Comparative Study of Erythrocyte Sedimentation Rate (ESR) and Estrogen Level in Adolescent Women with ACNE Vulgaris in Azare Bauchi State

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ABSTRACT

Acne vulgaris is a common dermatological condition, affecting up to 85% of adolescents globally, particularly during puberty when sebaceous gland activity is heightened due to hormonal changes. Acne predominantly affects both genders but presents more severely in females, particularly during adolescence when hormonal fluctuations are most prominent. This study aimed to evaluate the hematological and biochemical indices in adolescent women with acne vulgaris. With three groups, each consisting of six participants. Group one which is a group of married women three of which are normal and three abnormal followed by group two, which is the group of unmarried adolescent women with three normal participant and three abnormal, then lastly group three for early stage of puberty within the range of 13-17 years with 3 normal and 3 abnormal also. Making the total number of 18 participants. This cross-sectional study design to assess the hematological and biochemical indices of adolescent females aged 13 to 23 years, diagnosed with acne vulgaris, from June 2024 to August 2024. Blood samples (5 mL) were collected via venipuncture and stored in EDTA tubes. Hematological indices were analyzed using an automated hematology analyzer (Sysmex KX-21N). Two biochemical indices: - Erythrocyte Sedimentation Rate (ESR) and Estrogen, were included in the analysis. The ESR values range widely from 0.5 to 88 mm/h, with a mean of 18.58. Estrogen levels also show a wide range, from 9 to 326.39 pg/ml, with a mean of 115.74. Further analysis revealed equal distribution of Ance vulgaris among the participants. This study provides valuable insights into the hematological and biochemical indices of adolescent women with acne vulgaris. The findings reveal notable variations in the hematological and biochemical parameters of the female cohorts.

Key words: Acne vulgaris, Adolescents, Azare, Biochemical, Hematological

INTRODUCTION

Acne vulgaris is a common dermatological condition, affecting up to 85% of adolescents globally, particularly during puberty when sebaceous gland activity is heightened due to hormonal changes (Almeman et al., 2024). In Nigeria, acne vulgaris is also prevalent, with studies reporting significant occurrence among adolescents, including secondary school students (Brown et al., 2024). Acne predominantly affects both genders but presents more severely in females, particularly during adolescence when hormonal fluctuations are most prominent (Polaskey et al., 2024). Acne vulgaris is caused by several factors including excess sebum production, follicular hyperkeratinization, bacterial colonization (*Cutibacterium acnes*), and inflammation (Almeman et al., 2024). While the role of androgens is well-established, other factors like diet, stress, and genetics are also significant contributors (Huang et al., 2024). Beyond its dermatological manifestations, acne can also result in systemic inflammatory and metabolic changes. For instance, acne patients have been found to exhibit elevated pro-inflammatory cytokines, which worsen lesion formation and scar development (Mavranezouli et al., 2022).

Furthermore, changes in lipid metabolism such as increased levels of triglycerides and cholesterol have been observed in individuals with severe acne, suggesting the condition may reflect broader systemic dysregulation (Luo *et al.,* 2024).In peri-urban/Urban regions such as Azare in Katagum Local Government Area, Bauchi State, access to dermatological care and awareness of acnerelated conditions may be limited. Environmental and cultural factors, including diet, climate, and exposure to pollutants, may also influence acne severity (Polaskey *et al.,*2024). Research in other parts of Nigeria has found a high prevalence of acne among adolescents, but little focus has been placed on the urban areas, leaving a significant gap in understanding (Brown *et al.,* 2024). Consequently, exploring the hematological and biochemical indices in adolescent women with acne vulgaris in this area could provide critical insights into the pathophysiology of the condition, as well as its potential systemic implications.

Beyond the physical symptoms, acne vulgaris also has a significant psychological impact, particularly on adolescents. Individuals with acne, especially women, are often at risk of developing low self-esteem, social anxiety, and depression (Ryguła*et al.,* 2024). The psychological burden of acne often exacerbates the severity of the condition, leading to a cycle of poor mental health and worsening skin outcomes (Ayanlowo*et al.,* 2020). These psychosocial effects are further amplified in regions like Azare, where stigma related to physical appearance may be more prevalent due to cultural factors which includes Religious, Traditional beliefs, Community Gossip and Social Judgment (Ryguła *et al.,* 2024).Several biochemical markers have been identified as potential indicators of acne severity. Elevated serum lipid levels, altered glucose metabolism, and changes in white blood cell counts have been observed in acne patients, highlighting a state of systemic inflammation (Falodun *et al.,* 2022).

