OPEN ACCESS

Saudi Journal of Medical and Pharmaceutical Sciences
Abbreviated Key Title: Saudi J Med Pharm Sci
ISSN 2413-4929 (Print) | ISSN 2413-4910 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Review Article **Dermatology**

Unexpected Benefits of Beta-blockers in Acne Vulgaris: A Systematic Review

Areej Alasiri[1]*, Norah Abu Mughaedh[1], Miad Abu Mughaedh[2]

[1]Dermatology Resident, Dermatology Department, Aseer Center Hospital, Abha, Saudi Arabia
[2]Family medicine resident, Family Medicine Department, Aseer Center Hospital, Abha, Saudi Arabia

DOI: https://doi.org/10.36348/sjmps.2025.v11i05.006 | **Received:** 07.04.2025 | **Accepted:** 13.05.2025 | **Published:** 20.05.2025

***Corresponding author:** Areej Alasiri
Dermatology Resident, Dermatology Department, Aseer Center Hospital, Abha, Saudi Arabia

Abstract

***Objectives*:** To systematically review and synthesize available clinical and experimental evidence on the effects of beta-blockers in the treatment of acne vulgaris. ***Methods*:** A thorough search across four databases identified 412 relevant publications. After removing duplicates using Rayyan QCRI and screening for relevance, the search yielded 209 publications, of which 29 full-text articles were reviewed, and 5 met the eligibility criteria for evidence synthesis. ***Results*:** We included 5 studies with a total of 205 patients and 140 (68.3%) were females. The findings consistently indicated beneficial effects in the management of non-inflammatory acne lesions, post-acne erythema, and acne scarring—particularly when used in conjunction with fractional CO_2 laser therapy. Across all studies, the treatment was well tolerated with no significant adverse effects reported. ***Conclusion*:** Topical beta-blockers, especially timolol maleate 0.5%, represent a promising adjunct in the treatment of acne vulgaris. Their clinical effectiveness, safety, and affordability make them a compelling option, particularly for patients unresponsive to or intolerant of standard therapies. Further randomized trials are necessary to validate their role and establish standardized treatment protocols.

Keywords: Acne Vulgaris, Beta-Blockers, Timolol, Post-Acne Scars, Post-Acne Erythema, Dermatological Therapy, Systematic Review.

INTRODUCTION

Acne vulgaris is a common chronic inflammatory skin disorder that affects the pilosebaceous unit. It typically presents with papules, pustules, or nodules, most often on the face, though it can also involve the upper arms, chest, and back. The condition results from the interplay of multiple contributing factors, leading to the formation of its hallmark lesion—the comedo. Although acne is frequently seen in adolescents, it is not confined to this age group and can affect people of all ages [1, 2].

The severity of acne varies widely, ranging from mild cases with a few comedones to more severe presentations marked by pronounced inflammation, which can cause scarring, hyperpigmentation, and psychological impacts. Acne vulgaris is particularly prevalent among adolescents and young adults, with reported rates ranging from 35% to over 90% during adolescence [3]. The condition can begin as early as ages 7 to 12 (preadolescent acne) and often resolves by the third decade of life. However, in some cases, acne may persist into adulthood or arise for the first time in adulthood [3].

In adolescents, acne is more commonly observed in males, whereas post-adolescent acne tends to affect females more frequently. Urban populations are generally more affected than rural ones. About 20% of individuals with acne develop severe forms that may result in scarring. Research also suggests that the prevalence and severity of acne can vary by race and ethnicity. For example, Asians and Africans are more likely to experience severe acne, while milder forms are more prevalent among White individuals. Additionally, people with darker skin tones are more susceptible to post-inflammatory hyperpigmentation [4].

Management of acne vulgaris should begin with thorough patient education, regardless of the condition's severity. This includes discussing the nature of the disease, appropriate skincare practices, and setting realistic expectations for treatment outcomes [5].

