

OXIDATIVE STRESS IN ACNE VULGARIS

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ABSTRACT

Objective: Acne vulgaris is a common dermatological disease characterized by sebaceous hyperplasia, follicular hyperkeratinization, Immune reactions, and Inflammation. Our study aims to determine the role of oxidative stress in the pathogenesis of acne vulgaris.

Methods: 35 acne patients and 35 healthy people were selected and their serum levels of superoxide dismutase SOD and Malondialdehyde MDA were estimated and the results are compared with the control group. Also, the relationship between the duration and severity of acne with the parameters is assessed.

Results: The activity of SOD is found to be decreased and the level of MDA is found to be increased in acne patients compared to healthy people, suggesting increased oxidative stress in Acne vulgaris patients.

Conclusion: Our study concludes that oxidative stress plays a role in the pathogenesis of Acne vulgaris and antioxidants can be used as a part of treatment.

Keywords: Acne vulgaris, Oxidative stress, Serum malondialdehyde (MDA), Serum superoxide dismutase (SOD)

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INTRODUCTION

Acne vulgaris is one of the common skin disorders affecting the pilosebaceous unit in the skin. It is characterized by seborrhea, comedones (blackhead and whitehead), papules, pustules and sometimes scarring of the skin [1]. It is exclusively a human disease most commonly affecting sebaceous follicles of the face, chest, and back. It affects about 85% of adolescents and begins in the prepubertal period. It usually regresses spontaneously, but in about 5% of cases, acne will persist beyond the age of 24 and may extend up to the fourth and fifth decades of life [2].

The pathogenesis of Acne is multifactorial. It mainly involves excess sebum production, abnormal keratinization of follicles, Propionibacterium acnes colonization, and inflammation of the follicle and surrounding dermis [3].

The experience of acne may not be life-threatening per se, but it does carry significant psychological disability with it. Higher levels of depression, anxiety, anger, and suicidal thoughts are noted in acne patients [4]. Studies have shown that patients with acne have a more significant impairment of mental health compared to many other chronic conditions like epilepsy, diabetes, etc [5, 6].

The gravity of the involvement of oxidative stress in the pathophysiology of acne had been a matter of question over the past few years. Various studies have shown that patients with acne are under increased oxidative stress, both systemic and cutaneous [7]. Reactive oxygen species production by neutrophils will cause irritation and destruction of the follicular wall and are thought to be responsible for inflammatory progression. Inadequate antioxidant production and/or excess reactive oxygen species production leads to oxidative stress. Oxidative stress contributes to the development of Acne [7-9]. Although Acne vulgaris is a common skin disease affecting both sexes of the second decade, only a few studies are done to assess the antioxidant status of acne. The present study aims to determine the role of oxidative stress in different grades of *Acne vulgaris* and to determine a possible link with clinical severity.

MATERIALS AND METHODS

Study design

Hospital-based cross-sectional study done at the Department of Biochemistry and Dermatology, Government Medical College

Hospital, Thiruvananthapuram. The study period was one year after getting approval from the ethical committee (IEC. No.01/28/2014/MCT).

Sample size

35 acne vulgaris patients diagnosed by a dermatologist serve as cases and 35 healthy volunteers served as controls aged between 13-35 y included in the study [10].

Inclusion criteria

Acne patients, clinically diagnosed, both male and female, between 13-35yrs of age.

Graded using "The Global Acne Grading System" (GAGS)-is a quantitative scoring system in which the total severity score is derived from the summation of six regional subscores. Each is derived by multiplying the factor for each region by the most heavily weighted lesion within each region (factor for forehead and each cheek is 2, chin and nose is 1, and chest and upper back is 3) (1 for \geq one comedone, 2 for \geq one papule, 3 for \geq one pustule and 4 for \geq one nodule). The regional factors were derived from consideration of surface area, distribution, and density of pilosebaceous units.

Exclusion criteria

Patients with systemic illness, with the habit of smoking or alcohol abuse, those who are on treatment (systemic or topical) for the prior three months, and those who are not willing to participate in this study are excluded. The comparative group is taken from the preventive clinic. (otherwise, healthy people come for routine vaccination).

Collection of samples

About 5 ml of fasting blood sample was drawn under strict aseptic precautions and centrifuged serum sample was stored at -200C.

SOD activity was measured by using the kit of Fortress Diagnostics Limited based on colorimetry [11]. Malondialdehyde was measured by the method of Draper and Hadley [12].

RESULTS

Statistical analysis was performed using SPSS for windows version 22

The mean and standard deviation for quantitative variables and percentage for qualitative variables were calculated for 35 acne vulgaris patients and 35 healthy volunteers.

The Chi-square test was used to compare differences in the percentage of qualitative variables between the groups. Differences in means of quantitative variables between the two groups were compared by student t-test. Differences in means of quantitative variables between various groups of patients were calculated by ANOVA test *p-value* of less than 0.05 is considered significant.

