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SUNBURN TREATMENT USING HERBAL REMEDIES: AN EXPLORATORY STUDY ON KNOWLEDGE, PERCEPTIONS, AND SAFETY CONCERNS

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ABSTRACT

Background: Sunburn is a common condition resulting from overexposure to ultraviolet radiation, with symptoms ranging from erythema and blistering to systemic effects. While conventional treatments include corticosteroids and NSAIDs, interest in herbal alternatives is increasing due to their perceived safety and holistic benefits. **Objective:** The goal of this study is to review the literature regarding the use of common herbs —Aloe Vera, Calendula, Lavender, and Comfrey—for the treatment of sunscreen and to assess the knowledge and perceptions of pharmacy students. **Methods:** A cross-sectional survey was conducted among 40 participants, gathering demographic data, occupational background, and responses to five knowledge- and five opinion-based questions about the remedies. Data were analyzed using descriptive statistics and chi-square testing to identify associations between work type and knowledge levels. **Results:** Aloe Vera, Calendula, and Lavender were well recognized for their therapeutic benefits, with over 70% of respondents identifying them correctly. However, only 30% recognized Comfrey's potential liver toxicity. Participants working in pharmacy-related or healthcare fields demonstrated higher knowledge levels, especially regarding Lavender ($p = 0.029$). The average knowledge score was 56.5%, with only 25% scoring full marks. Opinion-based results reflected positive perceptions toward Aloe Vera and Calendula. **Conclusion:** While herbal sunburn remedies are well received, knowledge gaps remain—

particularly around safety concerns like Comfrey's hepatotoxicity. Targeted education for both consumers and professionals is essential to ensure the safe use of herbal remedies.

KEYWORDS: Aloe Vera, Calendula, Lavender, Comfrey, Sunburn, Herbal Remedies, Knowledge, Perception.

INTRODUCTION

Sunburn represents an acute skin response to prolonged UV exposure, typically from sunlight, and can lead to erythema, blistering, pain, and in severe cases, systemic symptoms such as nausea and fever. While conventional remedies such as topical corticosteroids and NSAIDs are commonly employed, there is growing interest in plant-based alternatives due to their natural composition and fewer reported side effects. Among the most widely used herbal treatments are Aloe Vera, Calendula, Lavender, and Comfrey.

Aloe Vera

Aloe Vera is widely recognized for its cooling, moisturizing, anti-inflammatory, and wound-healing properties, making it a staple in dermatological and cosmeceutical applications. These therapeutic effects are largely attributed to its rich phytochemical profile, which includes acemannan (a bioactive polysaccharide), gibberellins, aloesin, salicylic acid, and various amino acids and antioxidants. Acemannan, in particular, has been shown to enhance the proliferation and migration of fibroblasts and keratinocytes, promote collagen synthesis, and stimulate growth factor expression (Boudreau & Beland, 2006; Hamman, 2008). Gibberellins, along with other plant hormones in Aloe, contribute to anti-inflammatory signaling, helping reduce cytokine-mediated skin inflammation (Choi & Chung, 2003).

A study by Surjushe et al. (2008) confirmed that Aloe vera enhances wound healing by modulating fibroblast activity, collagen deposition, and angiogenesis, affirming its traditional use in treating burns, abrasions, and minor skin irritations. Moreover, a clinical trial by Hajhashemi et al. (2012) demonstrated that topical Aloe vera significantly reduced erythema and pain in patients with first- and second-degree burns compared to silver sulfadiazine, highlighting its potential as a safer and more natural alternative.

In addition, Aloe vera exhibits antioxidant properties that help neutralize reactive oxygen species (ROS) generated during UV-induced skin damage, which may explain its soothing effect in sunburn relief (Hu et al., 2003). Collectively, the evidence supports Aloe vera's

inclusion in modern skincare formulations as an evidence-based, multi-functional botanical agent with regenerative, anti-inflammatory, and hydrating effects.

Calendula (Calendula officinalis)

Calendula distinguished by its vibrant yellow to orange blossoms, has a long history of use in topical ointments, tinctures, and salves for managing wounds, burns, ulcers, and various dermatologic conditions. Its wound-healing properties are attributed to a variety of bioactive compounds, including triterpenoids, flavonoids, saponins, carotenoids, and essential oils, which collectively exert anti-inflammatory, antimicrobial, and antioxidant effects (Della Loggia et al., 1994; Parente et al., 2012).