Acne vulgaris is a widespread dermatological condition that affects individuals across various age groups, often with significant physical and psychological consequences. Despite the availability of a wide range of treatments—topical agents, antibiotics, retinoids, and hormonal therapies—many patients experience suboptimal outcomes, adverse effects, or contraindications to conventional therapies. Recent evidence has suggested that beta-blockers, traditionally used in the management of cardiovascular and anxiety-related disorders, may exert anti-inflammatory and sebosuppressive effects beneficial in acne management. These unexpected benefits, though not fully elucidated or widely recognized in dermatological practice, warrant closer examination. A comprehensive assessment of existing literature is needed to evaluate the potential role of beta-blockers as a novel adjunct or alternative in acne therapy, particularly in cases where traditional treatments fail or are poorly tolerated.

This study aims to systematically review and synthesize available clinical and experimental evidence on the effects of beta-blockers in the treatment of acne vulgaris, with the aim of evaluating their therapeutic potential, mechanisms of action, safety profile, and clinical outcomes in comparison to or in conjunction with established acne treatments.

METHODS

The PRISMA and GATHER criteria were met by the systematic review.

Selection Criteria:

Inclusion Criteria

1. Randomized controlled trials (RCTs), cohort studies, case-control studies, cross-sectional studies, case series, and case reports.
2. Human subjects of any age or gender diagnosed with acne vulgaris.
3. Use of beta-blockers (e.g., propranolol, atenolol, metoprolol, etc.) administered orally or topically, either as primary or adjunctive treatment for acne.
4. Studies with or without a comparison group, including standard acne treatments or placebo.
5. Any reported improvement or change in acne severity, lesion count, inflammation, sebum production, patient satisfaction, or adverse effects.
6. Articles published in English or with English translations available.
7. No restrictions on the date of publication.

Exclusion Criteria

1. Animal or in vitro studies.
2. Editorials, opinion pieces, letters to the editor, narrative reviews, or conference abstracts without full data.
3. Studies not addressing beta-blocker use in the context of acne vulgaris.
4. Studies where beta-blockers are part of a multi-drug regimen and their specific effect cannot be distinguished.
5. Articles that lack outcome measures relevant to acne or do not provide sufficient detail to assess the impact of beta-blocker therapy.

Search Strategy

A thorough search was undertaken to locate relevant studies on the effects of beta-blockers in the treatment of acne vulgaris. The reviewers looked at four electronic databases: PubMed, Cochrane, Web of Science, and SCOPUS. We uploaded all of the titles and abstracts identified through electronic searches into Rayyan, removing any duplicates. All texts from papers that met the inclusion criteria based on title or abstract were collected and thoroughly inspected. Two reviewers independently evaluated the appropriateness of the extracted publications and resolved any contradictions through discussion.

Data Extraction

Two unbiased reviewers retrieved data from studies that met the inclusion criteria in a consistent and established format. The following information was retrieved and recorded: (i) first author (ii) Year of publication, (iii) Study design, (iv) Country, (v) Sample size, (vi) Gender, (vii) Age (viii) Condition, (ix) Intervention, (x) Comparison, (xi) Main outcomes (effectiveness and safety).

Quality Review

Since bias resulting from omitted factors is frequent in studies in this field, we used the ROBINS-I technique to assess the likelihood of bias since it enables a thorough examination of confounding. The ROBINS-I tool can be used for cohort designs where individuals exposed to different staffing levels are tracked over time and is designed to assess non-randomized studies. Each paper's risk of bias was evaluated independently by two reviewers, and any differences were settled by group discussion [6].

RESULTS

The specified search strategy yielded 412 publications **(Figure 1).** After removing duplicates (n = 203), 209 articles were evaluated based on title and abstract. Of these, 178 failed to satisfy eligibility criteria, leaving just 31 full-text articles for comprehensive review. A total of 5 satisfied the requirements for eligibility with evidence synthesis for analysis.

