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Research paper

Therapeutic evaluation of herbal formulation in acne vulgaris and its influence on quality of life—A single-arm clinical trial

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ABSTRACT

Introduction: Acne vulgaris is a disease of the pilosebaceous unit that primarily affects teenagers and young adults. It relates to significant psychological morbidity and, on rare occasions, fatality due to suicidal tendencies. Though Unani medicines have been used to treat it for millennia, scientific investigations and evidence-based literature are rare. Thus, the purpose of this study was to determine the efficacy of the herbal formulation *Ṭīlā-i Muhāsa* consisting of *Azadirachta indica* A. Juss., *Albizia lebbeck* L., and *Iris ensata* Thunb. in treating acne vulgaris as well as the influence on patients' quality of life.

Methods: In this clinical trial, 31 clinically diagnosed patients with acne vulgaris received *Ṭīlā-i Muhāsa* to be applied on the afflicted site every night and washed off with normal water after 20–30 min, of whom 30 completed the protocol therapy. The primary outcome measures were changes in subjective parameters such as comedones, papules, pustules, erythema, and itching, assessed on a 4-point grading scale, and change in investigator's global assessment (IGA) for overall disease severity, at baseline, 7th, 14th, and 21st days. The secondary outcome measure was change in quality of life (QoL), assessed on the Cardiff acne disability index (CADI).

Results: The per-protocol analysis of subjective parameters revealed statistically significant improvement in comedones, papules, pustules, erythema, nodules, and itching. Additionally, statistically significant improvements in IGA and QoL were also detected.

Conclusion: The findings of the present study indicated that topical use of *Ṭīlā-i Muhāsa* is an effective and well-tolerated therapeutic option for patients with moderate to severe acne vulgaris.

1. Introduction

Acne is a follicular disorder involving pilosebaceous apparatus of the skin. It is one of the most common skin diseases treated by dermatologists (Chuang et al., 2018; Kim et al., 2018; O'Neill and Gallo, 2018; Park et al., 2017). The primary causes of acne include constriction of follicles due to aberrant keratinization of the infundibular epithelium, stimulation of excessive sebum secretion by androgen-sensitive sebaceous glands, and microbial colonization by *Cutibacterium acnes* (previously known as *Propionibacterium acnes*) (Chuang et al., 2018; Kim et al., 2018; O'Neill and Gallo, 2018; Park et al., 2017; Scholz and Kilian, 2016).

Acne is believed to have a global prevalence of approximately 9.4%, ranking it as the eighth most widespread disease (Saeed Alanazi et al., 2018). Acne vulgaris affects 85% of young adults between the ages of 12 and 25 years, according to the Global Burden of Disease report (Lynn et al., 2016; O'Neill and Gallo, 2018; Saeed Alanazi et al., 2018). Currently, the increasing incidence of acne vulgaris in late adolescence is a matter of concern worldwide. However, it is unknown if this increase is a result of increased Western diet intake, genetic causes, early puberty, or undiscovered environmental variables (Darji et al., 2017; Gupta et al., 2016; O'Neill and Gallo, 2018).

Acne vulgaris skin lesions are classed as non-inflammatory (comedones) or inflammatory (papules, pustules, nodules, and cysts) (Chen et al., 2018; Gupta et al., 2016). The lesions ranging from moderate to severe may result in hyperpigmentation and/or atrophic scarring that can result in anxiety, despair, and other forms of emotional stress impairing one's quality of life (Gallitano and Berson, 2018; Gupta et al.,

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2016; Saeed Alanazi et al., 2018).

Conventionally, topical or systemic benzoyl peroxide, antibiotics, retinoids, and laser therapy are all effective acne medicines (Mirnezami and Rahimi, 2018). In recent years, iso-tretinoin - an oral retinoid derived from vitamin A - has revolutionized its treatment. However, it has severe mucocutaneous and systemic adverse effects, including teratogenicity, hepatotoxicity, lip and nose mucosal dryness, and conjunctivitis. In rare cases, these adverse effects are so severe and bothersome to the patient that the physician is forced to taper or discontinue it (Bugdayci et al., 2016; Castillo and Keri, 2018; Mirnezami and Rahimi, 2018; Rai and Natarajan, 2013; Whitney and Ditre, 2011).