In a study conducted by Preethi, Kuttan, and Kuttan (2009), Calendula officinalis extract was shown to significantly reduce inflammation in animal models, comparable to standard anti-inflammatory drugs. The same study also demonstrated enhanced epithelial regeneration, supporting the traditional use of calendula in promoting skin repair and granulation tissue formation. Furthermore, calendula has been observed to stimulate collagen production and fibroblast proliferation, which are essential steps in the wound healing cascade (Efstratiou et al., 2012).

Clinical trials further validate its efficacy. Pommier et al. (2004) reported a notable reduction in radiation-induced dermatitis among breast cancer patients using topical calendula cream compared to trolamine. Its antiseptic properties also make it suitable for use in post-surgical and minor trauma care products. Given its gentle nature and low potential for allergic reactions, calendula is frequently incorporated into formulations designed for sensitive skin, infants, and the elderly. Its broad therapeutic range reinforces its role in evidence-based phytotherapy for wound care.

Lavender (Lavandula angustifolia), another prominent botanical in dermatologic therapy, is widely used for its antimicrobial, anti-inflammatory, analgesic, and anxiolytic properties, making it a valuable adjunct in treating wounds, burns, and skin infections.

Lavender (Lavandula angustifolia)

Lavender traditionally renowned for its calming fragrance, has gained increasing recognition for its therapeutic applications in dermatology, particularly in the management of burns, inflammation, and skin discomfort. Its essential oil is rich in biologically active constituents

such as linalool, linalyl acetate, camphor, and 1,8-cineole, which contribute to its antioxidant, analgesic, anti-inflammatory, and antimicrobial effects (Cavanagh & Wilkinson, 2002; Prashar et al., 2004).

Lavender oil has demonstrated the ability to scavenge reactive oxygen species (ROS), protecting skin tissues from oxidative damage following UV exposure. In vitro and in vivo studies confirm that lavender reduces lipid peroxidation and boosts endogenous antioxidant enzymes such as superoxide dismutase and glutathione peroxidase (Koulivand et al., 2013). These properties render it particularly useful for addressing sunburn-related inflammation and skin irritation, where oxidative stress plays a key role in tissue damage.

Lavender's analgesic effects also contribute to its effectiveness in sunburn and minor wounds. Linalool and linalyl acetate act on opioid receptors and voltage-gated calcium channels, providing topical pain relief while reducing skin sensitivity and redness (Ghelardini et al., 1999). A study by Kim and Cho (1999) noted significant reductions in erythema and pain scores in burn patients treated with topical lavender oil, compared to control groups.

Furthermore, lavender oil exhibits wound healing properties by enhancing fibroblast migration, collagen synthesis, and tissue remodeling, making it a beneficial component in formulations for burns, cuts, and post-inflammatory skin damage (Peana et al., 2003). Its antimicrobial action against Staphylococcus aureus and Candida albicans also aids in preventing secondary infections in damaged skin (Moon et al., 2010).

Taken together, the evidence supports the integration of lavender essential oil into cosmetic and medicinal skin preparations aimed at managing minor burns, sunburn, and skin inflammation, particularly when a natural, multipurpose agent is desired.

Comfrey (Symphytum officinale)

Comfrey a perennial herb native to Europe and Asia, has long been used in traditional medicine for its wound-healing, anti-inflammatory, and analgesic properties. Topical applications of comfrey leaf and root extracts have been employed to treat bruises, sprains, joint pain, and superficial wounds, primarily due to its bioactive compounds such as allantoin, rosmarinic acid, and mucilage polysaccharides (Staiger, 2012). Allantoin, a key phytochemical in comfrey, is known to promote cell proliferation, granulation tissue formation, and epithelial regeneration, which accelerates tissue repair (Chauhan et al., 2019).

Additionally, rosmarinic acid contributes anti-inflammatory effects by modulating cyclooxygenase (COX) activity and inhibiting pro-inflammatory cytokines such as IL-1β and TNF-α (Freiburger et al., 2015).

