CME LIVE OPEN ACCESS

Journal of
Biomedical and Engineering Research

Case Report

Development, Evaluation and Efficacy of an Ointment Formulated from Sweet Basil (Ocimum basilicum) for Common Dermatological Conditions

Maham Taqi Soomro* and Mahesh Kumar

Department of Molecular Biology & Genetics, MRC, LUMHS

Corresponding Author: Maham Taqi Soomro, Department of Molecular Biology & Genetics, MRC, LUMHS

Received: 2024 Jul 27 **Accepted:** 2024 Aug 20 **Published:** 2024 Sep 21

Abstract

Plants are naturally affected against wide range of human diseases. They were used from ancient times for several purposes including cooking, preserving food, for treating a wide range of health conditions including cold, dysentery, anemia, wound healing, curing insect bites and injuries. Nowadays people prefer products derived from natural sources more than products that are made from chemical methods. The plant Ocimum basilicum has a very range of health benefits including its potency to cure several skin conditions. This study aims to develop, evaluate, and determine the effectiveness of the herbal ointment made from Ocimum basilicum without alcohol and bees wax, using chea butter as thickening agent with the main focus on determining its outcome on common dermatological conditions such as acne (bacterial infection), eczema, inflammation, minor cuts, scrape wound. The prepared ointment was then evaluated for physiochemical characteristics including safety assessment of skin and stability tests. Then In Vivo experiments were carried in a group of volunteers including teenage and adults (two boys and four girls) skin, it reduced redness, inflammation and cured acne. The results showed the wound healing, anti-inflammatory and anti-bacterial activity of this ointment. In conclusion, no adverse reaction of this ointment was observed on skin, The thorough evaluation of this ointment has confirmed its anti-bacterial activity because of its ability to kill bacterial strains causing acne. Further research is needed for its commercial usage and clinical trials to use for Post surgery wounds, serious bacterial and fungal infections.

Keywords: Anti-Bacterial, Anti-Inflammatory, Ocimum Basilicum, Herbal Ointment, Wound Healing, Acne, Minor Cut and Eczema.

1. Introduction

The use of plants had been very useful throughout the centuries for medicinal purposes. They are always favoured for being natural, comprehensive advantages and lack of side effects. As reported by world health organization, a major part of the world depends on the use of herbal medicines, most commonly in developing countries. Many consumers prefer the use of natural products in terms of medicines, food, products of personal usage and home [1]. The industry of phytomedicines or plant derived medicines is being increased in size because population is interested in organic and natural products [2]. Plant derived medicines are now being used in present day therapeutic processes because of their effectiveness and lack of side effects in contrast to chemically derived medicines [3]. Attempts in order to incorporate phytomedicines in Alopethic medicine are going on in accordance with principles of scientific research [4].

The extracts of plants contain secondary metabolites which provide antibacterial, antioxidant, anti-inflammatory and anti-aging properties. Therefore, they are desired source of biologically active compounds to be used as dermatological preparations as well as cosmetic purposes without any adverse effects [5]. One study has demonstrated several cases showing harmful effects of fluorinated corticosteroids containing ointments on tinea infection, acne rosacea and seborrheic dermatitis. These corticosteroids cause several serious side effects effecting the collagen metabolism of skin causing dysfunction of skin also known as local atrophy, leakage of blood vessels also known as purpura, telangiectasia (visible blood vessel in skin), and skin ulceration. Therefore, many patients are withdrawing to use them because they are scared of uncomfortable inflammation [6]. Study conducted in the past has shown that plants heal the wounds quickly reducing the pain discomfort, and scarring of patients [7]. Ocimum basilicum

belonging to family Lamiaceae brought its importance for its different traditional uses throughout the world. It was used as anti-pyretics, cold, gastrointestinal diseases. Sweet basil, scientifically known as Ocimum Basilicum is a well-known herb in folk medicine. It has the property of reducing fever, inflammation and microbe related diseases that's why it is used in Unani, Yajurveda and Traditional Chinese Medicine. It was used for pious practices, cooking, and folk medicine by many civilizations around the world. In the prehistoric era, Egyptians has used it for preserving corpses [8]. The therapeutic contributions to sweet basil are mainly provided by active biochemical compounds present in the plant known as eugenol, linalool, and methyl chavicol, so researchers are investigating on how to extract these compounds to be used for ethnopharmacological purposes [9, 10]. Sweet basil has strong antimicrobial activity against many pathogens due to the presence of essential oils such as linalool, eugenol, and methyl chavicol [11].

