no significant but positive correlation between TSH and lipid profile in hyperthyroid patients. The differences in our findings may be due to changes in resting energy consumption and subsequent loss of weight. The disparities of our findings compared with previous findings [1,32-34] may be due to the differences in the research design and the subjects used in the studies.

Conclusion

Based on our findings in the current study, we conclude that hyperthyroidism may be associated with impaired lipid profile.

Conflict of Interests

The authors declared that there is no conflict of interests regarding the publication of this paper.

Acknowledgments

The authors thank the doctors, medical laboratory scientists and nurses of Aminu Kano Teaching Hospital, Kano, particularly Endocrinology unit and Donor Clinic for their cooperation toward the success of this research. Our gratitude also goes to the participants in this study.

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