Knowledge and Opinion of Healthcare Professionals on the Use of Herbs for the Treatment of Sunburn

The use of herbal remedies for treating sunburn and other minor skin conditions has grown significantly in recent years. The above botanicals have been widely adopted in both traditional and modern skincare practices. Some herbs such as Aloe vera, in particular, is extensively recognized among healthcare professionals (HCPs) for its moisturizing and anti-inflammatory properties, with clinical trials demonstrating its ability to reduce healing time and discomfort in first- and second-degree burns (Surjushe et al., 2008; Hajhashemi et al., 2012). Similarly, Calendula is appreciated for its epithelial-regenerating effects, although some HCPs express concern regarding its potential to cause allergic reactions in sensitive individuals.

Despite these benefits, the level of knowledge and clinical acceptance of herbal remedies in general among HCPs remains highly variable. Surveys and focus groups have shown that many physicians, pharmacists, and nurses are only partially familiar with the pharmacodynamics, clinical indications, and toxicities of herbal products. One multicenter study revealed that less than 40% of HCPs felt confident in recommending herbal agents for dermatologic use, citing insufficient training, lack of product standardization, and concerns about herb-drug interactions (Walji et al., 2009).

Among HCPs, pharmacists tend to show a relatively higher level of acceptance, particularly when herbs are used topically and have established safety profiles. Pharmacists often serve as a bridge between patients and other providers, providing evidence-based guidance on product selection, formulation quality, and safe usage. Nonetheless, there is a professional consensus that additional education, continuing professional development, and curricular integration of herbal medicine are essential for preparing them to advise patients effectively.

Despite its effectiveness, concerns about comfrey's hepatotoxicity have led to caution or avoidance among many HCPs, even for topical applications. The need for clear regulatory guidance, product labeling, and clinically validated PA-free formulations is critical. Barnes (2020) emphasized the vital role that healthcare professionals play in guiding patients toward

the safe and appropriate use of herbal remedies, while Blumenthal et al. (2019) reinforced the need for evidence-based regulation, referencing the standards set by Germany's Commission E.

Furthermore, the popularity of herbal remedies in commercial skincare products and wellness media—especially these herbs has created a false sense of safety among the public. This widespread acceptance contrasts with the limited public awareness of the risks associated with certain botanicals, particularly comfrey. The knowledge gap highlights the necessity for HCPs education, especially regarding over-the-counter herbal products containing potentially toxic compounds.

Although these herbal products are easily accessible, the safety profiles and appropriate usage guidelines are not always well understood by healthcare professionals or consumers. As interest in herbal medicine continues to rise, ensuring public safety through informed professional guidance and regulatory oversight remains a key concern.

Therefore, this study aims to assess the extent of students' knowledge and perception surrounding these herbal options, as well as to determine the influence of demographic and occupational backgrounds on herbal remedy literacy.

METHODOLOGY

The study employed a cross-sectional survey design to examine the knowledge and opinions of a sample group toward herbal sunburn treatments. The survey consisted of structured questions divided into sections capturing demographic data, knowledge of specific remedies, opinions on effectiveness and safety, and cross-tabulated responses based on work type.

A total of 40 participants aged 18 and above were surveyed. The sample included individuals from various educational backgrounds and professional sectors to ensure representation. Eligibility was limited to those able to provide informed consent and willing to complete the questionnaire in its entirety.

Data collected included gender, education level, work experience, and the nature of participants' employment—categorized as pharmacy-related, healthcare but non-pharmacy, and non-health-related. Knowledge-based questions evaluated understanding of the properties and risks associated with each remedy, while opinion-based items used a four-point Likert scale to capture agreement or disagreement regarding the remedies' effectiveness.

The collected data were analyzed using SPSS software. Descriptive statistics were used to summarize participant characteristics and responses. Chi-square tests were conducted to examine the relationship between participant work type and knowledge levels, with statistical significance set at $p < 0.05$.

RESULTS

Table 1 presents the demographic characteristics of the participants. Among the 40 participants, 25% were male, and 75% were female. Most individuals (65%) held a bachelor's degree, and half worked in pharmacy-related roles. About 40% of respondents had over five years of work experience. Half of them (50%) worked in a pharmacy-related field. Additionally, 40% had over five years of work experience.

