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PLASMA LEVELS OF MDA AND LIPID PROFILE IN PATIENTS WITH HYPERTHYROIDISM

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Abstract:

Hyperthyroidism is an endocrine condition of the thyroid gland characterized by low TSH levels and high thyroxine (T4) and triiodothyronine (T3) hormone levels. Our goal was to determine the oxidative status in hyperthyroidism patients by measuring malondialdehyde (MDA) and find out its correlation with the thyroid function hormones and lipid profile in the plasma. Sixty patients with overt hyperthyroidism were included in the study with 30 heathy people with normal thyroid function. The thyroid hormone profile has shown that hyperthyroidism patients have significant (P<0.05) low levels of TSH (0.53±0.11 mIU/mL), but significant (P<0.05) high levels of T3 (6.40±0.91 nmol/L) and T4 (175.36±21.27 nmol/L) in their plasma, compared to normal thyroid people. Hyperthyroidism patients have shown non-significant (P>0.05) alterations in the plasma triglycerides (104.08±17.13 mg/dL), and cholesterol (149.89±12.07 mg/dL), compared to the plasma of normal control. But, they have shown significant (P<0.05) lower levels of HDL (42.39±6.81 mg/dL) compared to the control. Furthermore, hyperthyroidism patients have shown significant (P<0.05) higher levels of MDA (1.63±0.60 µmol/L) in their plasma compared to the plasma of normal thyroid function people (0.54±0.13 µmol/L). The high levels of MDA in hyperthyroidism patients suggested lipid peroxidation, which occurs from an imbalance between oxidants and antioxidants not just in the thyroid gland but also systemically, as assessed in the plasma.

Keywords: Grave's disease, MDA, lipid peroxidation, hyperthyroidism

1. INTRODUCTION

Excess thyroid hormone causes clinical hyperthyroidism, also known as thyrotoxicosis, which can be generated by a variety of illnesses. Prognosis and treatment are influenced by the etiologic diagnosis. In community-based research, the prevalence of hyperthyroidism was estimated to be 2% for women and 0.2 percent for men [1]. Patients above the age of 60 account for 15% of all instances of hyperthyroidism [2].

Hyperthyroidism is defined by an excess of thyroid hormones in tissues, which results in a different clinical state [3-6]. Graves' disease is the leading cause of hyperthyroidism in the United States [4], Thyroid-stimulating antibodies stimulate TSH receptors, inducing thyroid hormone production. Graves' illness is associated with female sex as well as a personal or family history of an autoimmune ailment [7].

Thyroid hormones are required for proper growth, brain development, reproduction, and energy metabolism management. Hypothyroidism and hyperthyroidism are common thyroid illnesses that can have major health consequences. They have an impact on people all around the world. Thyroid disease epidemiology is impacted by a number of variables such as age, smoking status, genetic predisposition, ethnicity, endocrine disruptors, and the advent of novel medicines such as immune checkpoint inhibitors [8].

Oxidative stress is a condition of destructive cells due to the presence of highly reactive materials with electron withdrawing properties called free radicals and reactive oxygen species (ROS) [9-11]. The oxidative damage can found in different sites of the cell, as in the lipids of the membrane, the proteins in membranes or cytoplasm, and the genetic information carriers (RNA and DNA), which all results ultimately in the appearance of apoptotic cells [12]. When the ROS reacts with the membrane lipids, the process is termed lipid peroxidation and the formed lipid peroxides are also considered a highly reactive substances that need to be detoxified [13]. Peroxidation of lipid may be identified by measuring malondialdehyde (MDA), one of the stable end products that can provide an accurate prediction of the oxidative condition [14]. Oxidative stress is linked

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with many pathological conditions, including endocrine disorders [15, 16]. Here we aimed to determine the lipid peroxidation in hyperthyroidism patients and find out the relationship between MDA and lipid profile in these patients.