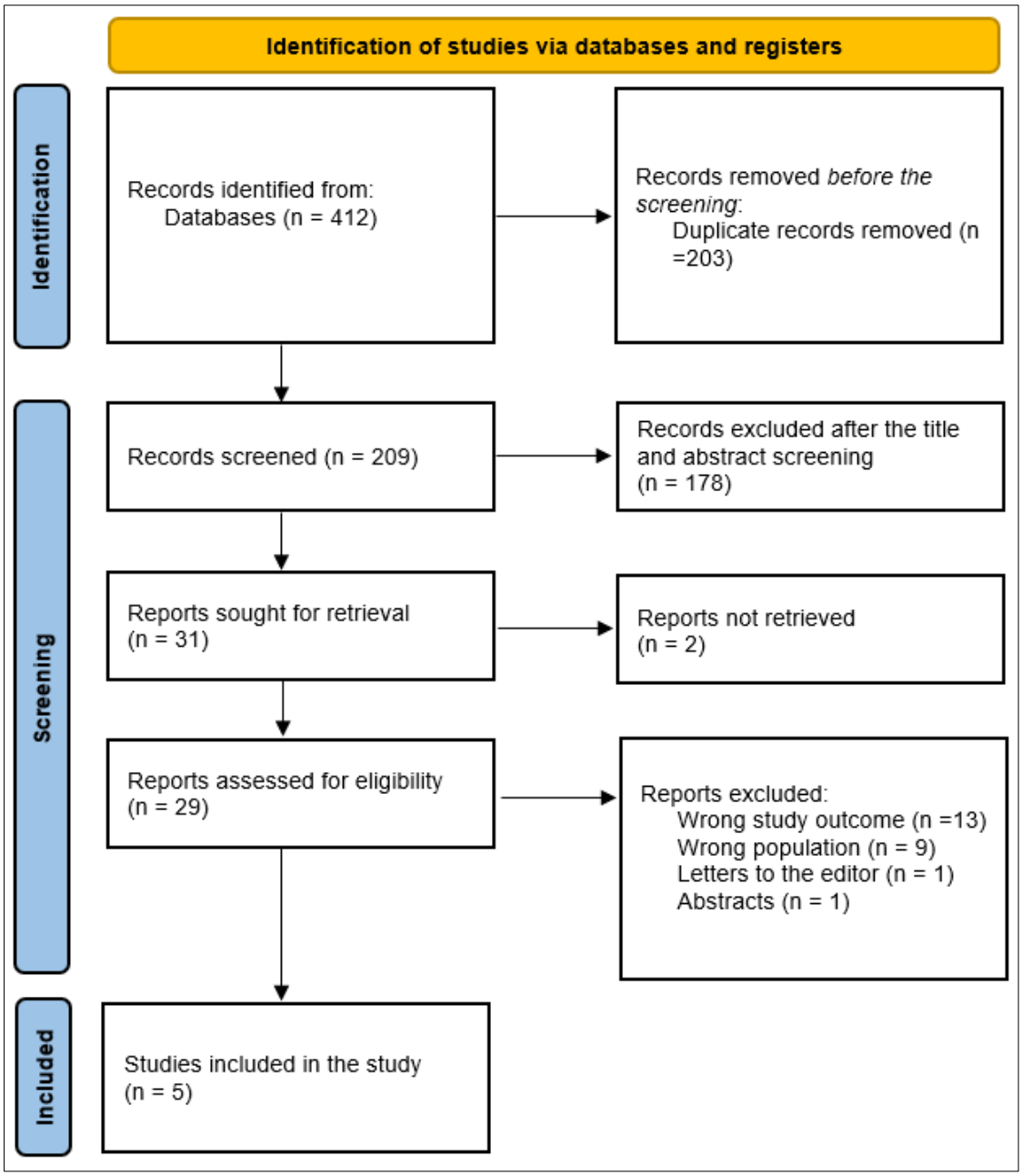

Figure 1: PRISMA flowchart [7]

Sociodemographic and Clinical Outcomes

We included 5 studies with a total of 205 patients and 140 (68.3%) were females. Two studies were case-controls [8, 11], two were prospective cohorts [9-12], and one was an RCT [10]. Three studies were implemented in Egypt [8-12], one in Iraq [9], and one in Thailand [10].

