Pattern of skin surface lipids in some South-Western Nigerians with acne vulgaris

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Summary
Unanswered questions still exist regarding pathophysiology of acne vulgaris generally and particularly in this environment.

Methods: Skin surface lipid (SSL) samples were collected by the heptane sponge technique from faces of 20 Nigerians with facial acne vulgaris and 25 controls. The subjects were classified into mild and moderately severe acne groups. Total cholestrol and triglycerides were determined and expressed in percentage (%) while Undetermined Skin Surface Lipids (USSL) (free fatty acids + squalene + wax ester + diglycerides) were computed.

Results: Triglycerides and total cholesterol levels were significantly higher in subjects with acne vulgaris compared with controls (p < 0.001 and p < 0.029 respectively). There was a progressively significant increase in triglycerides from control, though mild to moderately severe acne vulgaris subjects (P < 0.01) in all cases. In contrast there was a significant progressive decrease in USSL among the three groups (P < 0.001) in all cases. No significant difference was evident for all the values on comparison of female subjects with male subjects. There were however, significant increases in triglycerides and significant decreases in USSL levels for both male and female subjects with acne vulgaris compared with their respective controls (P < 0.02, P < 0.01, P < 0.03 and P < 0.014).

Conclusion: Alterations in composition of SSL may in part be the pathophysiological basis of inflammatory acne vulgaris. Severity of the disorder appears to parallel triglyceride level but there was no association with sex. Triglycerides and total cholesterol levels are lower in SSL in this environment compared with hotter climates.

Keywords: Acne vulgaris, Skin surface lipids (SSL), Triglycerides, Total cholesterol, USSL.

Résumé
Introduction: Des questions sans réponses existent encore en ce qui concerne la pathophysiologie de l’acné vulgarise en général et dans ce milieu en particulier.

Méthodes: Les prélèvements des lipides de la surface de la peau (SSL) ont été collectionnés dans les figures de 20 Nigerians atteints de l’acné vulgarise faciale et 25 contrôles à travers la méthode héptane éponge. Les patients ont été classés en groupe de l’acné moyen et sévèrement modérée. Le cholestérol total et les triglycerides ont été décidés et expérimentes en pour pourcentage (%) alors que les lipides de la surface de la peau non déterminées (USSL) (l’acide grass libre + squalene + ester gras + diglycerides) ont été calculées. Résultats: Des triglycerides de et le niveau total du cholestérol étaient manifestement plus élevés chez les patients avec l’acné vulgarise par rapport aux contrôles (P < 0.001 et P < 0.029 respective). Il y avait une augmentation importante progressive en matière des triglycerides dans le contrôle, chez des sujets de moyen a l’acné vulgarise sévère (P < 0.01) dans tous les cas. Par contraste, il y avait une diminution progressive importante en matière de USSL parmi les trois groupes (P < 0.01) dans tous les cas. Aucune différence importante était indiquée pour toutes les valeurs quant on avait comparé les patients femmes avec les patients hommes. Toutefois, il y avait une augmentation importante dans les triglycerides et une diminution importantes dans les niveaux de l’USSL pour patients hommes et femmes, les deux, avec l’acné vulgarise par rapport a leurs contrôls respective (P < 0.2, P < 0.03, et P < 0.014).

Conclusion: Changement apporté a la composition de SSL pourrait en partie être la base pathophysiologique de l’acné vulgarise inflammatoire. La sévérité du trouble parait être au même niveau avec la triglyceride mais il n’y avait aucune association avec le sexe. Les niveaux des triglycerides et cholestérol total sont en baisse en ce qui concerne SSL dans ce milieu par rapport avec des climates plus chaud.