2. MATERIALS AND METHODS

2.1. Patients

The patients were assessed by the Al-Kindy Teaching Hospital's Endocrinology Department (Baghdad, Iraq). The volunteers made the decision to take part in this project as volunteers after being informed of the standard criteria for the research. For the trial, which ran from March to September 2021, 60 people with overt hyperthyroidism and 30 healthy volunteers were selected.

2.2. Methods

Patients with hyperthyroidism and healthy controls received vein blood after an eight-hour fast. The blood was then well mixed, added to a tube containing heparin, and spun in a medical centrifuge (4000 rpm for 10 minutes). The plasma was subsequently maintained in a deep freezer at -20 °C for spectrophotometric analysis using commercial kits bought through Linear's representative in Spain (Apel PD-303, Japan) to check for triglycerides, total cholesterol, and high-density lipoproteins (HDLs). The Benge and Aust method was used to calculate the MDA level [17]. TSH, T3, and T4 hormone levels were obtained from hospital

2.3. Statistics

In order to compare means in an independent sample t-test and determine the association between MDA and other factors, the data were statistically examined on a computer using the IBM SPSS version 26.0 program. The area under the curve (AUC) of each variable was assessed using the receiver operating characteristic (ROC) curve to determine the sensitivity of protein carbonyl as a diagnostic marker for hyperthyroidism.

3. RESULTS

Age differences between patients with hyperthyroidism (39.779.59 years) and controls (40.8711.32 years) were non-significant (P>0.05). Table 1 shows the characteristics of the voluntarily contributed participants. When compared to those with normal thyroid function, the thyroid hormone profile of hyperthyroidism patients revealed that they had significantly higher levels of T3 and T4 than they did of TSH (0.53 and 0.11 mIU/mL and 6.40 and 0.91 nmol/L, respectively) (Table 1).

Table 1: Characteristics of volunteers people.

Parameter	**Hyperthyroidism**	**Control**	***P*-value**
N	60	30	-
Age (year)	40.87±11.32	39.77±9.59	0.650
TSH (mIU/mL)	1.67±0.39	0.53±0.11	0.0001
T3 (nmol/L)	1.85±0.55	6.40±0.91	0.0001
T4 (nmol/L)	94.97±11.38	175.36±21.27	0.0001
Triglycerides (mg/dL)	101.65±13.49	104.08±17.13	0.465
Cholesterol (mg/dL)	147.13±19.58	149.89±12.07	0.484
HDL (mg/dL)	49.84±7.63	42.39±6.81	0.0001
MDA (µmol/L)	0.54±0.13	1.63±0.60	0.0001

In contrast to the plasma of the normal control (TG 101.6513.49 mg/dL, cholesterol 147.1319.58 mg/dL), hyperthyroidism patients had non-significant (P>0.05) changes in their plasma triglycerides (104.0817.13 mg/dL) and cholesterol (149.8912.07 mg/dL). However, they had significantly (P 0.05) lower HDL levels (42.39 6.81 mg/dL) than the control group (49.84 7.63 mg/dL).

Additionally, patients with hyperthyroidism had significantly (P0.05) greater plasma levels of MDA (1.630.60 mol/L) than those with normal thyroid function (0.540.13 mol/L).

As demonstrated in Table 2, MDA has not been associated with hyperthyroidism patients with

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significant (P>0.05) lipid profile parameters or thyroid profile hormones.

Table 2: Correlations of MDA in hyperthyroidism patients.

Parameter		**TSH**	**T3**	**T4**	**Triglycerides**	**Cholesterol**	**HDL**
MDA	r	0.077	0.171	0.357	-0.150	0.185	-0.118
	P	0.685	0.367	0.052	0.427	0.327	0.535

The MDA ROC curve has demonstrated the value of this biomarker in the diagnosis of hyperthyroidism. As shown in Figure 1, MDA has demonstrated remarkable sensitivity (AUC = 0.988, P0.0001) in the diagnosis of hyperthyroidism patients as compared to the healthy controls with normal thyroid function.