Unani system of medicine (USM) is one of the traditional systems of medicine that derives its origin directly from ancient Greek (Yūnān) and is based on the four humours, namely blood, phlegm, yellow bile, and black bile(CCRUM, 2013). It has made significant contributions to date, with a number of traditional medicinal formulations for skin disorders being scientifically validated (Cai et al., 2021; Chaush et al., 2022; Husain et al., 2021; Husain and Khalid, 2021; Imran et al., 2022; Meysami et al., 2021; Said et al., 2020). Acne vulgaris is considered a clinical synonym for *Buthūr-i Labaniyya* in USM, which has been mentioned in greater detail in various Greco-Arab and Persian classical texts. According to Ibn Sina, *Mādda-i Sadīdiya* (ichorous matter/pus-like substance) originating from *Bukhārāt-i Badan* (vapours of body) is responsible for *Buthūr-i Labaniyya*, and a milky white viscid material is expressed on squeezing the lesions (Hakeem Ajmal Khan, 2002; Sina, 2010) which most commonly appear on the face and nose (Razi, 1994). Other possible risk factors include puberty, extreme heat, sun exposure, improper digestion, *Fasād-i Dam* (blood diathesis), amenorrhea, unhygienic conditions, consumption of oily and very spicy foods (Hakeem Ajmal Khan, 2002). However, Unani scholars largely acknowledge that *Ghalīz Khilt* (thick morbid humour) and *Mādda-i Sadīdiya* (ichorous matter/pus-like substance) are responsible for its development. It can effectively be managed with drugs exhibiting *Muhallil* (resolvent), *Jāli* (detergent), *Jāzib* (absorbent), *Murakh'khi* (emollient), and *Dāfi'-i Ta'affun* (anti-septic) properties (CCRUM, 2010).

Keeping the above notion in consideration, *Ṭīlā-i Muhāsa* was chosen for evaluation of its safety and efficacy in the management of acne as its constituents, *Barg-i Nīm* (*Azadirachta indica* leaves), *Post-i Siras* (*Albizia lebbeck* stem bark) and *Bīkh-i Sosan* (*Iris ensata* root) have the same attributes as stated above for the treatment of *Buthūr-i Labaniyya* (Hakeem Ajmal Khan, 2002; Kabeeruddin, 2010).

2. Methods

2.1. Site and time

This single-arm interventional study was initiated after getting approval from the institutional ethics committee (Protocol Reg. No. BJP/LUMC/PG/IEC/2017–18/03/MOALIJAT/04) and registration in Clinical Trial Registry - India (CTRI/2019/02/017493). Patients clinically diagnosed with facial acne vulgaris attending the outpatient department of Moalajat (Medicine), Luqman Unani Medical College, Hospital and Research Center Bijapur (Vijayapura), Karnataka, India between March 2019 and May 2020 were screened for the study.

2.2. Inclusion criteria

30 individuals aged 13–40 years of both genders and clinically diagnosed with facial acne vulgaris were recruited from the 61 subjects screened, after obtaining written informed consent.

2.3. Exclusion criteria

Patients aged less than 13 years and more than 40 years, those with other skin conditions such as acne rosacea, acne fulminans, acne necrotica, psoriasis, or eczema, those on corticosteroids, anticonvulsants, or oral contraceptives for the preceding month, pregnant or lactating women, and those with any severe systemic illness were excluded from the study. Patients who were uncertain about their ability to adhere to the treatment protocol were also excluded.

2.4. Method of preparation of Ṭīlā-i Muhāsa

All the ingredients of *Ṭīlā-i Muhāsa* were procured from a registered herbalist from Bijapur, Karnataka (*Azadirachta indica* leaves, *Albizia lebbeck* stem bark) and Kashmir, India (*Iris ensata* root) and were subjected to taxonomical identification and authentication by Miss Vidyashree Suryavanshi (Botanist) of SECAB's ARS Inamdar Arts, Science and Commerce College for Women, Bijapur, Karnataka, India (Table 1). The identified drugs were also deposited in the Museum of Luqman Unani Medical College Hospital and Research Center, Bijapur, Karnataka, India bearing herbarium file No. 04/HERB/LUMC/17 and voucher specimen numbers as; *Azadirachta indica* A.Juss. leaves (DBARSI-BJP1701), *Albizia lebbeck* L. stem bark (DBARSI-BJP1702) and *Iris ensata* Thunb. Root (DBARSI-BJP1703) respectively. The dried drugs were powdered with mortar and pestle. Further, it was passed through sieve no 80 in order to obtain fine powder (Hakeem Ajmal Khan, 2002; Kabeeruddin, 2010).