Socio-demographic parameters

Age distribution among patients and healthy volunteers

In the present study, the highest prevalence of acne was found to be in the age group less than 20 y followed by 20-24 and 25-29 y; the last two groups shared an equal prevalence of 28.6%

Biochemical parameters

Gender distribution among patients and healthy volunteers

In the present study, 65.7% of cases were females and the rest 34.3% were males. In controls, 54.3% were females, and rest 46.7% were males

Severity among cases

The cases were graded according to the global acne grading system and in the present study, 37.1% of cases were having mild acne, another 37.1% were having moderate acne and the rest 25.7% of cases were having severe acne vulgaris.

Duration among cases

In this study, 31.4% of cases had the disease for more than 3 y, 14.3% had the disease for 2-3 y, and another 14.3% have the disease for 1-2 y. 40% of the cases had the disease for only one year.

Table 1: Serum SOD among acne patients and controls

Category	N	SOD		t	p
		Mean	SD		
Case	35	105.13	33.75	6.301	<0.001

(*P* value<0.001: statistically significant, using student’s t-test)

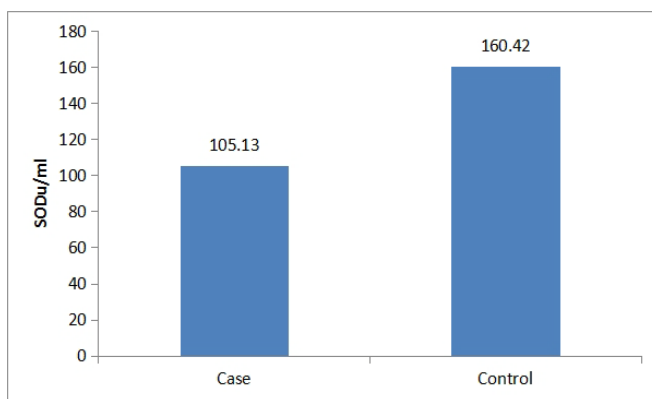


Fig. 1: Serum SOD among acne patients and controls, the mean SOD value among acne patients (n=35) is 105.13units/ml and that of healthy controls (n=35) is 160.42. The difference was found to be statistically significant (*P* value<0.001)

Table 2: Serum MDA among acne patients and controls

Category	N	MDA nmol/dl		t	p
		Mean	SD		
Case	35	106.17	20.03	5.390	<0.001
Control	35	84.69	12.45		

(*P* value<0.001: statistically significant)

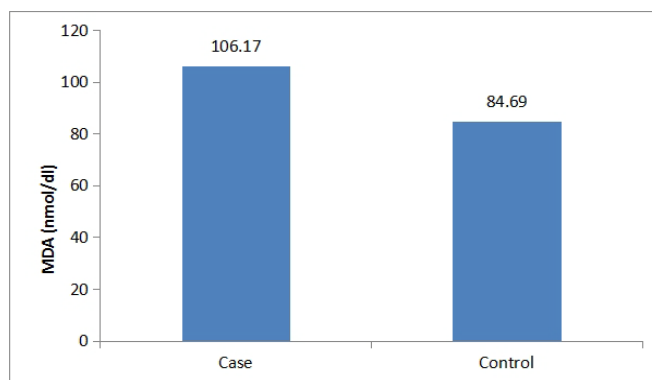


Fig. 2: Serum MDA among acne patients and controls, the mean MDA value among acne patients (n=35) is 106.17 nmol/dl and that of healthy controls (n=35) is 84.69 nmol/dl. The difference was found to be statistically significant (*P* value<0.001)

Table 3: Serum SOD and MDA among different severities of acne patients

Severity	N	SOD units/ml	MDA nmol/dl
		mean±SD	mean±SD
Mild	13	101.30±30.91	104.85±21.09
Moderate	13	98.64±21.20	111.38±20.46
Severe	9	120.03±48.90	100.56±18.10
Total	35	105.13±33.75	106.17±20.03
F		1.216	.814
P		0.310	.452

Although serum SOD is found to be highest among the severe group of acne, it turned out not to be significant statistically, and also there is no statistically significant relation between MDA among different severities of acne.

Table 4: Serum SOD and MDA among different age groups of acne patients

Age	N	SOD units/ml	MDA nmol/dl
		Mean/SD	Mean±SD
<20	28	137.2±47.7	93.6/20.1
20-24	20	130.9±43.8	98.1/21.9
25-29	14	146.8±39.8	92.6/14.7
>30	8	97.2±43.2	100.1/23.0
Total	70	132.8±45.9	95.4/19.8
F		2.259	.436
P		.090	.728

There is no statistically significant relation between SOD among different age groups of acne and also no statistically significant relation between MDA among different age groups of acne.

DISCUSSION

This hospital-based cross-sectional study was done to determine the extent of oxidative stress in acne vulgaris. In the present study, various biochemical parameters like serum superoxide dismutase, and malondialdehyde, were analyzed among 35 acne vulgaris patients and 35 healthy volunteers.