Introduction
Many questions still remain unanswered on the pathophysiology of Acne vulgaris.1 Over 80% of adolescents suffer from Acne vulgaris.2,3 Post-adolescent acne vulgaris represent an increasingly important population of acne vulgaris sufferers.1,3 Etiological factors of acne vulgaris are excessive sebum production, hyperkeratinization of the pilosebaceous duct follicles and bacterial colonization with propionibacterium acne.4,5,6,7 The contribution of sebum has been exploited in therapeutic agents for the suppression of acne vulgaris. Sebum is the main source of SSL.8,9 Climatic conditions may affect the evolution of acne vulgaris.10 Previous reports were carried out in Saudi Arabia with dry warm tropical climate,10 and in Europe and North America with temperate climate.11 However, there are no reports on the composition of skin surface lipid and its relationship to the development of acne vulgaris from a humid warm tropical climate such as is found in the South-Western part of Nigeria. There are conflicting reports on racial and ethnic differences in the severity of acne vulgaris. Additionally, in this sub region, there is paucity of reports on the prevalence of acne vulgaris. This study was therefore conceived to address this gap in knowledge.

Materials and subjects

Subjects
Twenty (9 males, 11 females) subjects with facial acne vulgaris were selected and grouped into mild acne and moderately severe acne according to the modified system of Leeds.15,16 This method was based on counting inflamed lesions, non-inflamed lesions and scars (mild ≤ 20, moder-
gently severe > 20 to ≤ 40, severe > 40 to ≤ 80 and very severe > 80).

Twenty-five (15 males, 10 females) subjects without facial acne vulgaris were selected as controls. Both patient and control groups were age matched (range 18 to 32 years). The exclusive criteria for both groups were manifestation of any other skin disease such as eczema, ringworm or any form of dermatitis.

**Collection and extraction of SSL samples**

The selection site for the subjects was Medical Hostels of UCH, Ibadan. Skin surface lipids samples were collected using sponge soaked in heptane from all 45 subjects according to the modified method of Zohair et al. within 4 - 12 hours after the subject last had a bath. All subjects were instructed not to apply face cosmetics on the day of sample collection. The lipid contents of the samples were recovered from the sponge by extraction with heptane of analytical grade (Hopkins and Williams Ltd., England) using the modified method described by Zohair et al. The solvent was allowed to evaporate at room temperature within 30 minutes in a shallow watch glass of known weight. The lipid extract and the container were measured using single pan electronic balance (Mettler AE 240, Metler England). The difference in weight of the container gives the weight of the dried lipid extract. The weighed lipid residues were reconstituted with sufficient volumes (ml) of heptane to give 1mg lipid/ml as described previously, which was employed as the working sample.

**Method**

The total cholesterol and triglyceride concentrations of the lipid extract were determined within one hour using the modified enzymatic methods of Alain et al. and Buccolo and David respectively employing chemical kits supplied by Human (Human Diagnostica, Germany).

Humatrol, quality control samples (Human Diagnostica, Germany) were used for quality assessment. The controls were included in each batch of analysis. The undetermined lipid fractions were computed by subtracting the sum of total cholesterol and triglyceride from 100% as previously described by Zohair et al. (1mg lipid/ml = 100%)

**Statistical analysis**

Data obtained were subjected to statistical analysis. Means, standard deviations and students t-tests were computed using SAS statistical package (SAS Institute Inc., Cary, NC). Results were expressed as Mean ± SD. Data were also subjected to one way analysis of variance (ANOVA). The 5% (P < 0.05) level of significance was adopted for significant findings.

**Result**

Tables 1 to 5 show the results obtained from this study.

**Subjects with acne vs controls**

Triglyceride level was significantly increased in patients compared with controls (P < 0.001). Total cholesterol was similarly increased in subjects with acne vulgaris compared with controls (P < 0.029). In contrast there was a significant decrease in the level of undetermined lipids in acne vulgaris sufferers compared with control (P < 0.001) (table 1).

**Moderately severe acne, mild acne subjects vs controls**

There was a significant progressive increase in the levels of triglycerides from controls to the moderately severe group (P < 0.01) (table 2). No similar observation was evident in total cholesterol when the three groups were compared (P > 0.05) in all cases. A trend opposite to that of triglycerides was also evident when undetermined lipid levels were compared in all three groups (P < 0.001).

