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Efficacy of 5% Benzoyl Peroxide in Mild to Moderate Acne: A Prospective Observational Study

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Abstract

Background and Aims: Acne vulgaris is a prevalent dermatological condition that significantly impacts the quality of life. Benzoyl peroxide (BPO) is a widely used topical therapy due to its antibacterial and comedolytic properties. This study aimed to evaluate the efficacy of 5% benzoyl peroxide in patients with mild to moderate acne over a 12-week treatment period.

Materials and Methods: A prospective observational study was conducted in the Department of Dermatology at Stanley Medical College over nine months. Thirty participants aged 18–40 years with mild to moderate acne (Grade I-II) were enrolled and applied 5% benzoyl peroxide twice daily for 12 weeks. Acne severity was assessed at baseline and follow-up visits using the Indian Acne Alliance (IAA) grading system.

Results: Among 30 participants, 53.3% were female, and 46.7% were male. After 12 weeks, 9 out of 10 patients with Grade 1 acne improved, while 1 was lost to follow-up. Among those with Grade 2 acne, 11 improved, 4 showed no change, and 5 were lost to follow-up.

Conclusion: Topical 5% benzoyl peroxide demonstrated significant efficacy in reducing acne severity, particularly in Grade 1 and Grade 2 cases.

KEYWORDS: Acne Vulgaris, Benzoyl Peroxide, Topical Treatment, Dermatology, Acne Severity, Prospective Study.

INTRODUCTION

Acne vulgaris is one of the most common dermatological conditions, affecting a significant proportion of the global population, particularly adolescents and young adults [1]. It is a chronic inflammatory disorder of the pilosebaceous unit, characterized by comedones, papules, pustules, nodules, and cysts. While acne is not life-threatening, it can have a profound impact on an individual's psychological well-being, self-esteem, and overall quality of life [2]. Despite being a widespread condition, the pathophysiology of acne is multifactorial, involving increased sebum production, follicular hyperkeratinization, Cutibacterium acnes proliferation, and an inflammatory response. Various environmental and genetic factors further contribute to its development and severity [2, 3].

Topical therapies play a crucial role in the management of mild to moderate acne, with benzoyl peroxide being one of the most commonly used agents due to its potent antibacterial, anti-inflammatory, and keratolytic properties [4]. Benzoyl peroxide (BPO) is an organic peroxide that exerts its action primarily by releasing free oxygen radicals, which effectively eliminate Cutibacterium acnes without inducing bacterial resistance. Additionally, it promotes the desquamation of keratinocytes, thereby preventing follicular obstruction and reducing the formation of new lesions. Given its broad-spectrum efficacy and relatively low risk of bacterial resistance, benzoyl peroxide is widely recommended as a first-line therapy for acne [5].

Despite the established efficacy of benzoyl peroxide, its use is often associated with local skin irritation, erythema, dryness, and peeling. The severity of these adverse effects varies among individuals and is influenced by factors such as skin type, concentration of the formulation, and frequency of application [6].

Therefore, it is essential to assess the tolerability and effectiveness of benzoyl peroxide in different populations to optimize treatment regimens and enhance patient adherence. Studies have demonstrated that lower concentrations, such as 2.5% and 5%, can be as effective as higher concentrations while minimizing side effects, making them a preferred choice for long-term acne management [6].

In addition to pharmacological interventions, acne management requires a comprehensive approach that includes lifestyle modifications, dietary adjustments, and proper skincare routines [7]. Emerging evidence suggests that certain dietary factors, such as high glycemic index foods and dairy products, may exacerbate acne. Moreover, external environmental factors, including ultraviolet (UV) exposure, occupational irritants, and cosmetic use, can influence acne severity and treatment outcomes. Therefore, understanding the role of these factors in acne pathogenesis is crucial for developing holistic treatment strategies [8].

The present study was conducted to evaluate the impact of 5% benzoyl peroxide in the treatment of mild to moderate acne among individuals aged 18–40 years. The study aimed to assess not only the clinical improvement in acne severity but also the tolerability, potential aggravating factors, and patient adherence over a 12-week treatment period. Furthermore, acne severity and response to treatment can vary based on individual characteristics such as gender, hormonal fluctuations, and occupational exposures [8]. For instance, females may experience premenstrual exacerbations of acne due to hormonal changes, while individuals with certain occupational backgrounds may be exposed to acne-triggering factors such as oil, heat, and chemicals. Therefore, this study also explored the influence of demographic and lifestyle factors on treatment outcomes, offering a more personalized perspective on acne management.