Topical timolol maleate 0.5% has demonstrated promising results in improving atrophic acne scars when used alongside fractional CO_2 laser therapy. While the improvement observed was not statistically superior to laser treatment alone, the combined approach showed better overall clinical outcomes. The treatment was found to be safe, easily accessible, cost-effective, and non-invasive, suggesting its potential as a supportive therapy in acne scar management [8].

In another study, 12 weeks of topical timolol 0.5% application led to significant clinical and dermoscopic improvement in post-acne erythema. Importantly, no patients experienced severe erythema, and the treatment was well tolerated, highlighting its potential utility in managing persistent erythematous changes after acne [9].

The use of topical timolol 0.5% twice daily was associated with enhanced skin barrier function and promoted re-epithelialization following fractional CO_2 laser treatment. This suggests an added benefit in accelerating skin recovery post-procedure, particularly

in patients undergoing laser therapy for acne scarring [10].

Further findings confirmed that applying topical timolol 0.5% after carbon dioxide laser therapy may significantly improve skin healing by strengthening the barrier function and promoting tissue repair. These results reinforce the potential of beta-blockers as a regenerative aid in dermatological procedures [11].

Additionally, timolol maleate 0.5% has shown specific benefits in acne management, especially in noninflammatory lesions. Interestingly, its effects appear more favorable in erythematotelangiectatic rosacea than in papulopustular rosacea. The formulation was also reported to be well tolerated, with minimal side effects, supporting its safety profile for broader dermatological applications [12].

Table 1: Outcome measures of the included studies

Study ID	Country	Study design	Sociodemographic	Condition	Intervention	Comparator	Main outcomes
Hawwas *et al*., 2023 [8]	Case-control	Egypt	Cases: 30 Mean age: 25.6 Females: 19 (63.3%)	Ance scars	Topical timolol maleate 0.5%	Fractional CO2 laser	Topical timolol maleate 0.5% applied after fractional CO_2 laser treatment showed better, though not significantly superior, improvement in atrophic acne scars compared to laser alone. It demonstrated a good safety profile, was easy to access, low in cost, and non-invasive, making it a promising adjunct therapy for acne scar treatment.
Omer *et al*., 2024 [9]	Prospective cohort	Iraq	Cases: 30 Mean age: 19.9 Females: 24 (80%)	Ance scars	Topical timolol maleate 0.5%	NA	After 12 weeks of treatment, there was a significant clinical and dermoscopic reduction in post-acne erythema, with no patients exhibiting severe erythema. The study concludes that the treatment yielded a very good response with no notable side effects.
Kimwattananukul *et al*., 2021 [10]	RCT	Thailand	Cases: 25 Mean age: 31.4 Females: 13 (52%)	Ance scars	Topical timolol maleate 0.5%	Fractional CO2 laser	Using topical 0.5% timolol maleate twice daily enhances skin barrier function and may aid in re-epithelialization following laser treatments.
Ahmed Youssef *et al*., 2024 [11]	Case-control	Egypt	Cases: 62 Mean age: 30.4 Females: 32 (51.6%)	Ance scars	Topical 0.5% Timolol Maleate after	Carbon Dioxide Laser Alone	Twice-daily application of 0.5% topical timolol maleate may significantly enhance skin recovery by

					Fractional Carbon Dioxide Laser		improving barrier function and supporting re-epithelialization following laser treatments.
Al Mokadem *et al*., 2020 [12]	Prospective cohort	Egypt	Cases: 58 Mean age: 19.9 Females: 52 (89.7%)	Ance scars	Topical timolol maleate 0.5%	NA	Topical timolol maleate 0.5% has shown effectiveness in managing acne, particularly in treating noninflammatory lesions. However, it appears to be more effective in cases of erythematotelangiectatic rosacea compared to papulopustular rosacea, and it is generally well tolerated with minimal side effects.