**Male subjects with acne vulgaris vs male controls**

Comparison of skin surface reveals that triglyceride level was significantly higher in male subjects with acne vulgaris than in controls (P < 0.02). There was no significant difference in total cholesterol level in

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**Table 1** Triglycerides, total cholesterol and undetermined skin surface lipids in subjects with acne vulgaris and controls

<table>
<thead>
<tr>
<th>Composition of SSL</th>
<th>Subjects with acne vulgaris</th>
<th>Controls</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 20)</td>
<td>(n = 25)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triglycerides (%)</td>
<td>30.7 ± 0.5</td>
<td>25.2 ± 2.1</td>
<td>4.019</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total cholesterol (%)</td>
<td>3.4 ± 1.3</td>
<td>2.7 ± 0.9</td>
<td>2.241</td>
<td>&lt;0.029</td>
</tr>
<tr>
<td>Undetermined (%)</td>
<td>66.1 ± 4.5</td>
<td>72.1 ± 9.6</td>
<td>3.771</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Values are means ± SD*

**Table 2** Triglycerides total cholesterol and undetermined skin surface lipids in subjects with moderately severe acne vulgaris, mild acne vulgaris and controls

<table>
<thead>
<tr>
<th>Composition of SSL</th>
<th>Subjects with moderately severe acne vulgaris</th>
<th>Subject with mild acne vulgaris</th>
<th>Controls</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 9)</td>
<td>(n = 11)</td>
<td>(n = 25)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triglycerides (%)</td>
<td>32.5 ± 3.8</td>
<td>29.3 ± 3.4</td>
<td>25.2 ± 2.1</td>
<td>9.627</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Total cholesterol (%)</td>
<td>3.6 ± 0.8</td>
<td>3.3 ± 1.7</td>
<td>2.7 ± 0.9</td>
<td>2.648</td>
<td>&gt;0.08</td>
</tr>
<tr>
<td>Undetermined (%)</td>
<td>63.9 ± 4.2</td>
<td>67.9 ± 3.9</td>
<td>72.1 ± 0.6</td>
<td>9.030</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Values are means ± SD*

**Table 3** Triglycerides, total cholesterol and undetermined skin surface lipids in male subjects with acne vulgaris and male controls

<table>
<thead>
<tr>
<th>Composition of SSL</th>
<th>Male subjects with acne vulgaris</th>
<th>Male controls</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 9)</td>
<td>(n = 15)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triglycerides (%)</td>
<td>29.0 ± 3.5</td>
<td>24.5 ± 4.7</td>
<td>2.482</td>
<td>&lt;0.020</td>
</tr>
<tr>
<td>Total cholesterol (%)</td>
<td>3.4 ± 1.8</td>
<td>2.5 ± 0.9</td>
<td>1.673</td>
<td>&gt;0.105</td>
</tr>
<tr>
<td>Undetermined (%)</td>
<td>68.2 ± 4.0</td>
<td>73.0 ± 0.5</td>
<td>2.289</td>
<td>&lt;0.030</td>
</tr>
</tbody>
</table>

*Values are means ± SD*
Table 4  Triglycerides, total cholesterol and undetermined skin surface lipids in female subjects with acne vulgaris and female controls

<table>
<thead>
<tr>
<th>Composition of SSL</th>
<th>Female subjects with acne vulgaris</th>
<th>Female Controls</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 11)</td>
<td>(n = 19)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triglycerides (%)</td>
<td>32.1 ± 3.7</td>
<td>26.3 ± 5.6</td>
<td>2.836</td>
<td>&lt; 0.010</td>
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<tr>
<td>Total cholesterol (%)</td>
<td>3.4 ± 0.8</td>
<td>3.0 ± 0.9</td>
<td>1.274</td>
<td>&lt; 0.21</td>
</tr>
<tr>
<td>Undetermined (%)</td>
<td>64.4 ± 4.2</td>
<td>70.6 ± 6.1</td>
<td>2.287</td>
<td>&lt; 0.014</td>
</tr>
</tbody>
</table>