Given the chronic and recurrent nature of acne, effective treatment strategies should not only target existing lesions but also prevent future breakouts. The study also aimed to evaluate the sustained effects of benzoyl peroxide beyond the treatment period by conducting follow-up assessments at one, two, and three months post-treatment. Understanding the long-term benefits and potential relapse rates associated with benzoyl peroxide therapy will aid in optimizing maintenance treatment plans for acne patients.

MATERIALS AND METHODS

Study Setting: This study was designed as a prospective study. The study was conducted over a period of nine months, from July 2015 to March 2016, ensuring adequate patient recruitment, treatment, follow-up, and data collection.The study was carried out in the Department of Dermatology at Stanley Medical College, a tertiary care hospital catering to a diverse patient population with dermatological disorders.

Study Participants: Participants included in the study were adults aged 18 to 40 years, of either sex, with mild to moderate acne, defined as total lesion count between 2 and 30 with Grade I-II inflammatory lesions. Patients were required to provide written informed consent before enrollment. Exclusion criteria comprised individuals with severe acne (nodulocystic, acne conglobate, or acne fulminans), those who had used anti-acne treatments within the last 30 days, and patients with secondary acne due to drug-induced causes. Additionally, individuals with known hormonal imbalances (e.g., polycystic ovarian syndrome, thyroid disorders), pregnant or lactating women, and those with a history of hypersensitivity to dapsone or benzoyl peroxide were excluded from the study.

Sample Size and Sampling Technique: The study enrolled a total of 30 patients who received topical 5% benzoyl peroxide applied twice daily for 12 weeks, followed by a three-month follow-up. A simple random sampling method was employed to minimize confounding factors.

Study Tools: The Indian Acne Alliance (IAA) grading system was used to assess acne severity and treatment response. Hematological and biochemical parameters, including complete blood count were assessed at baseline and after 12 weeks of treatment.Standardized digital photographs of acne lesions were taken at each visit to document treatment response.

Study Methodology: At the initial visit, a detailed history was obtained, and a thorough clinical assessment was performed to determine eligibility based on inclusion and exclusion criteria. Written informed consent was obtained from all participants.Eligible patients were instructed to apply a thin film of the assigned study medication twice daily (morning and night) to cleansed and dried affected areas. The medication was initially applied for a short contact period and gradually increased based on tolerance. Patients were advised to avoid dairy products and high glycemic index foods throughout the study and to restrict the use of medicated cosmetics.

Follow-Up and Monitoring: Participants were followed up at 2, 4, 8, and 12 weeks during treatment, and subsequently at 1, 2, and 3 months post-treatment to assess efficacy, safety, and tolerability. At each visit, acne

severity was graded using the IAA scaleand standardized photographs were taken. Any adverse events or hypersensitivity reactions were documented.

Ethical Issues: Ethical clearance was obtained from the Institutional Ethics Committee of Stanley Medical College before commencement. Written informed consent was obtained from all participants after providing detailed information about the study procedures, potential risks, and benefits. Participants were allowed to withdraw at any time without any repercussions. Confidentiality of patient data was strictly maintained.

Statistical Analysis: Data were analyzed using SPSS software 25. Descriptive statistics, including mean and standard deviation, were used to summarize demographic and baseline characteristics. Numbers and frequencies were calculated for qualitative variables.

RESULTS

The study included a total of 30 participants receiving topical 5% benzoyl peroxide. The mean (SD) age of the participants was 22 (3.8) years. The majority of the participants (43.3%) were between the ages of 21–25 years, followed by 40.0% who were 20 years old, 10.0% in the 26–30 age group, and 6.7% in the 31–35 age group. The gender distribution was relatively balanced, with 53.3% females (n=16) and 46.7% males (n=14). Regarding dietary habits, a significant proportion (90.0%) followed a mixed diet, while only 10.0% were vegetarians (Table 1).

Table 1: Baseline Characteristics of Participants Using 5% Benzoyl Peroxide.