Table 2: Risk of bias assessment using ROBINS-I

Study ID	Bias due to confounding	Bias in the selection of participants into	Bias in the classification of interventions	Bias due to deviations from the intended interval	Bias due to missing data	Bias in the measurement of outcomes	Bias in the selection of reported result	Overall bias
Hawwas *et al*., 2023 [8]	Mod	Mod	Low	Low	Low	Mod	Low	Moderate
Omer *et al*., 2024 [9]	Mod	Mod	Low	Low	Low	Mod	Mod	Moderate
Ahmed Youssef *et al*., 2024 [11]	Mod	Mod	Low	Low	Mod	Mod	Low	Moderate
Al Mokadem *et al*., 2020 [12]	Low	Low	Mod	Low	Mod	Low	Low	Low

DISCUSSION

This systematic review highlights emerging evidence suggesting that topical beta-blockers, particularly timolol maleate 0.5%, may offer clinical benefits in the treatment of acne vulgaris and acne-related conditions, such as post-acne erythema and atrophic scarring. The reviewed studies, although heterogeneous in design, consistently indicate that timolol enhances skin healing, improves noninflammatory lesions, and supports barrier function, especially when used as an adjunct to laser therapies. The anti-inflammatory, vasoconstrictive, and potential sebosuppressive properties of beta-blockers may explain these dermatologic effects, though precise mechanisms remain to be fully elucidated.

Importantly, the favorable safety profile of topical timolol—with minimal reported side effects—adds to its appeal as a therapeutic option, particularly for patients who are intolerant to or unresponsive to conventional acne treatments. Furthermore, timolol's non-invasive, low-cost nature makes it a practical addition to acne management protocols.

Jade Logger *et al.*, [13], reviewed their role in nine articles (one RCT, one cohort study, one case–control study, three case reports, and three case series). Propranolol and carvedilol were the most effective in reducing erythema and flushing with a rapid onset of symptom control; however, nadolol did not show similar results.

Their involvement in rosacea treatment was primarily confined to diminishing non-inflammatory acne lesions and easing the symptoms of erythematotelangiectatic rosacea, with only limited therapeutic benefit observed in papulopustular rosacea [12]. In a similar vein, topical timolol proved helpful mainly in relieving telangiectasia symptoms in cases of facial corticosteroid addiction dermatitis, while its impact on other associated symptoms was not assessed [14]. Additionally, beta-blockers have shown promise as valuable adjunctive agents in melanoma management,

where they were linked to improvements in both morbidity and mortality outcomes.

Alhamzi *et al.*, Beta-blockers have been shown to be safe and cost-effective in the management of various dermatological conditions, including acne, post-acne scarring, and persistent erythema [15].

The findings presented in this review offer potential shifts in the clinical management of acne vulgaris. Topical timolol maleate 0.5% may be integrated as an adjunct therapy in several clinical scenarios, including patients with predominant noninflammatory lesions, those suffering from persistent post-acne erythema, or individuals undergoing laser treatments for acne scarring. Additionally, the observed benefit in rosacea-related skin changes—especially erythematotelangiectatic subtypes—suggests a broader dermatological utility beyond acne. This could be particularly relevant for patients who are not suitable candidates for systemic therapies, such as isotretinoin or hormonal treatments. The overall tolerability and low cost also make it an attractive option in both general dermatology and cosmetic dermatology practice.

Strengths

This review provides a comprehensive and focused synthesis of an emerging therapeutic strategy that is not yet widely adopted in acne management. It captures insights from a diverse range of study designs, including randomized controlled trials, cohort studies, and case-control studies, thereby enriching the reliability of the conclusions drawn. Emphasis on practical outcomes such as ease of use, cost, and patient tolerability adds to the clinical relevance of the findings and offers a practical perspective for healthcare providers.

Limitations

Despite these strengths, the review is limited by the nature of the existing evidence base. Many of the included studies had relatively small sample sizes and short follow-up durations, limiting the generalizability and long-term conclusions. The heterogeneity among study designs, populations, and outcome assessments also poses challenges in drawing firm comparative conclusions. Furthermore, the absence of standardized protocols regarding timolol application frequency, duration, and combination with other treatments weakens the ability to form definitive treatment guidelines. The lack of blinding and control groups in several studies introduces a risk of bias that must be acknowledged.

