Original Article

Effect of Herbal Face Pack on Acne Vulgaris among Young Adult Females – A Randomized Controlled Trial

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ABSTRACT

Background & Objectives: Acne vulgaris (AV) is a chronic inflammatory condition affecting the pilosebaceous unit, which results in scarring and considerable psychological effects, thereby diminishing the quality of life (QoL). Factors such as Propionibacterium acnes, increased sebum production, altered keratinization, and inflammation play a role in the development of acne. Numerous other treatments methods are often expensive and leads to complications. This study seeks to assess the impact of a herbal face pack, composed of turmeric, sandalwood, and neem, on the severity of acne and QoL. **Methods:** A randomized controlled trial was carried out involving 60 participants, aged between 14 and 25 years diagnosed with AV. Participants were randomly allocated to one of two groups: the study group, which applied a herbal face pack for 20 minutes daily over a period of 30 days and the control group, which received standard medical care. Both groups were advised to refrain from consuming processed foods. **Results:** The data was analysed using SPSS version 21. Within group comparisons were conducted using t-test and difference-in-difference analysis, revealing a significant reduction in GAGS score in both the study group ($p<0.01$) and control group ($p<0.01$). Additionally, a similar significant reduction in Acne-QoL and DLQI score was observed in both the groups ($p<0.01$). However, the changes were more pronounced in the study group compared to control group. **Interpretation & Conclusion:** The use of a face pack containing turmeric, sandalwood, and neem, along with dietary modifications, can significantly decrease acne severity and enhance the QoL for individuals with AV. This herbal remedy offers a safe, cost-effective alternative for managing AV.

Key words: Herbal medicine, Acne vulgaris, Herbal face pack, Turmeric, Sandalwood, Neem

Acne vulgaris (AV) is a chronic inflammatory disorder of the pilosebaceous unit, commonly affecting young adults, particularly during puberty, and can lead to both physical and psychological consequences such as scarring and social anxiety [1-3]. The condition is influenced by factors like increased sebum production, bacterial colonization by *Propionibacterium acnes* (P. acnes), altered keratinization, and inflammation, and is prevalent in 8.96% of men and 9.81% of women globally [4-8]. While it peaks in teenagers, it can occur at any age, with severe acne often linked to increased sebum production and P. acnes proliferation [9-12]. Various external factors such as medication use, exposure to heat, and endocrine disorders can also exacerbate acne, while psychological impacts like depression and suicidal thoughts are significant concerns, particularly among adolescents [13-14].

Natural compounds have garnered attention for their potential therapeutic properties due to their safety and efficacy, particularly in traditional practices like Ayurveda and Chinese Medicine [16-17]. Herbs such as turmeric, sandalwood, and neem have been identified for their anti-inflammatory, antibacterial and antioxidant benefits, making them effective in managing skin conditions like acne [18]. Turmeric, for example, is known for its ability to purify blood and reduce oil production, while neem provides significant antibacterial and anti-inflammatory effects [19]. These natural remedies offer non-toxic alternatives to synthetic treatments and have been shown to improve skin conditions while reducing the appearance of acne scars and early signs of aging [20]. The aim of this study is to evaluate the effectiveness of herbal face packs in managing acne vulgaris (AV) among young adult females. The specific objectives are: (a) to assess the effect of herbal face packs on the severity of AV, and (b) to evaluate their impact on the quality of life (QoL) of individuals with AV.

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METHODOLOGY

A randomized controlled trial was conducted among individuals with acne vulgaris, recruited from educational institutes under Alva's Education Foundation, Moodbidri, Dakshina Karnataka. After obtaining written informed consent, a total of 100 subjects aged between 14 and 25 years were screened. Of these, 60 subjects meeting the inclusion and

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diagnostic criteria were recruited for the study. The participants were randomly assigned into two groups: a study group (n=30) and a control group (n=30). Pre-assessments were conducted for both groups prior to the intervention. The study group was given a herbal face pack consisting of turmeric, sandalwood, and neem, applied for 20 minutes daily over a period of 30 days. The control group continued with their usual daily activities while receiving standard medical care. Post-assessments were conducted after the 30-day intervention period. Ethical clearance was obtained from the Institutional Ethical Committee (ACNYS/IECHS/2022/68), and the details of the study were explained to the participants who provided informed consent.