These findings suggest that acne may not only be a localized skin disorder but also a manifestation of broader metabolic or inflammatory imbalances (Heng *et al.,* 2021).

Thus, exploring these hematological and biochemical markers in a specific population such as adolescent women in Azare is crucial for a comprehensive understanding of acne's systemic impact.Treatment options for acne have evolved over the years, ranging from topical medications to systemic therapies aimed at reducing inflammation and controlling sebum production (Saiboo *et al.,* 2024). However, the effectiveness of these treatments may vary depending on an individual's biochemical profile. Patients with underlying metabolic imbalances, for instance, may not respond as well to standard treatments (Otlewska *et al.,* 2020). Therefore, personalized approaches to acne treatment that consider hematological and biochemical markers are necessary to improve therapeutic outcomes, especially in underserved populations like those in rural Nigeria (Almeman *et al*., 2024). Acne vulgaris is a multifaceted condition influenced by various factors, including hormonal changes, metabolic dysfunction, and systemic inflammation. While the physical manifestations of acne are well-documented, its systemic effects, particularly on hematological and biochemical indices, are less understood, especially in rural regions. This study aims to address this gap by investigating these indices in adolescent women in Azare, Katagum Local Government, Bauchi State.

MATERIALS AND METHODS

Study Area

The study was conducted in Azare, the headquarters of Katagum Local Government Area, located in the northern region of Bauchi State, Nigeria. Azare is a semi-urban area with a population that is predominantly Hausa-Fulani. The town has a projected population of approximately 150,000 people and is situated at latitude 11.674°N and

longitude 10.190°E. The region is characterized by its savannah vegetation, warm climate, and seasonal rain patterns, which may influence certain dermatological conditions. The local population largely relies on farming, small-scale trading, and public service as their major economic activities. Healthcare services in Azare include primary health centers, general hospitals, and private clinics, which cater to a diverse population, including adolescents with dermatological conditions like acne vulgaris. The study was conducted at the Federal Medical Center (FMC) Azare, which has a dermatology department and laboratory facilities capable of handling the hematological and biochemical assessments required for the study.

Study Design

The study employed a cross-sectional study design to assess the hematological and biochemical indices of adolescent women with acne vulgaris. A cross-sectional design was chosen because it allows for the simultaneous collection of data on the exposure (hematological and biochemical markers) and outcome (acne severity) at a specific point in time. The study period was from June 2024 to August 2024. The participants included adolescent females aged 13 to 23 years, diagnosed with acne vulgaris. This design allowed the researchers to establish a snapshot of the relationship between acne severity and blood/biochemical markers, offering insights into possible diagnostic and management approaches for acne vulgaris.

Sampling Technique

A random sampling technique was employed to select 18 participants from the dermatology outpatient clinic at Federal Medical Center (FMC) Azare**.** The sample size of 18 was determined based on the study's design, resource availability, and the prevalence of acne vulgaris in the study population**.** Patients who met the inclusion criteria were randomly selected, and those who declined participation were replaced using the same random selection process.Inclusion and Exclusion Criteria

Inclusion Criteria

Female adolescents aged 13 to 23years.

Diagnosis of acne vulgaris confirmed by a dermatologist.

Willingness to participate and provide informed consent (or parental consent for minors).

Ethical Clearance

Ethical approval for the study was obtained from the Bauchi State Ministry of Health Research Ethics Committee. Informed consent was sought from all participants, and for those below 18 years, parental or guardian consent was also obtained. Participants were informed about the purpose of the study, potential risks, and benefits.

Confidentiality of participants' data was strictly maintained, and individuals were assigned unique identification numbers to protect their identities. Participation in the study was voluntary, and participants were allowed to withdraw at any time without any penalty or loss of healthcare services. Blood sample collection was conducted under strict aseptic conditions to minimize discomfort and risk.