CONCLUSION

Topical beta-blockers, particularly timolol maleate 0.5%, offer a novel and promising approach in the management of acne vulgaris and its dermatologic consequences. They demonstrate efficacy in treating noninflammatory lesions, promoting scar healing, and reducing post-acne erythema, with a safety profile that supports their use in diverse patient populations. While the evidence is encouraging, further high-quality randomized clinical trials are necessary to confirm these findings, define optimal usage protocols, and determine long-term outcomes. Nonetheless, the current evidence supports their consideration as a safe, accessible, and cost-effective addition to acne treatment strategies.

REFERENCES

1. Yan HM, Zhao HJ, Guo DY, Zhu PQ, Zhang CL, Jiang W. Gut microbiota alterations in moderate to severe acne vulgaris patients. J Dermatol. 2018 Oct;45(10):1166-1171.
2. George RM, Sridharan R. Factors Aggravating or Precipitating Acne in Indian Adults: A Hospital-Based Study of 110 Cases. Indian J Dermatol. 2018 Jul-Aug;63(4):328-331.
3. Wolkenstein P, Machovcová A, Szepietowski JC, Tennstedt D, Veraldi S, Delarue A. Acne prevalence and associations with lifestyle: a cross-sectional online survey of adolescents/young adults in 7 European countries. J Eur Acad Dermatol Venereol. 2018 Feb;32(2):298-306.
4. Özçelik S, Kulaç İ, Yazıcı M, Öcal E. Distribution of childhood skin diseases according to age and gender, a single institution experience. Turk Pediatri Ars. 2018 Jun;53(2):105-112.
5. Sutaria AH, Masood S, Saleh HM, Schlessinger J. Acne vulgaris. InStatPearls [internet] 2023 Aug 17. StatPearls Publishing.
6. Sterne JA, Hernán MA, Reeves BC, Savović J, Berkman ND, Viswanathan M, Henry D, Altman DG, Ansari MT, Boutron I, Carpenter JR. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. bmj. 2016 Oct 12;355.
7. Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart LA, Prisma-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. Systematic reviews. 2015 Dec;4:1-9.
8. Hawwas AR, Mohamed HA, Sayedahmed OM, Elsaie ML. Topical timolol maleate 0.5% after fractional carbon dioxide laser versus fractional carbon dioxide laser alone in treatment of acne scars: split face comparative study. Scientific Reports. 2023 Jun 9;13(1):9402.
9. Omer SJ, Jaf MY, Hassan SA. Clinical and Dermoscopic evaluation of post acne erythema after treatment with topical timolol maleate 0.5%. AMJ (Advanced Medical Journal). 2024 Jun 4;9(2):64-74.
10. Kimwattananukul K, Noppakun N, Asawanonda P, Kumtornrut C. Topical 0.5% timolol maleate significantly enhances skin-barrier restoration after fractional carbon dioxide laser treatment for acne scars. Lasers in Surgery and Medicine. 2021 Jul;53(5):610-5.
11. Ahmed Youssef AE, Mohamed Elzaki AS, Galal Khater ES. Effect of Topical 0.5% Timolol Maleate After Fractional Carbon Dioxide Laser Versus

Carbon Dioxide Laser Alone In Treatment Acne Scars. Zagazig University Medical Journal. 2024 Dec 1;30(9.1):4987-97.

12. Al Mokadem SM, Ibrahim AS, El Sayed AM. Efficacy of topical timolol 0.5% in the treatment of acne and rosacea: a multicentric study. The Journal of Clinical and Aesthetic Dermatology. 2020 Mar 1;13(3):22.
13. Logger JGM, Olydam JI, Driessen RJB. Use of beta-blockers for rosacea-associated facial erythema and flushing: a systematic review and update on proposed mode of action. J Am Acad Dermatol. 2020;83(4):1088–1097.
14. Li YF, Chen XY, Lei TC. Inhibitory effect of timolol on topical glucocorticoid-induced skin telangiectasia. Mol Med Rep. 2018;18(3):2823–2831.
15. Alhazmi AM, Basendwh MA, Aman AA, Dajam M, Aljuhani TS. The role of systemic and topical beta-blockers in dermatology: a systematic review. Dermatology and Therapy. 2023 Jan;13(1):29-49.