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Short Communication

Squalene Role in the Pathogenesis of Acne Vulgaris

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INTRODUCTION

Acne is the most common dermatologic disorder in humans which commonly occur in adolescent age between 15 to 25 years. It occurs due to the inflammation of hair follicles and propionium bacteria. The four main factors in the pathogenesis of acne vulgaris are Keratinization, Excess sebum production, Colonization by *P. acnes* and Inflammation. The human sebum is dominantly made up of triglycerides and fatty acids adding up to 57.5% of total lipids followed by wax esters (26%), squalene (12%) and cholesterol (4.5%). Sebum production is regulated by many factors that activate pathways involved in cell proliferation and differentiation, lipogenesis, hormone metabolism, and cytokine release [1]. Among the lipids squalene is the main cause of the acne, squalene buildup in the sebaceous gland may be linked to an over expression or increase in the activity squalene-synthase in the cells: or it may be related to decreased level or activity of the enzymes involved in the conversion to cholesterol [2]. Specifically, sebum of patients with acne contains lipoperoxides resulting from the peroxidation of the lipid squalene [3]. Squalene may cause pore clogging triggers inflammation, causing the body to produce a different inflammatory substances called Interleukin-6.

DESCRIPTION

Research was conducted on a single scalp hair tissue of 20 healthy (both male and female) and 20 acne affected patients using FTIR-ATR spectroscopic technique. Study on biochemical called biomarkers of proteins and lipids was done using FTIR-ATR method. For this, human scalp hair tissues were soaked in acetone for 1 minute and soaked in double distilled water later. The hair roots were taken into laminar dry airflow to remove water thoroughly. Since water is good absorbent of IR radiation, it affects the actual spectral response of the tissue dominated in the FTIR spectrum of the hair tissue sample. The roots of the hair samples was placed on the IRE (Internal reflectance element) diamond crystal on ATR accessory and spectrum recorded, using the principle of total internal reflectance. The spectra of healthy and acne patients were baseline corrected and normalized at a particular vibrational band, recorded in mid IR region (4000-450 cm^{-1}).

From the average overlaid spectrum of healthy subjects and acne hair tissues as shown in Figure 1. Sensitivity exhibited by the FTIR spectral bands of protein and squalene lipids shows these are the biomarkers responsible for the disease acne. Using the absorption values, four internal ratio parameters (IRPs) R_1, R_2, R_3 and R_4 were calculated; The Protein, Amide I, Amide II and Squalene levels in acne are higher when compared with healthy individuals.

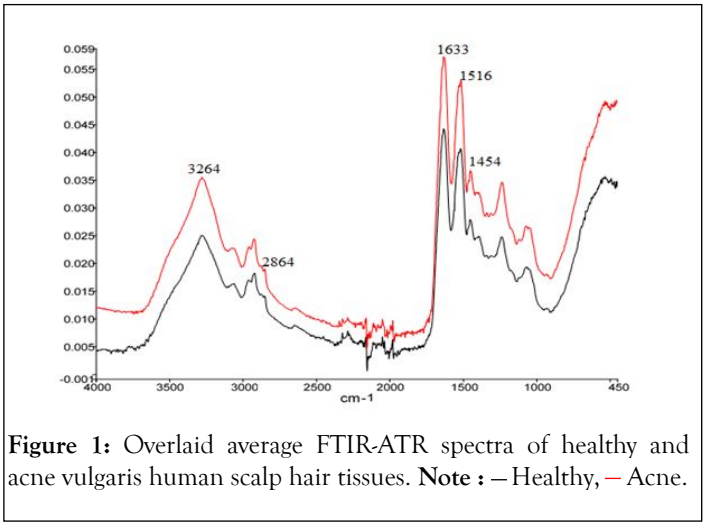

Figure 1: Overlaid average FTIR-ATR spectra of healthy and acne vulgaris human scalp hair tissues. **Note :** — Healthy, — Acne.