The inclusion criteria for the study were females aged between 14 and 25 years with facial acne presenting whiteheads, blackheads, papules, and pustules, and mild to moderate severity according to diagnostic criteria. Exclusion criteria included individuals who had been using herbal or allopathic treatments for acne in the past six months, had a history of polycystic ovarian disease (PCOD), were suffering from cystic acne, had allergies or skin irritations to turmeric, sandalwood, or neem, or had participated in other clinical trials in the past six months.

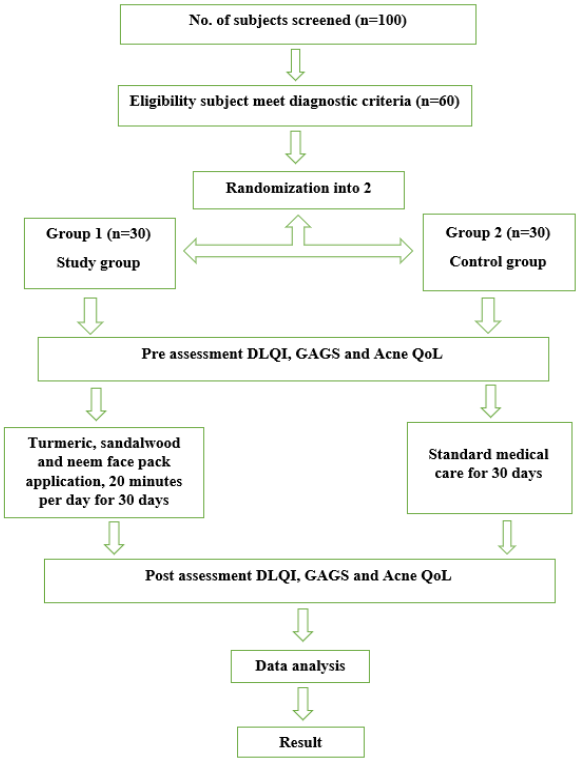


Figure 1: Illustration of study plan

INTERVENTION

Classification of Acne

- Mild: Comedones are the main lesions. Papules and pustules may be present but are small and few (generally<10).
- Moderate: Moderate number of pustules and papules (10 to 40) and comedones are present. Mild disease of the trunk may also be present.
- Moderately severe: Numerous papules and pustules (40 to 100), usually with many comedones (40 to 100), and occasional (up to 5) larger, deeper nodular inflamed lesions. Widespread affected areas usually involving face, chest and back.
- Very severe: Nodulocystic acne and acne conglobate with severe lesions; many large, painful nodular/pustular lesions along with many smaller papules, pustules and comedones [21].

Assessments

Global Acne Grading System (GAGS): A global acne grading system divides the face, chest, and back into six areas: forehead, cheeks, nose, chin, chest, and back. Each area is scored from 0-4 based on lesion severity (0 for no lesions, 1 for comedones, 2 for papules, 3 for pustules, and 4 for nodules). Each area has a size-based factor, and the score is calculated by multiplying the highest lesion severity by the area factor. The total score is the sum of individual area scores. Scores are interpreted as follows: a total score ranging from 1 to 18 indicates mild acne; 19 to 30 denote moderate acne; 31 to 38 suggests severe acne; and scores exceeding 39 are classified as very severe [22].

Acne – specific quality of questionnaire (Acne – QoL): The Acne-QoL questionnaire evaluates the impact of facial acne on quality of life across four domains: Self Perception, Role-Social, Role-Emotional, and Acne Symptoms. Responses are scored from 0 (extremely) to 6 (not at all), with higher scores indicating better quality of life. The domain scores are calculated by summing the coded responses for each relevant question [23].