Table 1: Demographic and Professional Overview (N=40).

Variables		*N* (%)
Gender	Male	10 (25)
	Female	30 (75)
	Non-Binary/Third Gender	0 (0)
	Prefer not to say	0 (0)
Education (Highest level attended)	Pre-Pharmacy	5 (12.5)
	Associate	1 (2.5)
	BSc/BA	26 (65)
	MA/MSc or Higher	7 (17.5)
State lived in	DC	6 (15)
	MD	15 (37.5)
	VA	1(2.5)
	Other states	17(75)
Type of Work	Rx-Related	20(50)
	Non-RX related but Healthcare Related	9 (22.5)
	Non-Health	9 (22.5)
If worked, experience of how many years?	Never worked	2 (5)
	1 - 2 Years	12 (30)
	3-4 Years	10 (25)
	5 and more	16 (40)

Table 2 & 3 summarize participants' knowledge regarding the effectiveness and potential risks of herbal remedies. The average score is much lower than expected in the fifty's range. The overall distribution of the knowledge scores revealed that 25% of participants answered all five knowledge questions correctly. An additional 30% scored four out of five, while 20% had three correct answers. Only one participant scored zero. The majority (77.5%) correctly recognized the benefits of Aloe Vera, while only 30% were aware of Comfrey's potential liver

toxicity. Similar recognition was seen with Calendula and Lavender, with 72.5% answering those questions correctly. In contrast, only 30% of participants correctly identified Comfrey's risk of liver damage because of potential drug interactions or internal use.

Table 2: Knowledge-Based Questions (N = 40).

Variables	Correct Answer	Participants with Correct Answer N (%)
Question 1: Aloe Vera is a cactus-like plant that grows in hot, dry climates and is widely used in various regions around the globe for its medicinal properties such as relief from sunburn.	True	31 (77.5)
Question 2 :Aloe Vera increases tooth decay and one risk of developing dental plaque. Many individuals who use Aloe Vera as mouth rinses suffer from various other oral diseases.	False	12 (30)
Question 3: Calendula is commonly characterized by its bright yellow petals that are dispensed as an ointment or tincture for one to use on sunburn.	True	29 (72.5)
Question 4: Lavender is an aromatic plant that studies have shown is impactful in helping to relieve pain followed by sunburn due to its antioxidant and anti-inflammatory properties.	True	29 (72.5)
Question 5: Those who use Comfrey for pain associated with sunburn are not at risk of liver damage as an interaction with other drugs that the individual may be taking.	False	12 (30)
AVERAGE SCORE		56.5%

Table 3: Participant Knowledge Score Distribution

Table 3 presents the distribution of participants based on their total correct answers out of five knowledge-based questions.

Number of Correct Answers	N (%)
5/5	10 (25)
4/5	12 (30)
3/5	8 (20)
2/5	6 (15)
1/5	3 (7.5)
0/5	1 (2.5)

Table 4 presents participants' opinions about the effectiveness of these herbal remedies. Aloe Vera and Calendula received the highest levels of agreement in terms of perceived effectiveness (Table 4). The average opinion score for Aloe Vera was 3.44 (SD = 0.56), and for Calendula it was 3.29 (SD = 0.52), indicating strong positive beliefs about their efficacy. Lavender also received favorable opinions, with participants acknowledging its calming aroma and anti-inflammatory benefits. However, responses concerning Comfrey were more mixed. Although some participants acknowledged its regenerative potential, others expressed

concern over possible adverse effects, reflected in its moderate mean score of 3.28 (SD = 0.73).

A chi-square test revealed a statistically significant association between the type of work participants engaged in and their knowledge of Lavender's healing properties. Those employed in pharmacy or healthcare-related roles demonstrated greater understanding compared to those in non-health-related fields, with a p-value of 0.029.

Table 4: Opinion-Based Questions.

