Biomedical Research 2012; 23 (2): 286-288

Oxidative stress status in hypothyroid patients.

Bhawna Bhimte, B.K. Agrawal, V.K. Sharma and Sarika Singh Chauhan

Department of Medical Biochemistry, Gandhi Medical College, Bhopal (M.P.), India
Department of Medicine, Gandhi Medical College, Bhopal 462001. (M.P.), India

Abstract

Thyroid hormone controls various metabolic functions. Hypothyroidism is a clinical condition with reduced thyroid activity. Study intended to appraise the oxidative stress in various degree of Hypothyroidism. Recently detected hypothyroid patients were grouped according to the TSH level into three categories as Group I: TSH level 6-20uIU/dl, Group II TSH level 21-40uIU/dl: & Group III TSH level above 40uIU/dl. Oxidative stress has been assessed by detecting Total antioxidant capacity (TAC) of hypothyroid patients, compared to euthyroid control. Total Antioxidant Capacity was reported to be reduced at baseline in all three groups of hypothyroid patients. After six weeks of thyroxin replacement therapy TAC level has been found to be increased. The reduction of Total Antioxidant Capacity in hypothyroid patients reflects increase oxidative stress in hypothyroidism. Oxidative stress has been associated with early aging and precipitating factor of many anomalous metabolic reactions. Consequently antioxidant therapy should also be included with thyroid replacement therapy.

Key words: Total Antioxidant Capacity, Hypothyroidism, Oxidative stress, Thyroxine

Accepted January 21 2012

Introduction

Thyroid disease in its various forms is common, affecting some 5% of the population. Thyroid hormones are among the most imperative humoral factors involved in setting the basal metabolic rate on a long rate on a long-term basis in target tissues such as liver, heart, kidney and brain [1]. Hypothyroidism, or under activity of thyroid gland, results from either reduced secretion of thyroxine and trioidothyronine that may be correlated with amplified secretion of Pituitary TSH [2].

Oxidants or free radicals are atoms or molecules that are capable of having an independent existence that contain one or more unpaired electrons. These unpaired electrons are highly reactive species that may damage the cells. Antioxidants are the antidote for these free radicals as the quench them and transform them into less reactive forms. TAC measurement not only gives sum of the activities of various anti-oxidative substances but it provides dynamic equilibrium influenced by the interactions between anti-oxidative constituents [3,4].

Study integrated to locate the oxidative stress among hypothyroid patients, and to find out the correlation between the different levels of hypothyroidism and total antioxidant capacity. In addition responsiveness of restoration of hormone replacement has also been studied.

Materials and Method

Prospective study has been carried out in Gandhi Medical College, Bhopal. 100 patients clinically diagnosed as hypothyroid, fulfilling inclusion and exclusion criteria has been enrolled for the study. 50 Age & Sex matched euthyroid were taken as controls.

Inclusion Criteria

Recently detected or poorly cotrolled (not responded to therapy)

Exclusion Criteria

Patients suffering from any other metabolic complications like Diabetes, Cardiac diseases, Smokers or tobacco chewers.

12 hour fasting blood samples were collected and serum was separated immediately. TAC was measured at baseline and tests were repeated after six weeks of therapy.

TSH were measured by microtiter competitive enzyme linked immunoassay [5,6]. Whereas Total Antioxidant Capacity was estimated by Korvacevic [7] method using Spectrometer (Systronics).

Statistical analysis was performed by SPSS-8 software. All the values were expressed as mean±SD. t-test were done by one way ANOVA Students t-test analysis for control, baseline and after therapy comparison. Whereas

Student t-test was performed for evaluation between the groups.

Table 1. *Incidence of hypothyroid patients according to TSH level*

TSH 6-20uIU/dl		**TSH 21-40uIU/dl**		**TSH Above40uIU/dl**	
n=66		**n=12**		**n=22**	
I	**II**	**I**	**II**	**I**	**II**
13.42±4.80	6.30±2.91	28.33± 7.47	6.00±1.75	67.13±16.46	8.95±4.63
P<0.001		P<0.001		P<0.001	

I= Before therapy, II= After 6weeks therapy

Table 2*. Total antioxidant capacity(TAC) in hypothyroid patients before and after therapy compared to controls*

Total Antioxidant Capacity (pg/dl)	**Mean± S.D.**			**F Value**	**P value**
	Control (A)	Before therapy (B)	After 6 weeks of therapy (C)		
	1.6±0.36	1.59±0.26	1.7±0.307	22.427	NS

Table 3. *TAC level in hypothyroid patients as per TSH level before and after therapy*

S.No.	**Parameter**	**TSH 6-20uIU/dl (A)**			**TSH 21-40uIU/dl (B)**			**TSH Above40uIU/dl (C)**		
		Mean± S.D.		t-test	MEAN± S.D.		t-test	MEAN± S.D.		t-test
		n=66			n=12			n=22		
		I	II		I	II		I	II	
1	Total Antioxidant Capacity	1.59± 0.49	1.78± 0.48	2.23 P<0.01	1.4± 0.52	1.72± 0.01	3.19 P<0.001	1.38± 0.42	2.0±0 .43	4.83 P<0.001

Discussion

100 newly diagnosed hypothyroid patients were registered for the study. Hypothyroidism is diagnosed on the basis of increased TSH >6uIU/dl (the higher limit given by kit manufacturer). 100 patients detected hypothyroid has been categorized on the basis of TSH level [2]. Categorization has been done on the basis of literatures and also number of incidences. In order to locate the extent of hormone causing oxidative stress hypothyroid patients were Grouped as follows: Group I: TSH level 6-20uIU/dl, Group II TSH level 21-40uIU/dl: & Group III TSH level above 40uIU/dl. 66 hypothyroid patients had TSH range 6-20uIU/dl, 12 hypothyroid patients had TSH range 21-40uIU/dl and 22 had TSH Above40uIU/dl.