2.5. Treatment procedure

Each patient was given finely powdered *Ṭīlā-i Muhāsa* to apply at night on a prewashed and dried face after preparing a homogeneous paste in lukewarm water. Additionally, after 20–30 min, it was advised to wash the face with normal water (Hakeem Ajmal Khan, 2002; Kabeeruddin, 2010). Concomitant use of any topical or systemic anti-acne medications was not allowed during the study.

2.6. Outcome measures

The trial lasted three weeks and included three follow-ups. From baseline to treatment completion, the response to treatment was assessed using a 4-point grading scale with 0 indicating nil, 1 indicating mild, 2 indicating moderate, and 3 indicating severe, for subjective parameters including comedones, papules, pustules, nodules, itching, erythema, and scars, along with investigator's global assessment (IGA) of overall disease severity measured on the same 4-point grading scale. Additionally, the Cardiff acne disability index was utilized to measure the quality of life from baseline through treatment completion after obtaining permission from the appropriate authority (Durai and Nair, 2015).

2.7. Statistical analysis

The sample size was determined to be 29 by assuming $\alpha = 0.05$, power= 85%, and effect size= 0.6 based on a previous study (Lone et al., 2012), using G*Power 3.1 program (Faul et al., 2007). The required sample size was increased by 10% to account for projected dropouts. Thus, the intended sample size for this study was 32 participants in total. Although, the total number of participants who completed the trial was 30, the sample size provided 92% power to demonstrate the difference between pre- and post-treatment with respect to IGA.

Statistical analysis was carried out using IBM SPSS statistics version 23. Data were presented as number, percentage, range, percentage

Table 1
Composition of herbal formulation *Ṭīlā-i Muhāsa*.

Plant drug	Botanical name	Part used	Quantity
Barg-i Nīm	*Azadirachta indica* A. Juss.	Leaves	500 g
Post-i Siras	*Albizia lebbeck* L.	Stem bark	500 g
Bīkh-i Sosan	*Iris ensata* Thunb.	Root	500 g

change, or mean ± SD wherever appropriate. The Wilcoxon Signed Ranks Test, Friedmann test, and paired samples t-test were used to compare baseline categorical and continuous variables to post-treatment variables.

3. Results

3.1. Participant flow

Of the 61 participants screened, 31 met the qualifying criteria for the study. Throughout the study duration, only one participant was lost to follow-up, and a total of 30 participants completed the three-week protocol therapy. The data were analyzed as per-protocol excluding the drop-out (Fig. 1).

3.2. Clinico-demographic profile

The mean ± SD of the age of 30 patients was 24.5 ± 4.07 years, with 24 (80%) females and 6 (20%) males. Of all 30 participants, 53.3% had oily skin and 46.7% had mixed type of skin. There was a significant familial concordance, with 40% of patients reporting a positive family history. Among 30 participants, the majority (63.3%) were unmarried, compared to married individuals (36.7%). The upper middle class (73.3%) had the highest incidence of acne, followed by the lower middle class (20%) and upper lower stratum (6.7%). In terms of diet, all participants in our study had mixed dietary pattern (Table 2).

3.3. Change in subjective parameters

3.3.1. Comedones

Out of 30 cases, 13 (43.3%) had mild comedones, 11 (36.7%) had moderate, and 4 (13.3%) had severe comedones. At the conclusion of the trial, the majority of the cases, 25 (83.3%) reported no comedones, whereas only 5 (16.7%) had mild comedones. The total percentage change between the pre- and post-intervention variables was 76.6%, which was statistically significant at $p < 0.0001$ (Table 3).

3.3.2. Papules

At baseline, all 30 cases had papules, of whom 21 (70.0%) had moderate papules, 5 (16.7%) exhibited mild papules, and only 4 (13.3%) showed severe papules. At the end of the trial, majority of them, i.e., 26 (86.7%), got rid of papules, while only 5 (16.7%) had mild papules and 1 (3.3%) had moderate papules. The total percentage change between the pre- and post-intervention variables was 86.7%, which was statistically significant at $p < 0.0001$ (Table 3).