Characteristic	Number (%)
Age Group (Years)	
20	12 (40.0)
21-25	13 (43.3)
26-30	3 (10.0)
31-35	2 (6.7)
Gender	
Male	14 (46.7)
Female	16 (53.3)
Diet	
Vegetarian	3 (10.0)
Mixed	27 (90.0)

Participants in the study belonged to diverse occupational backgrounds. The majority (50.0%, n=15) were students, followed by housewives (13.3%, n=4). Other occupations included business (6.7%), laborers (6.7%), salesmen (6.7%), office clerks (3.3%), teachers (3.3%), engineers (3.3%), mechanics (3.3%), and tailors (3.3%) (Table 2).

Several factors were reported to aggravate acne symptoms. Ultraviolet (UV) exposure was noted as the most common aggravating factor, reported by 16.7% of participants, followed by an oily diet in 13.3%. Chocolate consumption and smoking were each reported by 6.7% of participants. Occupational exposure as a potential trigger was identified in 3.3% of participants. Notably, 53.3% of participants did not identify any specific aggravating factors (Table 2).

Table 2: Occupation and Aggravating Factors in Participants Using 5% Benzoyl Peroxide.

Characteristic	Number (%)
Occupation	
Business	2 (6.7)
Engineering Student	1 (3.3)
Housewife	4 (13.3)
Labourer	2 (6.7)
Mechanic	1 (3.3)
Office Clerk	1 (3.3)
Salesman	2 (6.7)
Student	15 (50.0)

Tailor	1 (3.3)
Teacher	1 (3.3)
Aggravating Factors	
Chocolate	2 (6.7)
Occupation	1 (3.3)
Oily Diet	4 (13.3)
Smoking	2 (6.7)
UV Rays	5 (16.7)
None	16 (53.3)

Among the 16 female participants, premenstrual flare-ups of acne were reported by 6 (20.0%), while the majority (80.0%) did not experience exacerbations related to their menstrual cycle.The predominant lesion type among participants was a combination of comedones and papules, seen in 46.7% of cases. A considerable proportion (33.3%) had a combination of comedones, papules, and pustules, whereas isolated comedonal acne was observed in 20.0% of the participants (Table 3).

Table 3: Premenstrual Flare and Types of Lesions in Participants Using 5% Benzoyl Peroxide.

Characteristic	Number (%)
Premenstrual Flare	
Yes	6 (20.0)
No	24 (80.0)
Type of Lesion	
Comedones	6 (20.0)
Comedones + Papules	14 (46.7)
Comedones + Papules + Pustules	10 (33.3)

The efficacy of 5% benzoyl peroxide was assessed based on the improvement in acne grading over the 12-week treatment period. Among participants who initially had Grade 1 acne, 9 showed improvement, while 1 was lost to follow-up, with no cases of persistent Grade 1 acne.In those with Grade 2 acne at baseline, 11 participants demonstrated improvement, while 4 showed no change in acne severity. A total of 5 participants were lost to follow-up during the study period. The overall findings indicate a significant improvement in acne severity with the use of 5% benzoyl peroxide, particularly in patients with Grade 1 and Grade 2 acne (Table 4).

Table 4: Improvement in Acne Grading Over Time with 5% Benzoyl Peroxide.

Initial Grade	Improvement (N)	No Change (N)	Lost to Follow-Up (N)
Grade 1	9	0	1
Grade 2	11	4	5

DISCUSSION

Acne vulgaris is a prevalent dermatological condition affecting individuals across various age groups, with a notable impact on adolescents and young adults. This study evaluated the efficacy of 5% benzoyl peroxide in the treatment of mild to moderate acne, focusing on clinical outcomes and patient characteristics over a 12-week period. The findings provide significant insights into the demographic distribution, potential aggravating factors, lesion types, and treatment response associated with benzoyl peroxide therapy.

The study cohort consisted of 30 participants, with a mean age of 22 years. The majority of patients were in the 21–25-year age group, indicating that acne predominantly affects individuals in early adulthood. This is consistent with previous epidemiological studies, which have reported that acne onset typically occurs during adolescence and may persist into adulthood in a subset of individuals. The gender distribution was relatively balanced, with a slight predominance of female participants (53.3%). While acne is historically considered more severe in males due to increased sebaceous gland activity driven by androgens, the presence of a higher

proportion of female participants in this study aligns with observations that females often seek dermatological treatment more frequently than males [9].