Dermatology life quality index (DLQI): Scores from 0-1 indicate no effect on quality of life, 2-5 suggest a small effect, 6-10 a moderate effect, 11-20 a very large effect, and 21-30 an extremely large effect. This system helps healthcare providers understand how acne impacts daily life and guide treatment strategies [24].

Intervention: Pre – assessments were performed before starting the intervention. Herbal face pack were given for 20 minutes per day for 30 days and control group will continue their daily activity with standard medical care. Post assessments were taken after the 30 days of intervention in both the groups. Fresh turmeric rhizomes and neem leaves were collected, washed, and dried in the shade to preserve their properties. After drying, the turmeric was cut into small pieces and ground into a fine powder, while the neem leaves were also ground after drying. Both powders were stored in airtight containers in a cool, dark place to maintain freshness and effectiveness [25]. The prepared powder has been collected in a bowl as per person

requirement i.e., 5g of sandalwood and neem, 2g of turmeric and mix with water to form a paste. Apply this paste over to the skin which covers acne, keep it for 20 minutes and then wash with water [26]. The data were entered, coded, and analysed using Microsoft Excel and Statistical Package for the Social Sciences (SPSS) version 21. Semi parametric and parametric test was used for comparing within and between the group changes. Difference in Difference and t- test was used to see difference between the two groups. The groups mean values ± standard deviation values were calculated for all variables. p values less than 0.05 were indicated as significant value and 0.01 considered as highly significant value.

RESULT

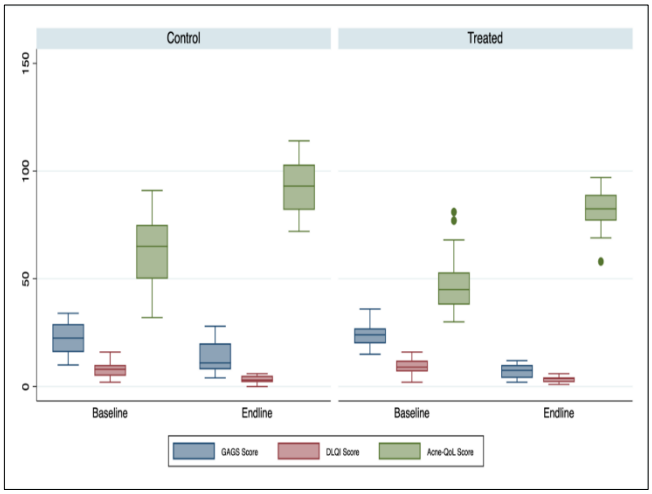


Figure 2: Boxplot showing the concentration of GAGS, DLQI & Acne-QoL scores in the selected sample

The present study was conducted to assess the efficacy of application of herbal face pack using natural ingredients such as turmeric, sandalwood, and neem in subjects with AV. The data was collected at baseline and endline i.e., after 1 month. Parametric and semi -parametric test was used for comparing within and between group changes. In order to check the characteristics of the subjects, the distribution of the data was checked and found that the study sample have normal distribution. Boxplot by GAGS, DLQI and Acne-QoL scores are shown in **Figure 2.**

The characteristics of the subjects both study and control were also checked by the level of GAGS and DLQI where it is found that in baseline both groups have higher proportion of moderate level of GAGS (60% in control and 83% in study) but during endline it reduces to 27% in control but there is no subject with moderate level in study group and all the subjects in study group falls in mild level of GAGS. The difference is not statistically significant during baseline but the difference between group is found statistically significant at $p<0.01$. No participants have less than 1 and more than 38 scores, i.e., all the participant have at least mild acne but no highly severe acne based on GAGS grading (Table 1).

In terms of DLQI, in both control and study group, highest proportion of the subject during baseline have moderate effect and highest proportion of subject during endline have small effect which might be due to reduction in GAGS score. None of the subject has extremely large effect (21-30 score) based on DLQI. It can also be noted that in both the group, 20% in control group 7% in the study group have no effect on DLQI (Table 2).

