Original Article

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The Serum Levels of Malondialdehyde, Vitamin E and Erythrocyte Catalase Activity in Psoriasis Patients

Biochemistry Section

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ABSTRACT

Background: Psoriasis is a common skin disease which is characterized by increased epidermal proliferation and dermal inflammation affecting 0.1-3% of general population. Most of the psoriasis patients are young or middle aged adults, although no age exempted. The oxidative stress develops due to imbalance in oxidants and antioxidants, which was proposed to have role in psoriasis.

Aims and Objectives: The presented research work was planned to evaluate oxidative stress by measuring serum malondialdehyde (MDA) as oxidant and serum vitamin E, erythrocyte catalase (CAT) activity as antioxidants in psoriasis patients.

Materials and Methods: Total 90 clinically diagnosed psoriasis patients of age group of 20 to 60 years and without any drug therapy for preceding two months and 90 matched healthy controls were included in the presented study. The severity of psoriasis was determined by PASI score. The fasting blood sample collected and accessed for serum MDA, serum vitamin E and erythrocyte catalase activity.

Results: The study results were compiled and statistical analysis was done using students t-test. Our results showed significantly increased levels of serum MDA ($p<0.001$) and significantly decreased serum vitamin E ($p<0.001$) as well as erythrocyte catalase activity ($p<0.001$) in psoriasis patients as compared to controls.

Conclusion: The presented study concluded the oxidative stress in psoriasis, indicated by increased serum MDA and decreased Vitamin E, erythrocyte catalase activity. Our study also supports the possibility of involvement of oxidative stress in pathogenesis of psoriasis.

Keywords: Catalase, MDA, Oxidative stress, Psoriasis, Vitamin E

INTRODUCTION

Psoriasis is a dermatological disorder affecting 0.1 to 3% of general population. Psoriasis is a common chronic, inflammatory and proliferative disease of skin. Most characteristic skin lesions are red, scaly sharply demarcated, indurated plaques [1,2]. Living with psoriasis may have psychological consequences for both patients and their families. Psychological problems can arise from the fillings of the patient about body appearance, social rejection, guilt, embarrassment, emptiness, sexual problems, professional inability [3].

The exact etiological factor for psoriasis is yet not clearly known but genetical factor, trauma, skin infection, drugs, emotional stress, alcohol and smoking etc greatly influences the clinical development of psoriasis [1]. The skin is potential target organ for oxidative injury because it continuously exposed to visible and ultraviolet irradiations and high oxygen concentration. The skin is also major organ for the entry of many airborne environmental pollutants; some of them are free radical generating agents [4]. Since last one decade, the researchers have intensely focused on and proposed the involvement of oxidative stress in psoriasis. This research work was aimed to evaluate the oxidative stress in psoriasis patients by measuring serum malondialdehyde (MDA), vitamin E and erythrocyte catalase (CAT) activity.

MATERIALS AND METHODS

The psoriasis patients visited Department of Skin and V.D., Raichur Institute of Medical Sciences, Teaching Hospital Raichur were studied in the presented research work. The study comprise 90 (30 from each mild, moderate and severe psoriasis) clinical diagnosed psoriasis patients and 90 age and sex matched healthy control subjects. The patients of age group 20 to 60 years and without any drug therapy for preceding two months were selected for the study. The subjects with present or past history of any disease like atherosclerosis, coronary heart disease, diabetes mellitus etc. that may affect the oxidative stress were excluded from study. This research project was approved by institutional ethical committee. The volunteers and the psoriasis patients were properly informed about the project and included in the research work after their consent.

The disease, psoriasis was diagnosed by clinical signs and symptoms as Auspitz sign, erythema, itching, thickening and scaling of the skin. Histopathological examination was done whenever needed to confirm the psoriasis. Psoriasis Area and Severity Index (PASI) score [5] was used to determine the severity and patients were grouped as mild, moderate and severe psoriasis.

Under all aseptic precautions 5 ml fasting blood sample was collected from psoriasis patients as well as normal healthy controls. The collected sample was divided by transferring 1.5 ml to EDTA bulb and 3.5 ml to plain bulb. The serum was separated after clot retraction in plain bulb. This serum sample was used for analysis of MDA [6]. The Lipoproteins in serum sample were precipitated by addition of 20 mg% TCA. Then serum was heated in boiling waterbath with Thiobarbituric Acid (TBA) in sodium sulfate to form the chromogen. The resulting chromogen was extracted in butanol and the absorbance of the organic phase was measured at 530 nm wavelength. The concentration of serum lipid peroxide (MDA) was determined by using the graph of standers prepared using 1,1,3,3 tetra ethoxy propane.

The serum vitamin E concentration was determined as antioxidant [7]. Serum vitamin-E was measured by its power of reducing ferric ions of ferric chloride to ferrous ions which in turn form a red complex with α-α dipyridyl.

The EDTA sample was used to determine the activity of erythrocyte catalase, an enzyme antioxidant [8]. In the ultra violate range hydrogen peroxide (H_2O_2) shows a continual increase in absorbance with decreasing wavelength. The decomposition of hydrogen

Paramete	Controls (Group I)	Psoriasis Patients (Total 90)		
		Mild (Group II)	Moderate (Group III)	Severe (Group IV)
Number of subjects	90	30	30	30
PASI Score	---	21.90± 5.32	50.03 ± 7.46	76.50 ± 8.15
Serum MDA (µmol/Lit)	2.51 ± 0.16	3.14 ± 0.24 *	3.98 ± 0.28 * †	5.92 ± 0.17 * † ‡
Serum Vitamin E (Mg/Lit)	10.64 ± 0.22	9.87 ± 0.16 *	9.12 ± 0.15 * †	8.28 ± 0.12 * † ‡
Erythrocyte Catalase Activity (k/gm of Hb)	311.49 ± 5.62	294.62 ± 4.07 *	272.38 ± 3.77 * †	237.46 ± 3.97 * † ‡

[Table/Fig-1]: Showing PASI score and values off Serum MDA, Vitamin E and erythrocyte catalase activity of normal healthy controls and psoriasis patients
Values are expressed as mean ± SD
(for erythrocyte catalase activity, k is the rate constant of first order reaction)
** p<0.001 as compared to group 1*
† p< 0.001 as compared to group II
‡ p< 0.001 as compared to group III

peroxide was followed directly by decrease in extinction at 285 nm. The difference in extinction per unit time was a measure of the catalase activity.