Dietary habits were also evaluated, with 90.0% of participants following a mixed diet. While the role of diet in acne pathogenesis remains controversial, emerging evidence suggests that high glycemic index foods and dairy products may exacerbate acne [10]. In this study, patients were advised to limit these dietary components, although their specific impact on treatment outcomes was not separately analyzed.

The occupational background of participants was diverse, with students constituting the largest subgroup (50.0%). Given that acne is most prevalent during adolescence and early adulthood, the predominance of students is expected. Other occupational groups included housewives, laborers, salesmen, office clerks, and professionals from technical fields such as engineering and mechanics. Occupational exposure to environmental pollutants and stress may influence acne severity, although the present study did not directly assess these factors [11].

Aggravating factors were reported in nearly half of the participants, with UV exposure (16.7%) and an oily diet (13.3%) being the most frequently cited triggers. These findings support existing literature suggesting that UV rays can induce oxidative stress, leading to inflammation and comedogenesis. Similarly, dietary factors, particularly those rich in fats and dairy, have been implicated in worsening acne symptoms. Interestingly, smoking and chocolate consumption were each reported by 6.7% of participants, although their roles in acne pathogenesis remain debated. Notably, 53.3% of participants did not identify any specific aggravating factors, suggesting a multifactorial etiology [12].

Among female participants, 20.0% reported premenstrual flare-ups of acne, a finding consistent with previous studies indicating hormonal fluctuations as a contributing factor in acne exacerbations. The role of androgens and progesterone in increasing sebaceous gland activity and inflammation is well-documented, highlighting the need for hormonal considerations in acne management [13].

Regarding lesion types, the majority of participants (46.7%) presented with a combination of comedones and papules, while 33.3% had a more severe manifestation involving pustules. The presence of multiple lesion types suggests varying degrees of inflammation, with comedones representing non-inflammatory lesions and papules/pustules indicating progression to inflammatory acne [14]. The distribution of lesion types aligns with the study's inclusion criteria of mild to moderate acne, as severe nodulocystic lesions were excluded.

The primary objective of this study was to assess the therapeutic response to 5% benzoyl peroxide over 12 weeks. The results demonstrated a notable improvement in acne severity, with 20 out of 30 participants (66.7%) showing positive clinical outcomes. Specifically, all nine participants with Grade 1 acne exhibited improvement, whereas among those with Grade 2 acne, 11 showed improvement while four experienced no change. These findings reinforce the established efficacy of benzoyl peroxide as a first-line treatment for mild to moderate acne.

Benzoyl peroxide exerts its therapeutic effect through its potent antibacterial activity against Cutibacterium acnes (formerly Propionibacterium acnes), as well as its keratolytic and anti-inflammatory properties [15]. Despite the overall positive response, four participants with Grade 2 acne exhibited no significant improvement. This lack of response may be attributed to individual variations in skin physiology, adherence to treatment, or the presence of underlying factors such as subclinical hormonal imbalances. Additionally, five participants were lost to follow-up, which could have influenced the overall efficacy assessment.

In comparison to other topical agents, benzoyl peroxide is associated with a favorable safety profile. Common adverse effects include mild irritation, dryness, and erythema, which are typically transient and manageable with proper application techniques [15]. The study protocol included a gradual increase in application duration to enhance tolerability, potentially contributing to the high adherence observed.

One of the strengths of this study is its prospective design, which allowed for systematic follow-up and evaluation of treatment outcomes. The use of standardized acne grading and digital photography ensured objective assessment, minimizing interobserver variability. Additionally, the inclusion of a diverse patient population enhances the generalizability of the findings.

However, certain limitations must be acknowledged. The small sample size (n=30) limits the statistical power of the study and may not fully capture variations in treatment response across a broader population. Additionally, the lack of a control group precludes direct comparisons with other treatment modalities. Another limitation is the reliance on self-reported aggravating factors, which may introduce recall bias.

CONCLUSION

This study demonstrates the effectiveness of 5% benzoyl peroxide in the treatment of mild to moderate acne, with significant improvement observed over a 12-week period. The findings reinforce the role of benzoyl peroxide as a reliable and well-tolerated option for acne management.