Variables (state the question for each question number)	Strongly Agree *N* (%)	Agree *N* (%)	Disagree *N* (%)	Strongly Disagree *N* (%)	Mean ± SD
Question 1. I believe that Aloe Vera skin protective qualities make it useful when recovering from various degrees of sunburn.	16 (40)	17 (75)	1(2.5)	0 (0)	3.4412 ± 0.56091
Question 2. I agree with Calendula that both ointment and tinctures are beneficial for sunburns and are a quick remedy for relief.	11(27.5)	22 (55)	1(2.5)	0 (0)	3.2941 ± 0.52394
Question 3. I believe that although Lavender's antioxidant and anti-inflammatory properties make it an ideal remedy for sunburns, it also eases the pain associated with sunburns due to its calming aromatic qualities as well.	10 (25)	19 (47.5)	4(10)	0 (0)	3.1818 ± 0.63514
Question 4. I believe that Comfrey has the potential to become harmful to the body if too much of a quantity is taken.	13 (32.5)	16 (40)	2 (2)	1 (2.5)	3.2813 ± 0.72887
Question 5. I think that the many remedies that are available for sunburn relief are easily accessible and not difficult to use.	12 (30)	15 (37.5)	5 (12.5)	0 (0)	3.2188 ± 0.70639

Table 5: Chi-Square Test for Work Type vs Lavender Knowledge

Table 5 shows the cross-tabulation of work type and participants' knowledge about Lavender. The chi-square test revealed a significant association (p=0.029) between participants' work type and their knowledge of Lavender's healing benefits.

Work Type	Strongly Agree	Disagree	Total
Rx-Related	11 (27.5)	5 (12.5)	16 (40)
Healthcare	7 (17.5)	0 (0)	7 (17.5)
Non-Healthcare	9 (22.5)	0 (0)	9 (22.5)
Total	**27 (67.5)**	**5 (12.5)**	**32 (80)**

Chi-Square Test: Pearson Value = 5.926, df = 2, p = 0.029

DISCUSSION

This study provides insight into public awareness and perception of plant-based remedies for sunburn management. Participants displayed a generally positive view of the efficacy of Aloe Vera, Calendula, and Lavender—especially those with professional backgrounds in pharmacy and healthcare. These findings are consistent with existing literature, which highlights the growing consumer preference for natural skincare options that are perceived as both effective and gentle on the skin.

A key highlight is the discrepancy in knowledge concerning Comfrey. Despite its known regenerative properties, only a small portion of respondents (30%) were aware of its hepatotoxic potential. This lack of awareness could pose safety concerns, particularly when consumers self-administer herbal remedies without professional guidance. The study reinforces the importance of regulatory oversight, public education, and accurate product labeling to bridge this knowledge gap.

The statistically significant relationship between work type and knowledge of Lavender's therapeutic value underscores the role of professional education in shaping understanding of phytotherapy. Those in healthcare-related fields were better equipped to recognize the benefits and risks of herbal treatments, suggesting that pharmacists and healthcare providers are in a unique position to guide patients on appropriate herbal use.

This study has several limitations. First, the small sample size (N=40) may limit the generalizability of the findings. The study also relied on self-reported data, which could be subject to response bias. Participants may have overestimated their knowledge or selected socially desirable responses. Additionally, the questionnaire focused on a limited number of herbs and questions, which may not capture the full spectrum of knowledge or opinions about herbal sunburn remedies. Lastly, the cross-sectional design precludes any assessment of causality between background and knowledge level.

CONCLUSION

This study reveals that there is a generally positive perception of herbal remedies among the study participants in the context of treating sunburn. Among the various natural treatments available included in this study, Aloe Vera and Calendula emerged as the most highly endorsed ones both being praised for their soothing and healing properties. These overall

findings suggest a widespread acceptance and trust in the efficacy of plant-based treatments, especially those with a long history of traditional use and anecdotal support.

Despite this favorable view, the study also uncovered significant gaps in public knowledge, particularly concerning the potential risks associated with certain herbal products. For instance, awareness of Comfrey's known toxicity especially when used on broken skin or over long periods was notably limited among respondents. This lack of awareness raises concerns about the safe and informed use of herbal remedies and points to a broader issue such that many individuals rely heavily on non-expert sources such as social media, online forums, or anecdotal recommendations when choosing and applying these treatments.

Conflict of Interest Statement

The author declares no conflict of interest related to the research, authorship, or publication of this manuscript. No financial, personal, or professional affiliations influenced the content, analysis, or conclusions presented. The study was conducted independently and did not receive funding or support from any herbal product manufacturers or commercial entities.

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