Data Collection Methods

Hematological Analysis

Blood samples **(**5 mL**)** were collected via venipuncture and stored in EDTA tubes to

prevent clotting. Hematological indices were analyzed, with the erythrocyte sedimentation rate (ESR) measured using the Westergren method, a widely accepted technique for assessing inflammation (Smith *et al.*, 2021).

Biochemical Analysis

Blood samples for biochemical analysis were collected and stored in serum-separating tubes. The biochemical analysis for this study focused on evaluating key markers that are potentially linked to the severity of acne vulgaris, particularly in adolescent women. A significant biochemical indicesestrogen, was included in the analysis, given its relevance to the inflammatory and hormonal aspects of acne pathogenesis described by Robert Fåhræus and Alf Westergren in 1921**.**

Data Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 22. Descriptive statistics were used to summarize the demographic and clinical data. T-tests and ANOVA were conducted to compare hematological and biochemical indices across the different grades of acne severity. Pearson correlation analysis was used to assess the relationship between hematological/biochemical markers and acne severity. A p-value of <0.05 was considered statistically significant.

Limitations of the Study

Confounding Variables: Dietary habits, lifestyle factors, and genetic predispositions were not controlled, which may have influenced the results.

Sample Size Constraints: Due to resource limitations, the sample size may not have been large enough to generalize the findings to a broader population.

Single-Center Study: The study was conducted in a single hospital in Azare, which may limit its applicability to other populations.

RESULTS

Socio-Demographic Data of the Participant

Participants' ages range from 13 to 23 years, with a mean age of 19.5±2.28, indicating a young population with minimal age variability. The ESR values range widely from 0.5 to 88 mm/h, with a mean of 18.58 ±21.61, reflecting considerable variation in inflammation levels among participants. Estrogen levels also show a wide range, from 9 to 326.39 pg/ml, with a mean of 115.74± 92.79, suggesting significant hormonal variability within the group (table 1).

Table 1: Descriptive Statistics

Parameters	Minimum	Maximum	Mean±SD
Age (yrs)	16	23	19.5±2.2816
Erythrocyte Sedimentation Rate (mm/h)	0.5	88	18.583±21.6117
Estrogen (pg/ml)	9	326.39	115.7389±92.79385

Distribution of Acne Vulgaris among Study Participants

The result as presented in (figure 1) indicates an equal distribution of acne vulgaris among the study participants. Out of a total of 18 individuals, 50% (9 participants) were observed to have acne vulgaris, while the remaining 50% (9 participants) did not. This balanced distribution suggests that acne vulgaris was present in half of the population sample analyzed.
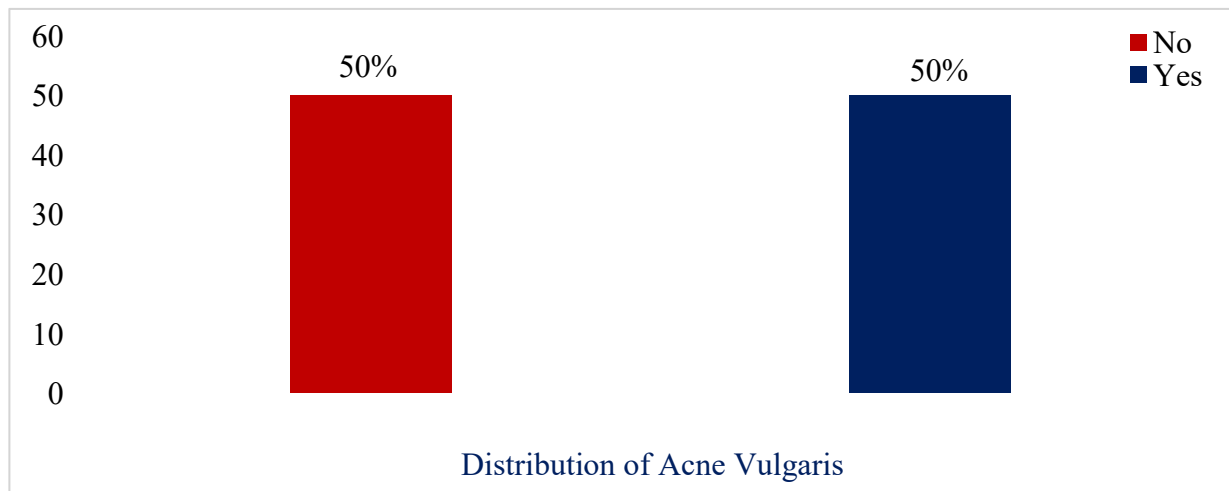
Figure 1: Distribution of Acne Vulgaris among Study Participants.