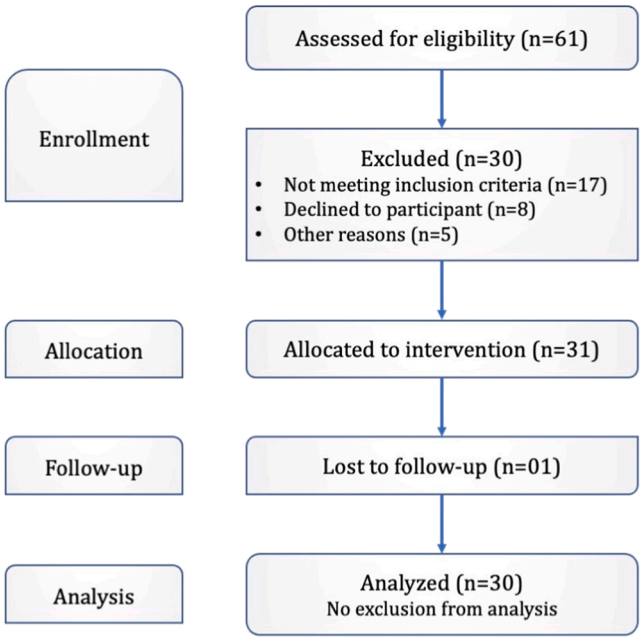

Fig. 1. Flow chart of the participants studied.

Table 2
Clinico-demographic profile of the participants studied.

Variables	Characteristics	Descriptive
Gender	Male, n, %	6 (20%)
	Female, n, %	24 (80%)
Age	Mean ± SD (years)	24.5 ± 4.07
Duration of disease	Mean ± SD (months)	12 ± 11
Skin type	Mixed skin (oily and dry skin), n, %	14 (46.7%)
	Oily skin, n, %	16 (53.3%)
Marital status	Married, n, %	11 (36.7%)
	Un-Married, n, %	19 (63.3%)
Socio-economic status	Upper Middle, n, %	22 (73.3%)
	Lower Middle, n, %	6 (20.0%)
	Upper Lower, n, %	2 (6.7%)
Dietary pattern	Mixed, n, %	30 (100%)

3.3.3. Pustules

At baseline, all 30 participants exhibited pustules, of whom 22 (73.3%) had moderate pustules, 6 (20.0%) had mild pustules, and only 2 (6.7%) cases had severe pustules. At the completion of the trial, majority of cases, i.e., 24 (80.0%) cases, were free from pustules, while only 6 (20.0%) cases had mild pustules. The total percentage change between the pre- and post-intervention variables was 80.0%, which was statistically significant at $p < 0.0001$(Table 3).

3.3.4. Nodules

At baseline, only 6 (20.0%) cases had nodules, of whom 3 (10.0%) had mild nodules and the remaining 3 (10.0%) cases had moderate nodules. At the end of the trial, only 4 (13.3%) cases had mild nodules, while 1 (3.3%) case had significant nodules. The total percentage change between pre- and post-intervention parameters was 6.7%, which was statistically significant at $p = 0.024$ (Table 3).

3.3.5. Itching

At baseline, 11 (36.7%) cases experienced itching, with 5 (16.7%) experiencing mild itching and 6 (20.0%) experiencing significant itching. All cases lacked itching at the completion of the experiment. The total percentage change between pre- and post-intervention components was 36.7%, which was statistically significant at $p = 0.003$. (Table 3).

3.3.6. Erythema

Out of 30 cases, 17 (56.7%) had moderate erythema, followed by 6 (20.0%) with severe erythema, 3 (10.0%) with mild erythema, and 4 (13.3%) with no erythema. At the completion of the trial, 27 (90.0%), lacked erythema, while only 3 (10.0%) exhibited mild erythema. The total percentage change between the pre- and post-intervention variables was 76.6%, which was statistically significant at $p < 0.0001$ (Table 3).

3.3.7. Scars

At baseline, just 2 (6.7%) individuals had mild scars that remained unchanged at the conclusion of trial, inferring that the trial medication had no effect on scarring (Table 3).