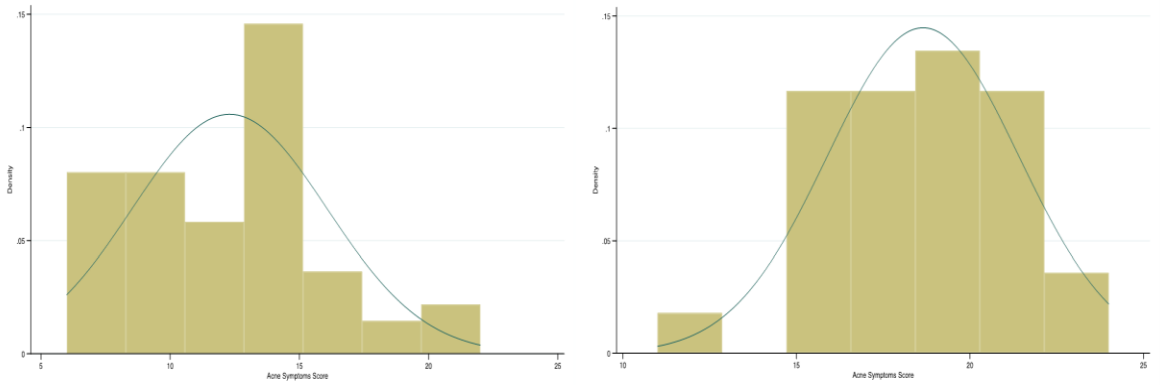
Table 1: Table showing distribution of study participants by Global Acne Grading System (GAGS)

	Baseline ($\chi2$ p-value = 0.114)			Endline ($\chi2$ p-value = 0.002)		
Level of GAGS score	**Control**	**Study**	**Total**	**Control**	**Study**	**Total**
Mild (1-18)	30.0	10.0	20.0	73.3	100.0	86.7
Moderate (19-30)	60.0	83.3	71.7	26.7	0.0	13.3
Severe (31-38)	10.0	6.7	8.3			
Total Participants	**30**	**30**	**60**	**30**	**30**	**60**

Table 2: Table showing distribution of study participants by Dermatology Life Quality Index (DLQI)

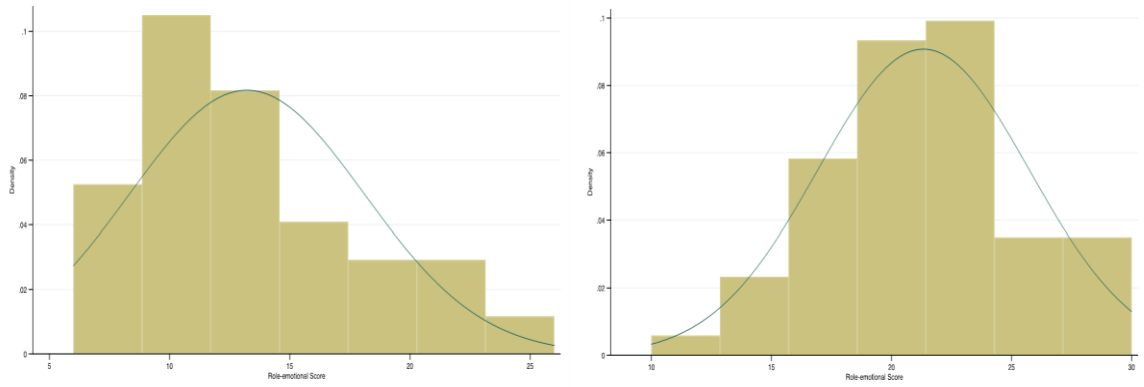
	Baseline ($\chi2$ p-value = 0.094)			Endline ($\chi2$ p-value = 0.025)		
Level of DLQI	**Control**	**Study**	**Total**	**Control**	**Study**	**Total**
No effect (0-1)				20.0	6.7	13.3
Small effect (2-5)	36.67	13.33	25	60.0	90.0	75.0
Moderate effect (6/10)	40	46.67	43.33	20.0	3.3	11.7
Very large effect (11-20)	23.33	40	31.67			
Total Participants	**30**	**30**	**60**	**30**	**30**	**60**

For analysing the component of Acne-QoL, dispersion of the data based on the selected indicators – Acne Symptom, Role Emotional, Role Social and Self Perception were also checked and found changed from baseline to endline (Figure 3, 4, 5 & 6).