In this study, 35 acne vulgaris patients and 35 healthy volunteers in the age group of 13-35 y were selected.

In the present study, the highest prevalence of acne was found to be in the age group less than 20 y followed by 20-24 and 25-29 y. The last two groups shared an equal prevalence of 28.6%. In this study, 65.7% of cases were females and the rest were males. In controls, 54.3% were females, and the rest were males. The cases were graded according to the global acne grading system and in the present study, 37.1% of cases were having mild acne, another 37.1% were having moderate acne and the rest 25.7% of cases were having severe acne vulgaris. In this study, 31.4% of cases had the disease for more than 3 y, 14.3% had the disease for 2-3 y, and another 14.3% have the disease for 1-2 y. 40% of the cases had the disease for only one year.

The mean SOD value among acne patients is 105.13units/ml and that among healthy controls is 160.42u/ml. The difference was found to be statistically significant (p -value<0.001).

The mean MDA value among acne patients is 106.17ng/dl and that of healthy controls is 84.69ng/dl. The difference was found to be statistically significant (p -value<0.001)

This result is similar to many studies. In a study conducted by Al-Shobaili *et al.*, 50 acne vulgaris patients with varying levels of severity according to the global acne grading system and 40 age and sex-matched controls were evaluated. In their study, they found out that SOD levels are low and MDA levels were high in acne patients compared to healthy volunteers. The difference was also statistically significant (p <0.001) [13].

In another study conducted by M A Ibrahim *et al.*, 40 acne vulgaris patients and 36 age and sex-matched controls are evaluated for oxidant-antioxidant status. A highly significant decrease in SOD and other antioxidant enzyme activity (p -value<0.001) and a highly significant increase in serum MDA (p -value<0.001) were detected in patients compared to healthy controls [14]. Similar results were obtained in a study conducted by G Sarici *et al.* [4].

Another study done by Al-Shobaili *et al.* found that plasma levels of SOD and catalase were lower and MDA was higher in patients compared to healthy people [15]. Similar results were obtained in a study done by AhemmadSali sahib *et al.*, where serum MDA was significantly elevated in acne patients compared to control (p -value<0.001) [16]. Lower levels of SOD in acne patients compared to controls are obtained in a study conducted by Pinar Y *et al.* [10].

There is no significant association between any of the parameters with age group, disease severity, or disease duration among acne patients. This also agrees with the study of Ibrahim *et al.* [14].

Also, there are a few studies that disagree with the result of the present study. A study conducted by Gaber, M. A *et al.* on 27 acne patients and 10 controls showed a significantly higher level of SOD and MDA in acne patients compared to controls (p -value<0.001) [17].

In another study done by El Garemetal, 50 acne patients were compared with 20 healthy controls. Although the result came as higher SOD in acne patients compared to controls, that was found not to be statistically significant [18]. Another study done by Arican, Ozer, *et al.*, came up with the result of elevated SOD and MDA in patients compared to the control (p -value<0.001) [19].

In a study done by Fattahet *et al.*, 23 acne patients were compared with 23 age and sex-matched controls. There was no significant difference in SOD and MDA levels between cases and controls [20]. In a recent study by Awad *et al.* in 60 patients, 40 control found significantly higher serum MDA in acne patients compared with control subjects with lower Total antioxidant activity (TAC) [21], and another study by Moazen M *et al.* also shows higher serum MDA in acne patients compared with control [22].

A recent study shows that oxidative stress plays a major role in the pathophysiology of acne through several other pathways, such as PPARs, mTOR, and TLRs [23]. Another study states that it is due to the anti-oxidative property, vitamin A derivatives can be used for the treatment of acne vulgaris [24].

LIMITATIONS OF STUDY

This study involved a smaller group of participants, so there is a need for larger studies in the future. This study didn't measure the effects of oxidative stress markers after treatment with antioxidants. As the present study was done on a particular area, further studies are needed to confirm the results in other racial groups.

FUTURE PERSPECTIVES

The effects of antioxidant therapy on oxidative stress biomarkers have to be studied in detail in the future. Also, studies should be made to know whether local or systemic antioxidant therapy is more beneficial.

CONCLUSION

Our present study shows that oxidative stress plays a key role in the pathogenesis and progression of acne vulgaris. Biomarkers of oxidative stress are elevated in acne vulgaris patients irrespective of the degree of severity. Antioxidants can be used as an effective method of treatment in Acne Vulgaris patients.

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AUTHORS CONTRIBUTIONS

Conceptualization is by Jisha. R, M. Saboorabeegum. The methodology by Jisha. R, M. Saboorabeegum and Yogapriya V. Formal analysis and investigation did by Jisha. R, M. Saboorabeegum, Yogapriya V. Writing-original draft preparation by Jisha. R. Review and editing by Jisha. R and Yogapriya V. Resources are taken from the Departments of Dermatology and Biochemistry, Government medical college Thiruvananthapuram, Kerala. Supervision done by M. Saboorabeegum.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest.

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