3.4. Change in investigator's global assessment (IGA)

The overall disease severity was assessed on IGA, comprising 4-points (0-nil, 1-mild, 2-moderate, and 3-severe). At baseline, equal numbers of participants had moderate and severe acne (50%). On first follow-up, most of the cases 20 (66.7%) had moderate acne followed by 7 (23.3%) cases with mild acne, and 3 (10%) cases with severe acne. On

Table 3
Changes in subjective parameters from baseline to treatment completion.

Sr. No.	Subjective parameters	Severity	Baseline	After treatment	Statistical analysis	p-Value[a]
1	**Comedones**	**Severe**	4 (13.3%)	0 (0.0%)	Total % change: 76.6%	p<0.0001
		Moderate	11 (36.7%)	0 (0.0%)	Negative ranks: 26	
		Mild	13 (43.3%)	5 (16.7%)	Positive ranks: 0	
		Nil	2 (6.7%)	25(83.3%)	Ties: 4	
2	**Papules**	**Severe**	4 (13.3%)	0 (0.0%)	Total % change: 86.7%	p<0.0001
		Moderate	21 (70.0%)	1 (3.3%)	Negative ranks: 30	
		Mild	5 (16.7%)	3 (10.0%)	Positive ranks: 0	
		Nil	0 (0.0%)	26(86.7%)	Ties: 0	
3	**Pustules**	**Severe**	2 (6.7%)	0 (0.0%)	Total % changed: 80.0%	p<0.0001
		Moderate	22 (73.3%)	0 (0.0%)	Negative ranks: 30	
		Mild	6 (20.0%)	6 (20%)	Positive ranks: 0	
		Nil	0 (0.0%)	24 (80%)	Ties: 0	
4	**Nodules**	**Severe**	0 (0.0%)	0 (0.0%)	Total % change: 6.7%	p = 0.024
		Moderate	3 (10.0%)	1 (3.3%)	Negative ranks: 6	
		Mild	3 (10.0%)	4 (13.3%)	Positive ranks: 0	
		Nil	24 (80.0%)	25(83.4%)	Ties: 24	
5	**Itching**	**Severe**	0 (0.0%)	0 (0.0%)	Total % change: 36.7%	(p = 0.003)
		Moderate	6 (20.0%)	0 (0.0%)	Negative ranks: 11	
		Mild	5 (16.7%)	0 (0.0%)	Positive ranks: 0	
		Nil	19 (63.3%)	30 (100%)	Ties: 19	
6	**Erythema**	**Severe**	6 (20.0%)	0 (0.0%)	Total % change: 76.7%	p<0.0001
		Moderate	17 (56.7%)	0 (0.0%)	Negative ranks: 26	
		Mild	3 (10.0%)	3 (10.0%)	Positive ranks: 0	
		Nil	4 (13.3%)	27(90.0%)	Ties: 4	
7	**Scars**	**Severe**	0 (0.0%)	0 (0.0%)	Total % change: 0.0%	p = 1.000
		Moderate	0 (0.0%)	0 (0.0%)	Negative ranks: 0	
		Mild	2 (6.7%)	2 (6.7%)	Positive ranks: 0	
		Nil	28 (93.3%)	28(93.3%)	Ties: 30	

[a] Wilcoxon Signed Ranks Test

second follow-up, most of the cases 27 (90.0%) had mild acne and only 3 (10.0%) had moderate acne. At the end of the trial, 21 (70.0%) had no acne, 8 (26.7%) had mild acne, and 1 (3.3%) had moderate acne. The mean rankings at baseline, the first follow-up, the second follow-up, and the third follow-up were 3.82, 3.07, 2.00, and 1.12, respectively, indicating a steady decline from baseline until the conclusion of the trial (Table 4).

3.5. Change in quality of life (QoL)

The Cardiff acne disability index (CADI) was used to assess the individuals' quality of life. The mean ± SD of total data was 9.7 ± 2.5 prior to treatment, that significantly decreased to 2.7 ± 2.6 upon completion of therapy ($p < 0.0001$) (Table 5).

3.6. Safety evaluation

Although no such adverse effects prompted participant withdrawal, 5 participants (16.7%) complained of bearable dryness.

Table 4
Change in the investigator's global assessment from baseline to treatment completion.

