Facial Sebum Levels and Its Relationship With the Severity of Acne Vulgaris in African Adolescents

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INTRODUCTION

Acne vulgaris is a chronic inflammatory disorder of the pilosebaceous unit which usually begins in adolescence and also affects a large proportion of young adults. It is multifactorial disease, arising as a result of interplay of four pathogenic mechanisms which include excessive sebum production, follicular hyperkeratinization, microbial colonization of the pilosebaceous unit by propionibacterium acnes and the release of inflammatory mediators into the follicle and surrounding dermis.[1] Its clinical picture varies from mild comedonal acne to a fulminant systemic disease.

Appearance, particularly facial appearance, represents an important aspect of one's perception of body image.[2] Acne vulgaris is a common condition in adolescence, a vulnerable stage in human development where individuals become more self-conscious of their appearance and beauty and therefore this condition can have devastating physical and psychological effects on these individuals, affecting their quality of lives.[3]

Management of acne has become more pro-active and involves management of early lesions to prevent acne complications like scarring and hyperpigmentation. This is achieved through management of the different pathogenic mechanisms involved in acne formation.

Sebum plays a central role in the pathogenesis of acne and excessive sebum production is usually considered to be a prerequisite for the development of acne, with subsequent hypercornification of the pilosebaceous duct leading to microcomedone and then visible comedone formation.[4] Many factors contribute to sebum production and its production might be altered by environmental factors such as temperature and humidity.[5]

Several conflicting studies on sebum secretion and its relation to acne severity exist.[6-8] Cunliffe *et al* [6] found that acne is associated with excess sebum level and that the severity of acne is directly related to the levels of sebum.

There is a paucity of studies on the level of sebum and its relationship with the severity of acne in black Africans. This study will therefore provide baseline information on whether facial sebum levels correlate significantly with the severity of acne vulgaris especially in black Africans, which may potentially influence future management strategies of patients with acne vulgaris in the tropics.

AIMS AND OBJECTIVES

To determine the prevalence, pattern and severity of acne vulgaris, and also determine the relationship between facial sebum levels and the severity of acne vulgaris in African adolescents.

METHODOLOGY

This was a cross-sectional study conducted in randomly selected secondary schools (four) in Ibadan, the city at the junction of the savannah and the forest. Ibadan is the capital city of Oyo State and the third largest metropolitan area by population in Nigeria. This was done after an ethical approval from the Research and Ethics Committee of the University College Hospital Ibadan. Permission was also obtained from the Ministry of Education, Oyo State, Nigeria.

Three hundred an eighty-eight study participants were recruited between August and September

2013. Male and female patients aged between 10 to 19 years, attending various arms of the secondary schools (Junior and Senior classes) were included in the study, excluding those on medical/surgical treatment or chemical peeling for acne (last 6 months).

At the screening assessment, participants' completed a pro-forma. Information obtained included subject's bio-data, acne history, previous treatment for acne and nature of treatment where applicable. Routine physical and skin examination, including the weight and heights of participants (to calculate the body mass index), were performed.

Acne lesions in affected subjects were counted, including the inflammatory and non-inflammatory types. The combined acne severity scale (CASS) was used to grade acne severity into mild, moderate or severe acne.

Sebum casual levels expressed as $\mu g/cm^2$ were then recorded using a sebumeter® which provide a direct measure of sebum secretion. Taking into consideration the regional differences in facial sebum secretion, sebum from adjacent regions of a high sebum secreting zone (forehead), and a low sebum secreting zone (both cheeks) were measured, to reflect regional discrepancies.

Sebum was measured on four sites on the face of each subject. The first site was on the forehead at a fixed point, one centimeter above an imaginary line between the medial boundaries of both eyebrows and then an adjacent site just near it and an average value taken for the forehead sebum measurement. For the cheek, site chosen was the prominence over the zygomatic process of the right cheek and a site just adjacent to it, with an average value also taken.

However, it is known that the amount of sebum secreted is approximately constant with time and body site for a given individual. As advised by the manufacturers of the device, subjects were instructed not to apply make-up or cream on their faces on the day of the study. In order to avoid problems associated with circadian variation in the number of actively secreting sebaceous follicles on the face, all measurements were taken between 10 a.m. and 12 p.m.

Data retrieved was analyzed with SPSS V.16. The independent or explanatory variables of interest in this study were sebum levels, sex, age, BMI among others. Factors associated with acne were assessed using Pearson's Chi square test. Independent Student's t-test was used to compare means between patients with and without acne. Fisher's Exact was used where assumptions for Pearson Chi square test was not met. Mann Whitney U test was used to determine if there was any significant difference between sebum levels in various sexes, while Kruskal-Wallis test was used to determine if there was any statistically difference in sebum levels among different age groups.