At the baseline of study before initiation of therapy TAC level were found to be decreased in hypothyroid patients as compared to controls. Among all the three groups, value of TAC has been found to be reduced. Table No 2 reveals the TAC levels were decreased in proportionate way of TSH status. Results are noticeable for showing oxidative stress among hypothyroid patients. After six weeks of hormone replacement therapy TAC values were found to be improved indicating decrease in oxidative stress.

Hypothyroidism is defined as a serum thyroid stimulating hormone (TSH) concentration above the statistically defined upper limit of the reference range. Pathological consequences of hypothyroidism point to a high potential for antioxidant imbalance. According to Kale[10] Thyroid hormones accelerate cellular reactions and increase oxidative metabolism. By stimulating enzymes that control active transport pumps, demand for cellular oxygen increases, and as ATP production goes up, heat is produced. Hypothyroidism causes immunosuppression that may lead to oxidative stress.

According to Yilmaz A et.al [11] TSH at a higher concentration may induce secretion of inflammatory cytokines and decrease the antioxidant status while by Carmeli, E., Bachar, A et al [12] from their studies reported Hypothyroidism-associated oxidative stress is the consequence of both increased production of free radicals and reduced capacity of the anti-oxidative defense Variations in the levels of thyroid hormones can be one of the main physiological modulators of *in vivo* cellular oxidative stress due to their known effects on mitochondrial respiration. In particular, it has been suggested that the increase in reactive oxygen species induced by a deficiency of thyroid hormones can lead to an oxidative stress condition in the liver and in the heart and some skeletal muscles with a consequent lipid peroxidative response. [13]. Metabolic

disorder from autoimmune-based hypothyroidism can also increase oxidative stress.

Hypothyroidism undeniably can be risk factor for increased oxidative stress; can eventually lead to many other complications. Antioxidant therapy and antioxidant diet should be advised along with thyroid hormone replacement therapy to diminish further complications.

Acknowledgement

My sincere and deep gratitude towards my guide Dr. B.K. Agrawal and my co-guide Dr. V.K. Sharma for their support and encouragement.

References

1. Pasupathi PP, Latha R. Free Radical Activity and Antioxidant Defense Mechanisms in Patients with Hypothyroidism, Thyroid Science 2008; 3 (12): CLS1-6.
2. Prakash A, Lal AK. Serum Lipids in Hypothyroidism: Our Experience. Indian Journal of Clinical Biochemistry 2006; 21(2): 153-155.
3. Das K, Chainy G.B.: Thyroid hormone influences antioxidant defense system in adult rat brain. Neurochem. Res 2004; 29 (9): 1755-1766.
4. Sarandol E, Tas S, Dirican M, Serdar Z. Oxidative stress and serum paraoxonase activity in experimental hypothyroidism: Effect of vitamin E supplementation. Cell Biochem. Funct 2005; 23 (1): 1-8.
5. Surks MI. A new radioimmunoassay for plasma triiodothyronine: measurements in thyroid disease and in patients maintained on hormonal replacement; J Clin. Invest. 1972; 51(12): 3104.
6. Spencer CA, et.al., "Clinical Chemistry Interlaboratory/Intermethod differences in functional sensitivity of immunometric assay of thyrotropin (TSH) and impact on reliability of measurement of subnormal concentrations of TSH". Clin Chem. 1995; 41: 367.
7. Koracevic D, Koracevic G, Djordjevic V, Andrejevic S, Cosic V. Method for the measurement of antioxidant activity in human fluids. J Clin Pathol 2001; 54: 356-351.
8. Jain A, Verma M, Agrawal BK. Altered Total Antioxidant Capacity and increased Lipid Peroxidation in Protein Energy Malnutrition. Flora and Fauna 2008; 14 (2): 367-370.
9. Komosinska-Vassev K, Olczyk, K, Kucharz EJ, Marcisz C, Winsz-Szczotka K, Kotulska, A.. Free radical activity and antioxidant defense mechanisms in patients with hyperthyroidism due to Graves' disease during therapy. Clinica Chimica Acta 2000; 300: 107-117.
10. Kale M, Umathe SN, Bhusari KP. Oxidative stress and the thyroid. Positive Health 2006 ecognitive.com; 21-27.
11. Yilmaz S, Ozan S, Benzer F, Canatan H. Oxidative damage and antioxidant enzyme activities in experimental hypothyroidism. Cell Biochem Funct 2003; 21 (4): 325-330.
12. Carmeli E, Bachar A, Barchad S, Morad M, Merrick J. Antioxidant status in the serum of persons with intellectual disability and hypothyroidism: A pilot study. Res. Development. Disab. 2008, 29: 431-438.
13. Nanda N, Bobby Z, Hamide A. Association of thyroid stimulating hormone and coronary lipid risk factors with lipid peroxidation in hypothyroidism; Clinical Chem Lab Med, 2008; 46 (5): 674-679.

Correspondence to:

Bhawna Bhimte
Department of Medical Biochemistry
Gandhi Medical College
Bhopal 462001, India