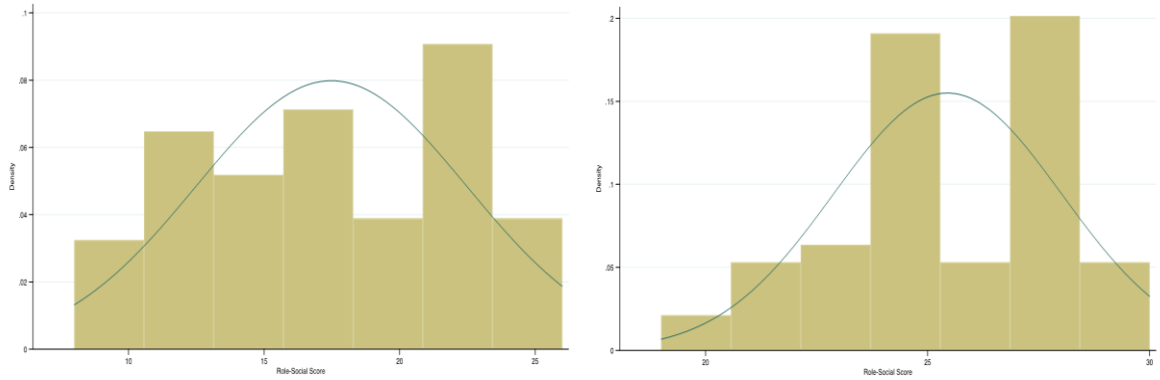
Baseline Endline

Figure 3: Graph showing distribution of participants during baseline and endline by Acne Symptom score



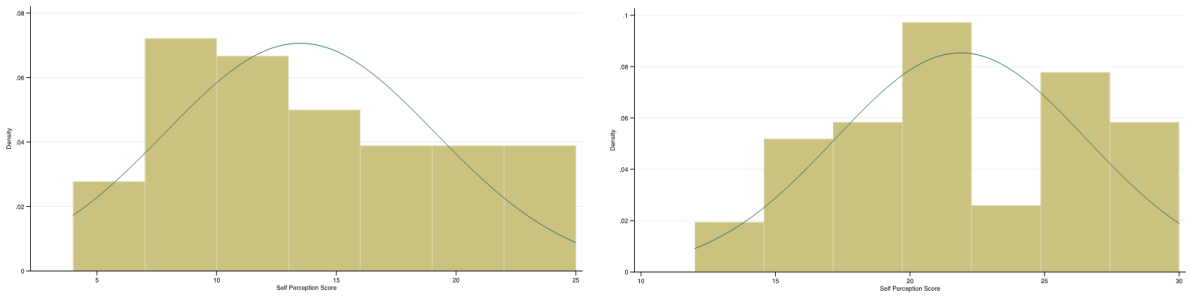
Baseline Endline

Figure 4: Graph showing distribution of participants during baseline and endline by Role-Emotional score



Baseline Endline

Figure 5: Graph showing distribution of participants during baseline and endline by Role-Social score



Baseline Endline

Figure 6: Graph showing distribution of participants during baseline and endline by Self-Perception score

t – TEST AND DIFFERENCE IN DIFFERENCE ANALYSIS FOR CONTROL AND STUDY GROUP:

The result of t-Test and difference-in-difference showed improvement in GAGS, DLQI and Acne-QoL in both control and study groups (Table 3 & 4). It is found that the GAGS score in both the study group and control group reduced significantly at p<0.01 and the DID result also shows that the change in GAGS score over time between control and study group shows statistical significance at p<0.01. In the case of Acne – QoL and DLQI score, t-Test result shows that there is improvement in the DLQI and Acne-QoL among the study participants in both control and study groups. The difference is found statistically significant at p<0.01. Though there is improvement related to change in the DLQI and Acne-QoL score over time between control and study group, the difference is not found statistically significant. Moreover, analysis also shows that the changes are found to be more in the study group compared to control group.

t-Test and Difference in Difference analysis is done for component of Acne-QoL. The result of the t-Test shows that Acne Symptom, Role Emotional, Role Social and Self Perception shows that there is significant decline increase in the mean score at p<0.01 for both control and study group thought the mean is higher in control group compared to study group in both baseline and endline. From the Difference in Difference analysis, it is found that the change in mean Acne-symptom, Role Emotional and Self Perception scores over time between control and study group do not show significant difference. The mean score of Role Social has positive change over time between control and study group at p<0.10. Perhaps the mean scores are significantly higher in control group compared to study group during baseline and endline.

Table 3: t-Test result showing comparing the means of Baseline and Endline

	Control			Study		
	Baseline (B)	Endline (E)	Diff	Baseline (B)	Endline (E)	Diff
	Mean [SD]	Mean [SD]	(E-B)	Mean [SD]	Mean [SD]	(E-B)
GAGS Score	22.2 [7.16]	13.1 [6.6]	-9.1***	24.2 [4.86]	6.6 [3.35]	-17.6***
DLQI score	7.8 [3.78]	3.2 [1.94]	-4.6***	9.2 [3.27]	3.5 [1.28]	-5.7***
Acne-QoL Score	64.6 [15.65]	93.3 [11.9]	28.7***	48.4 [14.01]	81.4 [8.49]	33.0***
Acne Symptoms	14.2 [3.72]	19.8 [2.61]	5.5***	10.4 [2.71]	17.5 [2.46]	7.2***
Role-emotional	15.2 [4.85]	23.3 [4.34]	8.1***	11.2 [4.11]	19.4 [3.57]	8.2***
Role-Social	19.4 [4.46]	26.2 [2.36]	6.7***	15.5 [4.8]	24.7 [2.61]	9.2***
Self-Perception	15.7 [5.1]	24.1 [4.61]	8.4***	11.3 [5.36]	19.7 [3.65]	8.4***

Note: * p<0.10; ** p<0.05; & *** p<0.01 level of significance

Table 4: Difference in Difference analysis result of change in severity of acne and quality of life before and after intervention.

	Baseline			Endline			Diff-in-Diff
	Control (C)	Study (T)	Diff (t-test)	Control (C)	Study (T)	Diff (t-test)	Endline(T-C)-Baseline(T-C)
	Mean [SD]	Mean [SD]	(T-C)	Mean [SD]	Mean [SD]	(T-C)	DID (p-value)
GAGS Score	22.2 [7.16]	24.2 [4.86]	2.0	13.1 [6.6]	6.6 [3.35]	-6.6***	-8.6***
DLQI score	7.8 [3.78]	9.2 [3.27]	1.4	3.2 [1.94]	3.5 [1.28]	0.3	-1.0
Acne-QoL Score	64.6 [15.65]	48.4 [14.01]	-16.2***	93.3 [11.9]	81.4 [8.49]	-11.9***	4.3
Acne Symptoms	14.2 [3.72]	10.4 [2.71]	-3.9***	19.8 [2.61]	17.5 [2.46]	-2.2***	1.6
Role-emotional	15.2 [4.85]	11.2 [4.11]	-4.0***	23.3 [4.34]	19.4 [3.57]	-3.9***	0.1
Role-Social	19.4 [4.46]	15.5 [4.8]	-3.9***	26.2 [2.36]	24.7 [2.61]	-1.4**	2.5*
Self-Perception	15.7 [5.1]	11.3 [5.36]	-4.4***	24.1 [4.61]	19.7 [3.65]	-4.4***	0.1

Note: * p<0.10; ** p<0.05; & *** p<0.01 level of significance.