Multivariate analysis was performed using logistic regression model for variables that had statistical significant association with acne ($p<0.05$).

RESULT

A total of 388 respondents were included in the study, of whom 198 (51.0%) were male and 190 (48.9%) female. The mean age of the subjects was 15.2 years (range: 10-19 years). The overall prevalence of acne in this study was 81.9%. Using the combine acne severity scale, most of the subjects had mild acne 198 (63.26%), with moderate acne seen in 107 (34.2%) and severe acne in 8 (2.56%) subjects.

The overall median casual sebum levels was 50 $\mu g/cm^2$ (IQR: 20 - 95) for the forehead and 45 $\mu g/cm^2$ (IQR: 20 - 95) for the cheek. There was a rise in forehead casual sebum levels: from 30 $\mu g/cm^2$ in early adolescence (10-13 years), to 70 $\mu g/cm^2$ in late adolescence (17-19 years); p value-0.0001. Similar findings were found on cheek sebum analysis.

There was a significant increase (p-value 0.002) in forehead sebum with each severity scale. Severe acne had the highest sebum levels and mild acne the lowest. This was also observed with cheek sebum but was not statistically significant (p-value 0.047)

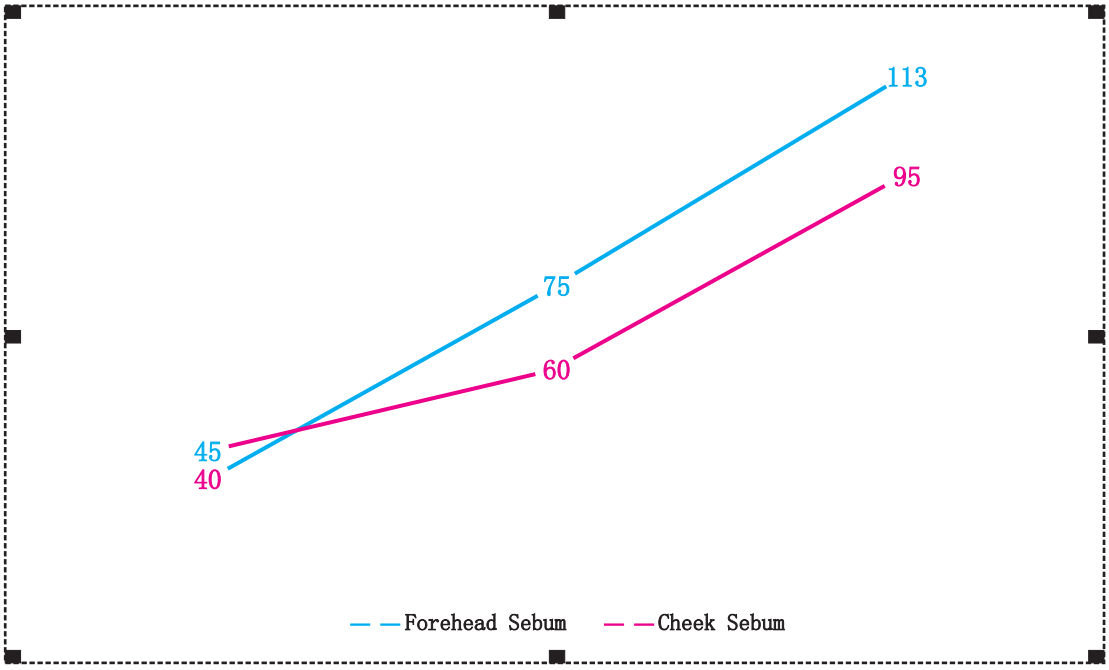

Figure 1. Correlation between acne severity and sebum levels

Significant factors associated with acne severity included; forehead sebum levels (p-0.0012), duration of acne vulgaris in years (increasing with greater number of years, p-0.0063), diet (oily food, carbonated drinks and fast foods majorly, p-0.003), and truncal acne (p-0.004). Those that had previously used topical creams (bleaching creams majorly) as acne treatment also had worsened acne severity (<0.0001). Family history of acne did not significantly affect the severity of acne from this study.

Table1. Factors associated with acne severity

FACTORS	Mild Acne	Moderate Acne	Severe Acne	p-value
Forehead Sebum (Median, IQR)	40 (20-90)	75 (40-120)	113 (55-145)	0.002*
Cheek Sebum (Median, IQR)	45 (20-95)	60 (20-95)	95 (48-113)	0.415
Duration of lesion (Mean, SD)	1.7 (1.5)	2.4 (1.9)	2.1 (1.7)	0.006*
Age (Mean, SD)	15.3 (1.9)	15.7 (1.8)	15.9 (1.1)	0.103
Previous topical creams (n, %)	48 (26.4%)	57 (54.3%)	5 (62.5%)	0.001*
Sex (n, %)				
Males	95 (48.2%)	56 (53.3%)	6 (75.0%)	0.266
Females	102 (51.8%)	49 (46.7%)	2 (25.0%)	
Diet (n, %)				
No	64 (35.8%)	19 (19.0%)	2 (28.6%)	0.003*
Yes	55 (30.7%)	52 (52.0%)	2 (28.6%)	
Truncal involvement (n, %)	6 (6.3%)	8 (14.3%)	3 (60.0%)	0.004*
Family History (n, %)				
Yes	116 (59.5%)	57 (54.3%)	5 (71.4%)	0.520
No	79 (40.5%)	48 (45.7%)	2 (28.6%)	