Values are means ± SD

Table 5  Triglycerides, total cholesterol and undetermined skin surface lipids in male and female subjects with acne vulgaris

<table>
<thead>
<tr>
<th>Composition of SSL</th>
<th>Male subjects with acne vulgaris</th>
<th>Female subjects with acne vulgaris</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 9)</td>
<td>(n = 11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triglycerides (%)</td>
<td>29.6 ± 3.5</td>
<td>32.1 ± 3.7</td>
<td>1.929</td>
<td>&lt; 0.067</td>
</tr>
<tr>
<td>Total cholesterol (%)</td>
<td>3.4 ± 1.8</td>
<td>3.4 ± 0.8</td>
<td>0.008</td>
<td>&lt; 0.989</td>
</tr>
<tr>
<td>Undetermined (%)</td>
<td>68.2 ± 4.0</td>
<td>64.4 ± 4.2</td>
<td>2.0543</td>
<td>&lt; 0.053</td>
</tr>
</tbody>
</table>

Values are means ± SD

Key:
SSL = Skin surface lipids
Undetermined = Free fatty acid + Squalene + wax esters + diglycerides

Male subjects with acne compared with male controls (P > 0.05). The level of undetermined lipids in male subjects with acne was also significantly lower than in male controls (P < 0.03) (table 3).

Female subjects with acne vulgaris vs female controls
The level of total cholesterol was similar in both female patients and controls (P > 0.05). Like the male acne sufferers there was significant increase in the level of triglycerides when the two groups were compared (P < 0.01) (table 4). Again as in the male acne vulgaris patients the level of undetermined lipids was significantly lower in female patients than controls (P < 0.014).

Female patients vs male patients
The levels of total cholesterol, triglycerides and undetermined lipids in female patient were not significantly different from those of male acne vulgaris patients (P > 0.05) in all cases (table 5).

Discussion
Acne vulgaris has been associated with disorder of the sebaceous glands of the skin. Data from this study indicate significant elevations in skin surface cholesterol, triglycerides and reduction in USSL in patients with acne vulgaris compared to controls. The significant increase in both triglycerides and total cholesterol imply that both contributed to the development of acne vulgaris in the subjects. This corroborates the earlier reports that acne vulgaris results from excessive production of sebum, which is a secretion of the sebaceous gland of the skin.

Additionally, there was progressive statistically significant elevations of triglycerides and non-significant progressive elevation of total cholesterol in controls, mild and moderately severe acne vulgaris. This further implicates skin surface triglycerides in the development and severity of acne vulgaris. An observation earlier made by Milton et al., that glandular activity of sebaceous gland is higher in those with acne vulgaris than in normal individuals.

It was also observed in this report that there was no statistically significant difference in the mean values for triglycerides, total cholesterol and USSL in female subjects with acne vulgaris compared with their male counterparts. This may suggest that gender may not be a contributory factor in the prevalence and severity of acne vulgaris.

The mean triglyceride and total cholesterol levels found in the female and male subjects without acne vulgaris were 26.3%, 3.0% and 24.5%, 2.5% respectively. These values were lower than the values reported by Zohair et al., in hotter but less humid environments. These investigators reported that Saudi females and males have triglycerides and total cholesterol values of 37.6%, 4.3% and 33.6%, 3.9% respectively. The lower triglycerides values found in this environment in this current report may be as a result of increase in lipolysis of triglycerides converting some to diglycerides and free fatty acids by bacteria. Kellum and Thomas et al. have noted that skin surface triglycerides are converted to free fatty acids and diglycerides by the process of lipolysis through bacterial action. The bacterial lipolytic action might be favoured in this warm and humid environment as humidity favours bacterial growth.

It appears that alteration in the composition of human skin surface lipids may be related to the development of inflammatory acne vulgaris in this environment. The severity of the disease appears to parallel increase in triglycerides level, but there is no association with sex. Furthermore, triglycerides and total cholesterol have lower values in the composition of skin surface lipids in this environment compared with those in hotter less humid climates such as Saudi Arabia. The implications are not clear at the moment.

References