The results were compiled and statistical analysis was done by using students t-test.

RESULTS

The [Table/Fig-1] depicts the distributions of psoriasis patients according to severity, levels of serum MDA and vitamin E as well as erythrocyte catalase activity of normal healthy controls and psoriasis patients.

Results of presented study showed that the values of serum MDA were significantly higher (p<0.001) in all psoriasis patients than normal healthy controls. It was further found that the concentrations of serum MDA were increased with severity of the psoriasis. The values of MDA were significantly higher in, moderate psoriasis patients than mild psoriasis patients (p<0.001) as well as severe psoriasis patients than moderate psoriasis patients (p<0.001) respectively.

The serum vitamin E and erythrocyte catalase activity was found to be significantly decreased (p<0.001) in all psoriasis patients as compared to normal healthy controls.

The serum levels of vitamin E were decreased significantly in; moderate psoriasis patient than mild psoriasis patients (p<0.001) and also sever psoriasis patients than moderate psoriasis patients (p<0.001) respectively.

Similarly, the erythrocyte catalase activity was found to be significantly low in; moderate psoriasis patients than mild psoriasis patients (p<0.001) and severe psoriasis patients than moderate psoriasis patients (p<0.001) respectively.

DISCUSSION

The psoriasis is recurrent inflammatory skin disease, characterized by marked increase in karatinocyte proliferation as well as abnormal differentiation [1,2]. The intensified interest in this research area speculated relationship between oxidative stress in development or exacerbation of the psoriasis.

The results of earlier studies indicated significant increase in serum levels of MDA [9-12] as well as positive correlation between increased serum MDA level and the severity of psoriasis [13-14]. There were few studies showing non significantly increase or unchanged levels of MDA in the serum of psoriasis patients [15-16].

Numerous studies found significantly decreased levels of serum Vitamin E [15-17] and erythrocyte catalase activity [18-21] in psoriasis patients. Whereas some research work did not found any significant change in the levels of antioxidants like serum vitamin E [16-22] and erythrocyte catalase activity [23] in psoriasis patients.

The presented study showed the significantly increased oxidants (serum MDA) and significantly decreased antioxidants (serum vitamin E and erythrocyte catalase activity) levels in psoriasis patients.

Increased lipid peroxidation is indicated by increased concentration of Malondialdehyde (MDA) [24]. In very early phase of developing psoriasis lesions, macrophages were seen within the epidermis followed by lymphocytes. During subsequent development neutrophils began to appear between the upper layers forming pockets (Micro-abscesses). Neutrophil migration into the epidermis was most pronounced in active disease and occurred in a rhythmic pattern [25].

The infiltrated and activated leukocytes might lead to release ROS via processes like respiratory bust. Polymorphoneuclear (PMN) leukocytes have the potential to damage surrounding tissue by releasing superoxide anion radical produced via NADPH oxidase/ myeloperoxidase which further give rise to other activated oxygen species which all together were known to induce lipid peroxidation. ROS in turn also stimulates PMN recruitment by increasing PMN adhesion to endothelium [26].

The increased generation of ROS, by increased infiltration and activation of PMNs might target cellular polyunsaturated fatty acids for lipid peroxidation, which might indicate by the increased concentration of MDA in serum of psoriasis patients.

The oxidative stress develops due to increased oxidants and/or decreased antioxidants. During oxidative stress there can be the overload of superoxide radicals in the psoriasis. This over formation of the superoxide radical was proposed to inhibit the activity of catalase [27]. This may be one of the reasons for our results of decreased CAT activity. The histological studies of epidermis of psoriasis patients revealed that polymorphonuclear leukocytes get infiltrated in it. These polymorphonuclear leukocytes might releasing cytokines like TNF alpha and interleukins in the surrounding tissues, for which ROS are known to be the mediators of their action [4]. This in turn might trigger the inflammatory reactions that are the basis of psoriasis.

Also, the oxidative stress might be responsible for activation of phospholipase A2 and production of mediators from arachidonate, increased gene expression, deactivation of adenylate cyclase and activation of guanylate cyclase leading to decrease in cAMP/ cGMP ratio. These effects of oxidative stress all together might be responsible for epidermal proliferation [20,28-30].

It was also proposed that the drugs used to treat psoriasis might act as antioxidants and decreasing oxidative stress. Nitric oxide was increased in the serum of psoriatic patients and considered as factor for pathogenesis of psoriasis. It was observed that the level of NO was decreased during the treatment of psoriasis by betamethasone (topical) [31]. It was also found that topical application of α-tocopherol reduces the content of lipid peroxidation product in human skin [32].

Psoriasis risk was significantly decreased by intake carrots, tomatoes and fresh fruit. The consumption of vegetable and fruits may be beneficial in psoriasis due to their high content of various antioxidants such as carotenoids, flavonoids and vitamin C [33].

CONCLUSION

The presented study concluded the oxidative stress in psoriasis, indicated by increased serum MDA and decreased Vitamin E, erythrocyte catalase activity. Our study also supports the possibility of involvement of oxidative stress in pathogenesis of psoriasis.

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