* Signficant P value

Table 2: Independent predictors of acne

	B	S.E	OR	p-value	95% CI
*Diet	1.467	0.465	4.34	0.002	1.7 – 10.8
Seasonal variation	0.822	0.566	2.11	0.146	0.8 – 6.9
*Age	0.189	0.076	1.21	0.013	1.0 – 1.4
*BMI	0.146	0.056	1.16	0.009	1.0 – 1.3
*Forehead Sebum	0.009	0.003	1.01	0.004	1.0 – 1.0

*statistically significant. OR- odds ratio

A multiple linear regression as shown in the table below was modeled with variables that showed positive association and the combined acne severity scale was fitted into the model. Increasing forehead sebum levels, longer duration of acne and prior history of treatment were independently linked with worsening acne severity.

Table 3: Independent predictors of acne severity

	B	S.E	p	95% CI
Forehead Sebum	0.004	0.002	0.01	0.001 – 0.007
Cheek Sebum	-0.001	0.002	0.702	-0.004 – 0.002
**Duration*	0.050	0.022	0.026	0.006 – 0.093
**Prior Topical creams*	0.177	0.074	0.017	0.032 – 0.333
Trunk Involvement	0.144	0.102	0.159	-0.057 – 0.345

DISCUSSION

The prevalence of acne vulgaris in this study population was 81.9%. When compared with previous studies done in the same environment, 35% by Ogunbiyi et al [9] and 54.7% by Okoro[10], it suggests that acne vulgaris is becoming a much more common problem amongst adolescents in this environment, as compared with those in western world, ranging between 79% to 95%, and was 100% in a US study.[11-14] Previous studies done in Africa have been reportedly lower, with prevalence rates between 42.5% to 58.9%. [15, 16] However, in a recent study, Yahaya noted acne prevalence of 90.7% in Kaduna, northern Nigeria.[17]

This is the first study to our knowledge that evaluates facial sebum levels in relation with the severity of acne in African adolescents. The overall median causal sebum level (forehead) was 50 (20-95) μg/cm^2 and cheek sebum level was 45 (20-95) μg/cm^2. The overall sebum level was slightly lower than from a previous study done in African subjects by Okoro et al [18] (median sebum levels 73.10 μg/cm2).

The varying results noted may be influenced by the different geographical location of the studies as this present study was conducted in cooler part of the country in Nigeria (western Nigeria). The overall sebum levels in these studies of African subjects were however noted to be lower than seen in Caucasians and other racial groups[19-20]. Environmental factors including temperature, humidity and possibly genetics may play a role in the observed variation in different geographical

location and races.[20] Nutrition may also play a vital role [21-22] and so more studies in this environment are needed to validate these findings.

There was a direct correlation between casual sebum levels and acne severity, with the highest levels of forehead sebum in those with severe acne as opposed to those with mild and moderate acne. Two previous studies had also corroborated this finding in other racial groups [23- 24] and even though Powell et al [25], in a separate study, found no correlation between the 2 variables, the reasons for the contrary findings were proposed be technical and a smaller sample size was also used[26].

Using an objective bioengineering method, as was done in this present study, Choi et al [27] showed significant positive correlation between causal sebum level and the number, proportion and location of acne lesions in a large study group with acne. They also found higher sebum levels associated with inflammatory lesions, which is indicative of a greater acne severity in their study.

Acne usually occurs in patients with seborrhea and severity of acne has been directly correlated with the degree of seborrhea. Acne however usually regresses post-adolescence in most people despite a persistently raised sebum level. Even though increased sebum is known as a major pathogenic mechanism in acne formation, Youn et al [28] is of the opinion that seborrhea is merely an aggravating factor and not a direct cause of acne lesions. Apart from facial sebum level, other factors were also found to be associated with worsening acne in this study and attaining statistical significance included duration of acne lesions, previous use of topical bleaching creams, diet and truncal acne. More clinical studies in this environment are needed to corroborate these findings.

In conclusion, facial sebum levels correlate directly with the severity of acne vulgaris in African adolescents and reduction of seborrhea in these patients will reduce attendant complications of acne including formation of scars and hyperpigmentation and with resultant indiscriminate use of topical bleaching creams

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