REFERENCES

1. Lynn DD, Umari T, Dunnick CA, Dellavalle RP. The epidemiology of acne vulgaris in late adolescence. Adolesc Health Med Ther. 2016 Jan 19;7:13-25. doi: 10.2147/AHMT.S55832.
2. Nandy P, Shrivastava T. Exploring the Multifaceted Impact of Acne on Quality of Life and Well-Being. Cureus. 2024 Jan 22;16(1):e52727. doi: 10.7759/cureus.52727.
3. Chauhan PN, Sharma A, Rasheed H, Mathur H, Sharma P. Treatment Opportunities and Technological Progress Prospective for Acne Vulgaris. Curr Drug Deliv. 2023;20(8):1037-1048. doi: 10.2174/1567201819666220623154225.
4. Fox L, Csongradi C, Aucamp M, du Plessis J, Gerber M. Treatment Modalities for Acne. Molecules. 2016 Aug 13;21(8):1063. doi: 10.3390/molecules21081063.
5. Scheer VM, Jungeström MB, Serrander L, Kalén A, Scheer JH. Benzoyl peroxide treatment decreases Cutibacterium acnes in shoulder surgery, from skin incision until wound closure. J Shoulder Elbow Surg. 2021 Jun;30(6):1316-1323. doi: 10.1016/j.jse.2020.12.019.
6. Kolakowski L, Lai JK, Duvall GT, Jauregui JJ, Dubina AG, Jones DL, Williams KM, Hasan SA, Henn RF 3rd, Gilotra MN. Neer Award 2018: Benzoyl peroxide effectively decreases preoperative Cutibacterium acnes shoulder burden: a prospective randomized controlled trial. J Shoulder Elbow Surg. 2018 Sep;27(9):1539-1544. doi: 10.1016/j.jse.2018.06.012.
7. Araviiskaia E, Layton AM, Estebaranz JLL, Ochsendorf F, Micali G. The Synergy between Pharmacological Regimens and Dermocosmetics and Its Impact on Adherence in Acne Treatment. Dermatol Res Pract. 2022 Aug 9;2022:3644720. doi: 10.1155/2022/3644720.
8. Conforti C, Giuffrida R, Fadda S, Fai A, Romita P, Zalaudek I, Dianzani C. Topical dermocosmetics and acne vulgaris. Dermatol Ther. 2021 Jan;34(1):e14436. doi: 10.1111/dth.14436.
9. Ghosh S, Chaudhuri S, Jain VK, Aggarwal K. Profiling and hormonal therapy for acne in women. Indian J Dermatol. 2014 Mar;59(2):107-15. doi: 10.4103/0019-5154.127667.
10. Romańska-Gocka K, Woźniak M, Kaczmarek-Skamira E, Zegarska B. The possible role of diet in the pathogenesis of adult female acne. Postepy Dermatol Alergol. 2016 Dec;33(6):416-420. doi: 10.5114/ada.2016.63880.
11. Yang J, Yang H, Xu A, He L. A Review of Advancement on Influencing Factors of Acne: An Emphasis on Environment Characteristics. Front Public Health. 2020 Sep 17;8:450. doi: 10.3389/fpubh.2020.00450.
12. Delost GR, Delost ME, Lloyd J. The impact of chocolate consumption on acne vulgaris in college students: A randomized crossover study. J Am Acad Dermatol. 2016 Jul;75(1):220-2. doi: 10.1016/j.jaad.2016.02.1159.
13. Lai JJ, Chang P, Lai KP, Chen L, Chang C. The role of androgen and androgen receptor in skin-related disorders. Arch Dermatol Res. 2012 Sep;304(7):499-510. doi: 10.1007/s00403-012-1265-x.
14. Kraft J, Freiman A. Management of acne. CMAJ. 2011 Apr 19;183(7):E430-5. doi: 10.1503/cmaj.090374.
15. Yang Z, Zhang Y, Lazic Mosler E, Hu J, Li H, Zhang Y, Liu J, Zhang Q. Topical benzoyl peroxide for acne. Cochrane Database Syst Rev. 2020 Mar 16;3(3):CD011154. doi: 10.1002/14651858.CD011154.