Severity	Baseline	1st follow-up	2nd follow-up	3rd follow-up	Analysis
Nil	0 (0.0%)	0 (0.0%)	0 (0.0%)	21 (70.0%)	Percentage difference from baseline: 70%
Mild	0 (0.0%)	7 (23.3%)	27 (90.0%)	8 (26.7%)	
Moderate	15 (50%)	20 (66.7%)	3 (10.0%)	1 (3.3%)	
Severe	15 (50%)	3 (10.0%)	0 (0.0%)	0 (0.0%)	
Mean rank	3.82	3.07	2.00	1.12	p < 0.0001

*Friedman Test

Table 5
Change in Cardiff acne disability index from baseline to treatment completion.

Time points	Mean±SD	t-value	p-Value[a]
Baseline	9.7 ± 2.5	22.5	p < 0.0001
After treatment	2.7 ± 2.6		

[a] Paired samples t-test

4. Discussion

Acne is a multifactorial disorder. The main pathogenic components are abnormal follicular keratinization with retention of keratinous plug in the follicle, excessive sebum production, overgrowth of *Cutibacterium acnes* (gram-positive anaerobic bacterium) and inflammation (Kang et al., 2019). Recent studies in acne pathogenesis have evinced the critical role of oxidative stress in the causation of acne (Tabasum et al., 2014).

This study was conducted to evaluate the efficacy of *Ṭīlā-i Muhāsa* in *Buthūr-i Labaniyya* and the change in life quality index. The mean ± SD age of participants was 24.5 ± 4.07 years and females were more affected than males. The data are in agreement with Collier et al. who reported that acne vulgaris continues to be a common dermatological problem in late adolescence, with females being more affected than males aged 20 years or older (Collier et al., 2008). This study found a 40% familial occurrence, which is consistent with Biswas et al. and Ghodsi et al. who observed a positive family history in causation of acne vulgaris (Biswas, 2010; Zahra Ghodsi et al., 2009). In terms of diet, all the participants had mixed dietary pattern which is consistent with the observations of Biswas et al. (Biswas, 2010). Moreover, Halvorsen et al. (2012) established a relation between acne and a lower intake of raw vegetables (Pappas, 2009). The proportion of patients with oily skin was greater than those with mixed skin types which is consistent with Munawwar et al. and Ghodsi et al., who identified a relationship between oily skin type and higher severity grades of acne (Ghodsi et al., 2009; Munawar et al., 2009). The higher incidence of acne was found in upper middle class (73.3%) in congruence with the data reported by

Halvorsen et al. and Munawwar et al. (Halvorsen et al., 2012; Munawar et al., 2009).

The per-protocol analysis inferred that Unani herbal formulation significantly decreased the acne lesions over a period of 3 weeks and helped in improving quality of life as well. The alleviation of the acne lesions with the herbal formulation appears to be due to *Qabiz* (astringent), *Muhallil-i Waram* (resolvent), *Dafi' Ta'ffun* (antiseptic), *Jāli* (detergent) and *Mujaffif* (desiccant) properties of the ingredients as described in Unani literature (Hakeem Ajmal Khan, 2002; Kabeeruddin, 2010). *Azadirachta indica* leaf has been reported for its anti-acne (Miglani and Manchanda, 2014), anti-inflammatory (Naik et al., 2014), immunomodulatory (Sharma et al., 2016) antiseptic, anti-allergic, and skin renewal activities (Moin et al., 2021; Naik et al., 2014; Wadher et al., 2009). Nimbin (triterpene) is the primary bioactive chemical found in *Azadirachta indica* attributed to these effects (Islas et al., 2020). Studies on *Albizia lebbeck* stem bark have concluded the antibacterial (Bobby et al., 2012), anti-inflammatory (Meshram et al., 2016; Saha and Ahmed, 2009), antioxidant (Pandey et al., 2010), analgesic (Meshram et al., 2016; Saha and Ahmed, 2009) and anti-androgenic activities (Gupta et al., 2006). *Iris ensata* root is also found to be a potent antimicrobial (Wagay and Jain, 2018), antioxidant (Ahmad Ganaie et al., 2018) and anti-inflammatory (Mirza, 2017) drug. The putative mechanism of action is presented in Fig. 2 based on the reported pharmacological activities.