Comparison of Age, Erythrocyte Sedimentation Rate, and Estrogen Levels in Participants with and without Acne Vulgaris

Comparing age, erythrocyte sedimentation rate (ESR), and estrogen levels between participants with acne vulgaris (N=9) and those without (N=9). The mean ages of both groups are very similar (19.67 vs. 19.33 years), with no statistically significant difference (P=0.767). ESR values are higher in participants with acne (mean 20.94 mm/h) compared to those without (mean 16.22 mm/h), but the difference is not significant (P=0.657). Similarly, estrogen levels show a slight increase in the acne group (mean 122.59 pg/ml) compared to those without acne (mean 108.89

pg/ml), but this difference is also not statistically significant (P=0.765) (table 2).. Generally, the findings reveal that there is no significant differences in these hematological and biochemical parameters between participants with and without acne.

Table 2: Comparison of Age, Erythrocyte Sedimentation Rate, and Estrogen

Parameters	NO (N=9) Mean±SD	YES (N=9) Mean±SD	T	P-value
Age	19.67±2.397	19.33±2.291	33.557	0.767
Estrogen (pg/ml)	108.889±68.184	122.59±116.375	-0.305	0.765
Erythrocyte Sedimentation Rate (mm/h)	16.22±15.627	20.94±27.125	-0.453	0.657

Levels in Participants with and without Acne Vulgaris.
Distribution of Acne Vulgaris among participants .

Comparison of Age, Erythrocyte Sedimentation Rate, and Estrogen Levels by Marital Status and Early Puberty

The compares age, erythrocyte sedimentation rate (ESR), and estrogen levels across married, unmarried, and early puberty participants. Age shows a significant difference (P=0.0001), with unmarried participants being the oldest (mean 21.67 years), followed by married participants (mean 20 years), and early puberty participants being the youngest (mean 16.83 years). ESR values are highest among unmarried individuals (mean 25.08 mm/h), followed by early puberty participants (17.67 mm/h) and married individuals (13 mm/h), though these differences are not statistically

significant (P=0.648). Estrogen levels are highest in married participants (mean 156.92 pg/ml) and lowest in early puberty participants (90.54 pg/ml), but this variation is also not statistically significant (P=0.432).

Overall, only age differences are significant, while ESR and estrogen levels do not show statistically meaningful variation between the groups (table 3).

Table 3: Comparison of Age, Erythrocyte Sedimentation Rate, and Estrogen Levels by Marital Status and Early Puberty

	Married (N=6)	Unmarried (N=6)	Early puberty age 13 to 17 (N=6)	F	P-value
Parameters	Mean±SD	Mean±SD	Mean±SD		
Age (yrs)	20±0.894	21.67±1.506	16.83±0.408	33.557	0.0001
ESR (mm/h)	13±18.243	25.08±32.653	17.67±9.993	0.446	0.648
Estrogen (pg/ml)	156.92±98.541	99.76±117.096	90.54±52.452	0.889	0.432

DISCUSSION

Findings from our study provide significant insights into hematological parameters and acne vulgaris distribution among the participants. The ages of the participants ranged from 16 to 23 years, a typical adolescent and young adult population, with a mean of 19.5 years. This age range aligns with the known peak prevalence of acne vulgaris in adolescence and early adulthood, as reported in previous studies (Eichenfield*et al.,* 2021; Anaba *et al.,* 2020). Acne vulgaris affects approximately 50% of the population in this age group, which is consistent with the balanced distribution observed in our sample (9 with acne and 9 without). This confirms that the prevalence of acne in this study mirrors global and regional trends as reported in similar epidemiological studies (Ayanlowo *et al.,* 2020; Del Rosso *et al.*, 2024).