DISCUSSION

The result of the present study shows a significant reduction in GAGS score in both the study group ($p<0.01$) and control group ($p<0.01$). In addition, a similar significant reduction in Acne – QoL and DLQI score was observed in the study group ($p<0.01$) and the control group ($p<0.01$). Better improvement in reduction of acne and oil production in skin has been observed in study group with improvement in quality of life.

The present study was aimed to evaluate the efficacy of herbal face pack combination of turmeric, sandalwood and neem application on severity of acne and QoL in individuals with AV. Subjects in both the groups are strictly avoided from processed foods. Natural herbs used for skin treatment are turmeric, sandalwood and neem with the turmeric plant, scientifically known as Curcuma longa, belonging to the ginger family Zingiberaceae. It has anti-inflammatory, antioxidant, and antibacterial properties [27]. Curcumin, a bioactive compound in turmeric, shows promise as an alternative acne treatment by inhibiting nuclear factor-kappa B (NF-kB) and reducing pro-inflammatory cytokines like IL-6 and TNF-α. It also acts as a potent antioxidant, scavenging reactive oxygen species (ROS), and protecting skin cells from oxidative damage. Curcumin stimulates apoptosis in excess skin cells, helping to prevent clogged pores, and it enhances healing by increasing growth factors such as TGF-β and FGF.

Recent studies indicate that curcumin microemulsions can effectively inhibit acne-related bacteria like S. epidermidis and P. acnes, while its antioxidant properties boost protective enzyme activity. This suggests that curcumin may offer a natural solution for acne management, especially in light of rising antibiotic resistance [28,29]. In many of the study, turmeric as in AV treatment concluded that medicinal plant has shown properties of anti-fat and anti-inflammation. Chemical drugs preference is still the first choice for treating acne and skin infection but nowadays medicinal plants are used as there is less side effect and safe [30]. A study conducted in 2021, on polyherbal anti-acne gel prepared from the extract of citrus sinensis (0.2%), aloe barbadensis (1%) and curcuma longa (0.8%) produced significance in their antibacterial activity on staphylococcus aureus and S. epidermis with no irritation so it can be used for treatment of acne [31].

Kant et al, also proposed that the anti- inflammatory and antioxidant properties of curcumin may be responsible for increased wound healing in diabetic rats. The investigators observed that curcumin decreases TNF-α, IL- 1 β and MMP-9, and increased superperoxide dismutase and catalases in the animals. And also found elevated gluthathione peroxidase levels [32]. Santalum album, widely known to be East Indian sandalwood, Chandana, or sandal, belongs to the Santalaceae family. This small evergreen hemiparasitic tree is renowned for its fragrant heartwood, which has cooling properties and a pleasing aroma, for over 5,000 years, used in pharmaceuticals and perfumer due to its active compounds, alpha and beta-santalols. It offers a range of therapeutic properties, including antioxidant, anti-inflammatory, antibacterial, and antifungal effects [33].

The mechanism of action of sandalwood, is particularly through its active compounds like alpha- and beta-santalols. These components of sandalwood can inhibit pro-inflammatory cytokines and enzymes like the cyclooxygenase (COX) and lipoxygenase (LOX). Reducing the levels of inflammatory markers, helps alleviate the redness and swelling associated with acne lesions. It helps neutralize reactive ROS, protecting skin cells from oxidative stress that can exacerbate acne [34]. In a study conducted on efficacy of sandalwood and red sandalwood on patient with AC concluded that both the treatment is effective and safe but sandalwood shows higher effectiveness than red sandalwood for reducing the acne on skin [35].

Neem (Azadirachta indica), belonging to the Meliaceae family, is commonly known as margosa, Indian lilac and Azadirachta indica. It is known as "Arishta" in Sanskrit, meaning "reliever of sickness. All parts of the tree possess a bitter taste, and it has been recognized by the United Nations as the "Tree of the 21st Century" [36]. Neem offers significant therapeutic potential by enhancing antioxidant activity, inhibiting bacterial growth, and influencing genetic pathways.