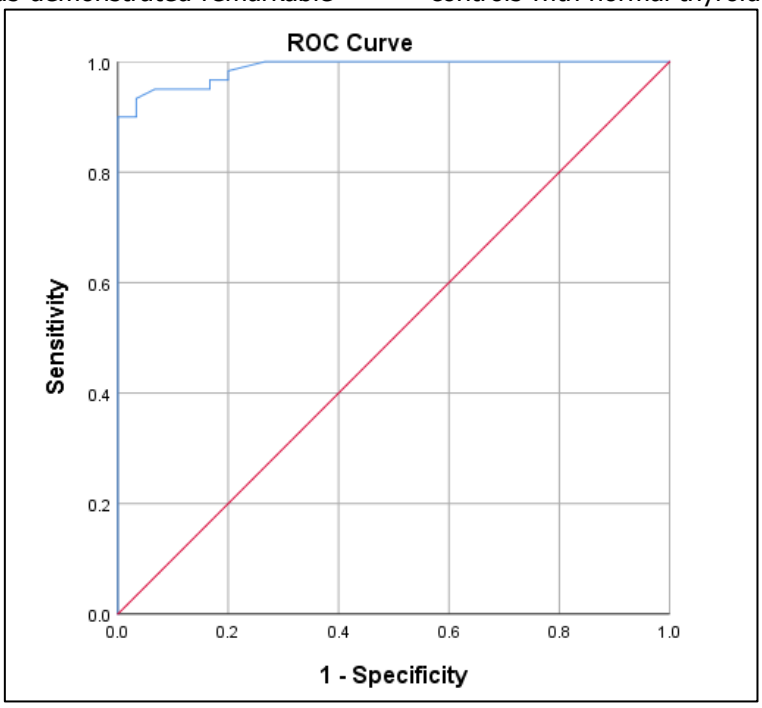

Figure 1: The ROC curve of MDA in the diagnosis of hyperthyroidism disease.

4. DISCUSSION

The findings showed that patients with hyperthyroidism had a changing redox balance and developed oxidative stress. According to Ali et al., hyperthyroidism caused an increase in plasma MDA levels. They came to the conclusion that hyperthyroidism results in a number of metabolic alterations in tissue that make them more vulnerable to oxidative harm [18]. Patients with overt hyperthyroidism experienced the most oxidative damage, according to Erem et al., who showed a significant rise in MDA levels in both subclinical and overt hyperthyroidism patients. Due to the rise in MDA levels, oxidative stress may be predicted with more accuracy, and it also signals lipid level oxidative damage [19].

According to Cetinkaya et al., patients with subclinical hyperthyroidism displayed a considerable rise in MDA levels together with the activity of the superoxide dismutase enzyme. They contend that increased oxidative stress induces an excess of the antioxidant system [20]. Patients with Graves' illness had significantly higher levels of MDA, according to Lassoued et al. They have suggested that individuals with thyroid issues are more susceptible to oxidative damage [21].

According to Rizos et al., thyroid hormones can change the metabolism of HDL by raising the activity of CETP, which switches cholesteryl esters from HDL2 to VLDL and TGs in the opposite direction [22]. With the exception of the considerable decrease in HDLs, all of the lipid measures reported by Altahir et al. in individuals with overt hyperthyroidism [23] were significantly altered. Similar HDL values in patients with

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hyperthyroidism have been reported by Dhannoon et al. [24].

5. CONCLUSION

The overt clinical manifestation of hyperthyroidism has demonstrated the existence of extremely high levels of oxidative stress. Elevated MDA levels in hyperthyroidism patients were a sign of lipid peroxidation. Lipid peroxidation is caused by a systemic imbalance between oxidants and antioxidants, which was discovered in the plasma. Except for a considerable reduction in HDL, the patients' lipid profiles were unchanged. The use of antioxidants is crucial in the treatment of hyperthyroidism due to the harmful effects of oxidative stress.

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