To sum up, this study has provided evidence that the present formulation is safe, efficacious, and tolerable in acne patients. However, limitations of this study have to be taken into consideration, such as smaller sample size, non-controlled trial, and shorter duration of therapy. Hence, randomized controlled clinical trials with an adequate sample size should be conducted to further establish the efficacy of intervention. Additionally, sophisticated scientific metrics illustrating the mechanistic effects of the trial intervention should be employed for better comprehension of the mechanism of action.

5. Conclusion

The study inferred that *Ṭīlā-i Muhāsa* containing *Azadirachta indica* A. Juss. leaves, *Albizia lebbeck* L. stem bark, and *Iris ensata* Thunb. roots, is statistically as well as clinically significant in alleviating acne vulgaris signs and symptoms. Although the formulation was found to be efficacious and well-tolerated in the treatment of acne vulgaris, additional well-designed, double-blinded, controlled clinical trials using the plants extracts with a larger sample size and longer duration of therapy employing validated scientific parameters are necessary to strengthen the scientific evidence.

Ethical approval

Approval taken from Institutional Ethics Committee, LUMC, Bijapur Karnataka (protocol reg. no. BJP/LUMC/PG/IEC/2017–18/03/MOALIJAT/04).

Research funding

Nil.

Author contributions

All authors have accepted responsibility for the entire content of this manuscript and approved its submission.

Informed consent

Written informed consent was obtained from all individuals included in this study.

Trial registration

Clinical Trial Registry of India (www.ctri.nic.in) registration number CTRI/2019/02/017493.

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Nil.

CRediT authorship contribution statement

Meenu Doni: Conceptualization, Data curation, Methodology, Formal analysis, visualization, Writing – original draft. **Mohd Qudrathullah:** Conceptualization, Methodology, Formal analysis, Supervision. **Mohd Khalid**: Writing – review & editing, Visualization. Formal analysis, Resource. **Nazim Husain**: Data curation, Formal analysis, Writing – review & editing, Visualization. **Mohammad Iliyas Patel**: Conceptualization, Methodology, Project administration, Resource Investigation. **Bibi Ayesha:** Conceptualization, Methodology, Formal analysis, Resource.

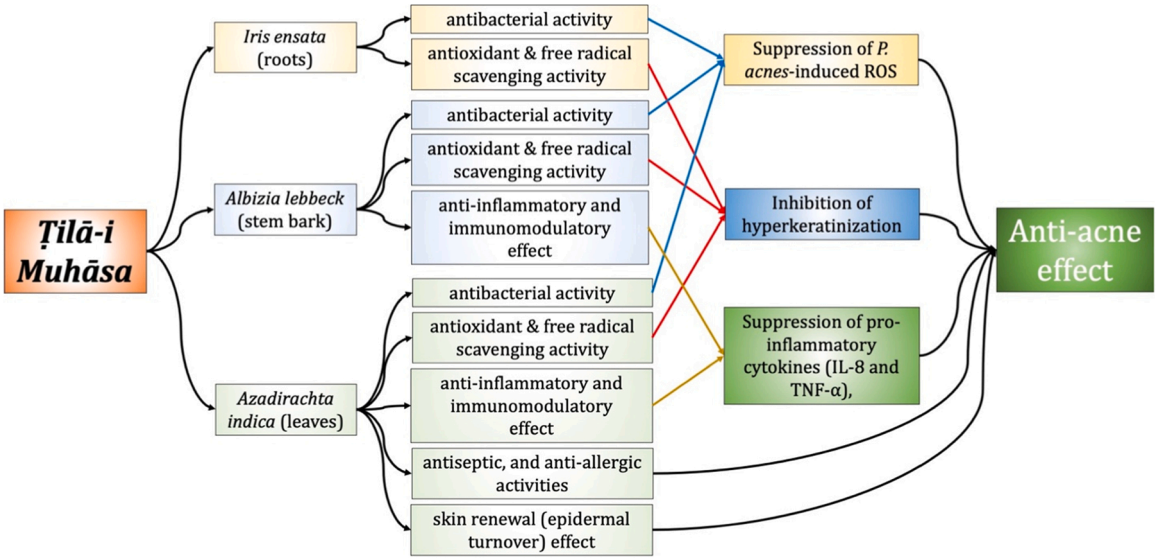

Fig. 2. Probable mechanism of action of *Ṭīlā-i Muhāsa* in acne vulgaris.

Competing interests

The authors have no conflicting financial interests.

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