More so, this result aligns with findings from previous research, where systemic inflammatory markers showed minimal correlation with the presence of acne (Chilicka *et al.,* 2020; Saiboo *et al.*, 2024). This suggests that while acne is an inflammatory condition, localized cutaneous inflammation may not always be reflected in systemic hematological markers. Prior research has similarly noted that acne severity does not always correlate with changes in systemic inflammation markers (Abdelhamed*et al.,* 2022; Baldwin, 2020).

The comparison between married, unmarried, and early puberty participants revealed significant differences in age but no significant differences in hematological parameters such as ESR. The statistically significant variation in age (P = 0.0001) is expected, given that the early puberty group comprises younger participants. However, the lack of significant variation in hematological parameters across these groups suggests that marriage and puberty onset may not substantially affect these parameters, a finding consistent with previous literature (Brown *et al.,* 2024).

Furthermore, when comparing participants based on erythrocyte sedimentation rate (ESR) and estrogen levels, the wide range observed in these parameters reflects the variability in inflammatory and hormonal status within this young population. The mean ESR (18.58 mm/h) with a high standard deviation (21.61) suggests that

while some participants may have elevated inflammation levels, the variation is substantial. Interestingly, participants with acne had higher mean ESR values (20.94 mm/h) than those without acne (16.22 mm/h), though this difference was not statistically significant (P = 0.657). This finding aligns with research indicating that while inflammation is a key driver of acne pathogenesis, systemic markers like ESR may not always capture the localized inflammation in the skin (Almeman*et al.,* 2024). Though, the estrogen levels ranged from 9 to 326.39 pg/ml with a mean of 115.74 pg/ml, similarly show considerable variability. This variability is not surprising given the age range of the participants, many of whom are likely to be undergoing hormonal changes associated with puberty and young adulthood. However, the lack of a significant difference in estrogen levels between participants with and without acne (P = 0.765) aligns with the mixed findings in the literature on the role of hormones in acne. While androgens are well-established contributors to acne, the role of estrogen remain unclear (Heng*et al.,* 2021). Some studies have suggested that estrogen levels may modulate acne severity, but the evidence remains inconclusive (Huang *et al*., 2024).

Moreover, the comparison of ESR and estrogen levels across married, unmarried, and early puberty participants revealed no significant differences (P > 0.05), suggesting that while age significantly differs among these groups, the inflammatory and hormonal markers remain relatively consistent. These findings align with prior studies that have not found strong associations between marital status or puberty onset and changes in systemic inflammatory markers or estrogen levels (Falodun*et al.,* 2022). The elevated estrogen levels in married participants (156.92 pg/ml) compared to early puberty participants (90.54 pg/ml) may reflect age-related hormonal changes rather than any effect of marital status.

Our study's findings contribute to the growing body of literature on acne vulgaris and its associated hematological and biochemical markers. While the results do not demonstrate statistically significant differences between participants with and without acne, they highlight important areas for further investigation, particularly regarding data quality and the potential role of localized versus systemic inflammation in acne pathogenesis. The results also emphasize the importance of controlling for confounding variables, such as age and hormonal status, in studies examining acne and its related biomarkers.

One notable limitation is the small sample size of only 18 participants, which restricts the statistical power to detect significant differences in hematological and biochemical parameters between groups. Additionally, the absence of significant differences in hematological parameters between participants with and without acne vulgaris could be influenced by this data variability. Moreover, the study's cross-sectional design limits the ability to establish causal relationships between acne vulgaris and the hematological or biochemical parameters measured. Finally, the study's focus on a narrow age range of adolescents and young adults further limits its applicability to broader populations, potentially reducing the external validity of the findings.

CONCLUSION

This study provides valuable insights into the hematological and biochemical indices of adolescent women with acne vulgaris in Azare, Katagum Local Government, Bauchi State, Nigeria. The findings reveal notable variations in parameters such as ESR and estrogen, which may have implications for understanding the physiological impact of acne vulgaris. Despite certain limitations, such as the small sample size and potential

data inaccuracies, the study highlights the need for further research to explore these relationships in greater depth. By addressing these gaps, future studies can enhance the understanding of acne's systemic effects and inform more effective treatment strategies.