STATISTICAL ANALYSIS

The internal parameter of R_1 (3264/2864), R_2 (1633/2864), R_3 (1516/2864) and R_4 (1454/2864) of acne hair tissue ignores the difference in the amount of sample under investigation, it nullifies the contradiction in the quantity of the sample and gives measured out exact deviation in observed results from internal ratio parameter calculations. The data obtained from internal ratio parameters is picturized using histograms as shown

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in Figure 2. Protein and Lipid shows the increase in height of the histogram of acne vulgaris. The results of IRP ratios compared with the group statistical data, which are exactly similar to the mean values of internal parameter ratios. The statistical test was carried out for these four intensity ratio parameters are shown in Table 1.

The mean intensity ratio R_1 level is 2.0460 ± 0.3584 in acne patients and 1.6971 ± 0.1485 in healthy ones. R_2 level is 4.2167 ± 1.3056 in acne and 2.8878 ± 0.5313 in healthy subjects, R_3 level is 3.8105 ± 1.2124 in acne patients and 2.6356 ± 0.4868 in healthy ones. R_4 level is 2.6935 ± 0.7971 in acne patients and 1.7591 ± 0.3603 in healthy ones. Among all the IRPs acne vulgaris protein and lipid values of acne vulgaris scalp hair tissues are high when compared with the healthy persons.

	Group	N	Mean	Std. Deviation
Protein/ Lipid	Acne vulgaris	20	2.046	0.3584
	Healthy	20	1.6971	0.1485
Amide I/ Lipid	Acne vulgaris	20	4.2167	1.3056
	Healthy	20	2.8878	0.5313
Amide II/ Lipid	Acne vulgaris	20	3.8105	1.2124
	Healthy	20	2.6356	0.4868
Squalene/ Lipid	Acne vulgaris	20	2.6935	0.7971
	Healthy	20	1.7591	0.3603

Table 1: Group statistics T-Test of hair tissues of healthy and acne vulgaris tissues of protein, Amide I, Amide II, Squalene.

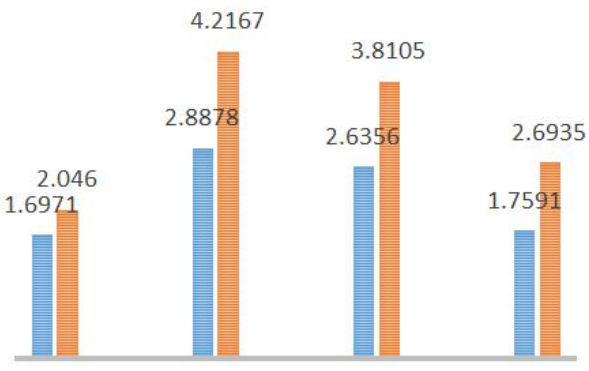

Figure 2: Histogram indicating the mean intensity ratios of healthy and acne vulgaris hair tissues of Protein/Lipid, Amide I/Lipid, Amide II/Lipid and Squalene/Lipid. **Note:** Healthy persons hair tissue, Acne vulgaris patients hair tissues.

Observed results are analyzed using an independent samples t-test, where the p-value p=0.000 and "Sig" was less than 0.05; for the ratios of (R_1, R_2, R_3, R_4) where the variances are unequal, and value of 'Sig' (2), observed to be 0.005, 0.002, 0.002 and 0.004.

This analysis revealed a significant difference between healthy subjects and acne patients. Several studies also done in china and Brazil showed association between lipid profiles with acne vulgaris [4,5]. Squalene reported to be highly sensitive to oxidation and researchers reported that both squalene and its oxidized metabolites found at much higher levels in acne vs. healthy controls [6]. The data's obtained also give satisfactory results. Thus, the variance was found to be different in healthy subjects and acne patients, which indicated that the spectral variations have provided significant differences in the healthy subjects and acne vulgaris scalp hair tissues.

CONCLUSION

Even though the causes of acne vulgaris is unpredictable, and research works also going on, in this study we look it in a different angle using FTIR-ATR technique. Thus, FTIR-ATR spectroscopic technique shows, very well results in detecting quantity variation in the functional groups present in the tissue components such as lipid squalene and proteins using noninvasive single human scalp hair tissue.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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