Neem for its anti-acne properties primarily through its anti-inflammatory effects, which involve the regulation of pro-inflammatory molecules including COX and LOX. At the molecular level, neem plays a crucial role in managing AV by regulating sebum production, decreasing inflammation, and inhibiting the growth of acne-causing bacteria, particularly P. acnes. The bioactive compounds found in neem influence key cell signaling pathways that are essential for the proliferation and differentiation of keratinocytes, the primary cells in the outer layer of the skin. This action promotes healthier skin turnover, helping in preventing dead skin cells buildup that can clog pores and contribute to acne formation. Moreover, by modulating inflammatory cytokines, neem effectively reduces inflammation and redness associated with acne lesions. Its ability to lower the activity of pro-inflammatory enzymes leads to a significant alleviation of acne symptoms, resulting in clearer, healthier skin overall. As such, neem not only addresses the symptoms of acne but also supports the underlying mechanisms that contribute to its development, making it a valuable natural remedy for acne management [36, 37].

A clinical study conducted on purifying neem for face wash in acne highlighted the benefits of herbal ingredients (neem and turmeric) to prevent and reduce mild to moderate acne with no side effect. Out of 120 study subjects, 79% showed reduction and 72% had nil new outcomes of acne lesions due to inflammation or non-inflammatory ways [38]. A study of in house making along with the development and evaluation of face packs of herbal cosmetics with various natural powders (turmeric, sandalwood, rice flour, dried rose, orange peel

powder, tomato & potato powder) conclude that home remedies using natural products are widely accepted in the notion of being safer and no side effect. It is used to enhance blood circulation, rejuvenate the muscle and keep skin's elasticity intact [39]. According to previous research herbal packs have a significant reduction in acne without side effect with lower cost and easy to implement.

In the present study, natural remedies involving the application of herbal face packs have been used. These serves multiple purposes for skin care, including stimulating blood circulation, rejuvenating facial muscles, and maintaining skin elasticity. These natural formulations effectively cleanse the skin by removing dirt and impurities from the pores, promoting a clearer complexion. One of the key benefits of herbal face pack is their non-toxic nature, which significantly reduces the risk of allergic reactions and skin sensitivities often associated with synthetic products. Made from plant-based ingredients, these pack harness the therapeutic properties of herbs, providing nourishment without harmful chemicals. Additionally, herbal pack can enhance skin hydration and improve overall skin texture, making them a gentle yet effective choice for various skin types.

By incorporating herbal face packs into a skincare routine, individuals can enjoy a holistic approach to beauty that not only enhances skin health but also supports a more sustainable and eco-friendlier lifestyle. This natural method of skincare emphasizes wellness and promotes a vibrant, youthful appearance. In present study the combination of turmeric, sandalwood and neem face pack on severity of acne and QoL in individuals with AV shown better improvement in subjects with AV. However, at the end of the study, slight dryness of skin was observed. To see more effect, using the herbal face pack alternate days of treatment may be better.

CONCLUSION

The current study concludes that applying an herbal face pack containing turmeric, sandalwood, and neem for 30 days to individuals with acne vulgaris leads to notable reduction in acne severity and an enhancement in quality of life. Therefore, combination of turmeric, sandalwood, and neem face pack can be regarded as one of the safest alternative and complimentary therapies for the management of AV.

Limitations of the study

The study had several limitations, including its short duration of 30 days, which did not allow for the assessment of long-term effects. Additionally, no follow-up was conducted to evaluate the sustainability of the treatment outcomes. The relatively small sample size may have limited the generalizability of the findings. Furthermore, light skin dryness was observed at the end of the study, which could indicate potential side effects. Future prospects for this research include conducting studies with a larger sample size and incorporating follow-up assessments to better understand the long-term benefits and sustainability of the herbal face pack treatment.

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