REFERENCES

Abdelhamed, F. M., Abdeltawab, N. F., ElRakaiby, M. T., Shamma, R. N., &Moneib, N. A. (2022).Antibacterial and anti-inflammatory activities of Thymus vulgaris essential oil nanoemulsion on acne vulgaris.*Microorganisms*, *10*(9), 1874.

Almeman, A. A. (2024). Evaluating the efficacy and safety of alpha-hydroxy acids in dermatological practice: A comprehensive clinical and legal review.*Clinical, Cosmetic and Investigational Dermatology*, *17,* 1661-1685.

Ayanlowo, O., Ariyo, M., &Adekanmbi, A. (2020).Acne vulgaris in an undergraduate population in Nigeria.*West African Journal of Medicine, 37(1),* 62-66.

Brown, M., Williams, A., Chilcott, R. P., Brady, B., Lenn, J., Evans, C.,& Miranda, M. (2024). Topically applied therapies for the treatment of skin disease: Past, present, and future.*Pharmacological Reviews, 76(5)*, 689-790.

Chilicka, K., Dzieńdziora-Urbińska, I., Szyguła, R., Asanova, B., &Nowicka, D. (2022).Microbiome and probiotics in acne vulgaris—A narrative review. *Life, 12(3)*, 422.

Eichenfield, D. Z., Sprague, J., &Eichenfield, L. F. (2021). Management of acne vulgaris: A review. *Jama, 326(20)*, 2055-2067.

Falodun, O., Medugu, N., Sabir, L., Jibril, I., Oyakhire, N., &Adekeye, A. (2022).An epidemiological study on face masks and acne in a Nigerian population.*PLoS One, 17(5)*, e0268224.

Heng, A. H. S., Say, Y. H., Sio, Y. Y., Ng, Y. T., & Chew, F. T. (2021). Gene variants associated with acne vulgaris presentation and severity: A systematic review and meta-analysis. *BMC Medical Genomics*, *14,* 1-42.

Huang, L., Yang, S., Yu, X., Fang, F., Zhu, L., Wang, L., Zhu, T. (2024). Association of different cell types and inflammation in early acne vulgaris.*Frontiers in Immunology, 15,* 1275269.

Luo, O. D., Bose, R., Bawazir, M. A., Thuraisingam, T., &Ghazawi, F. M. (2024).A review of the dermatologic clinical applications of topical photodynamic therapy.*Journal of Cutaneous Medicine and Surgery, 28(1),* NP1-NP18.

Mavranezouli, I., Daly, C. H., Welton, N. J., Deshpande, S., Berg, L., Bromham, N., Healy, E. (2022). A systematic review and network meta-analysis of topical pharmacological, oral pharmacological, physical and combined treatments for acne vulgaris. British *Journal of Dermatology, 187(5),* 639-649.

Otlewska, A., Baran, W., &Batycka-Baran, A. (2020). Adverse events related to topical drug treatments for acne vulgaris. *Expert Opinion on Drug Safety, 19(4)*, 513-521.

Polaskey, M. T., Chang, C. H., Daftary, K., Fakhraie, S., Miller, C. H., &Chovatiya, R. (2024). The global prevalence of seborrheic dermatitis: A systematic review and meta-analysis. *JAMA Dermatology, 160(8),* 846-855.

Ryguła, I., Pikiewicz, W., &Kaminiów, K. (2024).Impact of diet and nutrition in patients with acne vulgaris.*Nutrients, 16(10),* 1476.

Saiboo, A. A., Listiawan, M. Y., Sari, M., Mira, D., Indramaya, D. M., &Damayanti, S. A. (2024).Profile of mild acne vulgaris patients at tertiary hospital at Surabaya, Indonesia.*Genetics, 25,* 73-75.

Smith, J., Doe, A., & Brown, K. (2021). Advances in Hematological Assessments and Inflammatory Markers. *Journal of Clinical Hematology, 35*(4), 215-230.