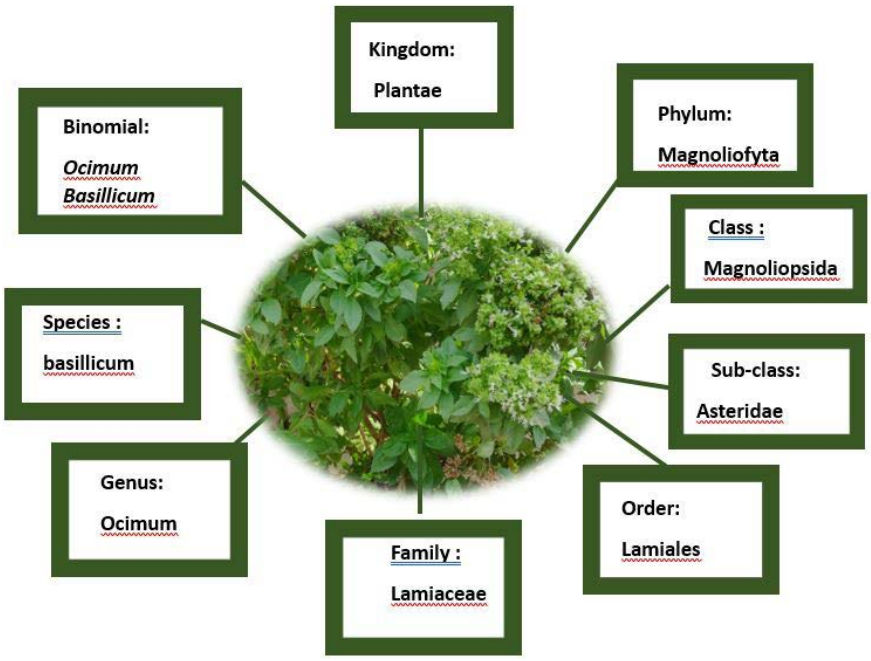
The compounds in extracts of Ocimum Basilicum are known to inhibit the expression of inflammatory cytokine mRNA induced by co-culture showing anti-inflammatory effects [12]. The ethanolic extracts of sweet basil leaves show antioxidant activity due to the presence of phenolic compounds, flavonoids and tannins and possess higher radical activity [13]. The wound healing property of sweet basil was observed in mice in which they were treated with honey in combination with alcoholic leave extract of sweet basil in combination with solcoseryl-jelly, showed signs of dermal healing.(Synergistic_effects_of_alcoholic_extract_of_sweet_, n.d.) Studies conducted in the past has demonstrated that medicinal plants are very helpful in treating wounds by increasing the rate of wound heel with reduction in pain, discomfort and scaring of skin in patients . Ointments derived from plants can be made in different concenterations. An ointment is a product with semisolid consistency applied on skin and various mucous membranes. Ointments don't contain water and contain one or two chemicals either in suspension or solution or dispersion form therefore they have many types such as absorption bases, dehydrating hydrocarbon and water-soluble types [14]. Ointments are used externally for variety of applications, to remove excess oil from the skin, moisturizer, protectants, to relieve itching, to treat dry skin such as acne, warts, calluses and other lesions [14].

The main aim of this study was to show that Ocimum basilicum when synthesized as an ointment for topical use has applications on skin and also has high potential as an antibacterial agent for its ability to kill strains of bacteria causing acne. The aim of the current study deals the formulation evaluation, and effectiveness of herbal ointment using leaves of Ocimum basilicum without using alcohol or bee's wax. As sweet basil has many therapeutic properties so it is possible to use it in the form of ointments. The use of sweet basil in formulation of topical ointment goals to apply these properties to skin diseases and inflammation for safe and effective treatment. This study covers the steps of development of an ointment and evaluation of its safety and efficacy.

1.1. Literature Review

Plant Profile

Ocimum basilicum also known as sweet basil in folk medicine, grows in the regions of Asia, Africa and South America. It is an annual herb, used as spice in both dry and fresh forms [15]. It's wide range of usage is found in therapeutics, food industry, Aromatherapy and perfume industries [16].



Taxonomy of Ocimum basilicum [12].

Citation: Soomro, M. T., Kumar, M. (2024) Development, Evaluation and Efficacy of an Ointment Formulated from Sweet Basil (Ocimum basilicum) for Common Dermatological Conditions. Journal of Biomedical and Engineering Research. 2(2). 1-6.

Morphology

• **Leaves:** The leaves of Ocimum basilicum are oviform, light or dark green in colour, and does not have sharp edges.
• **Stems:** The stems of sweet basil are angular shaped, as a characteristic of family Lamiaceae, and extend up to 60cm.
• **Flowers:** The flowers of sweet basil are small, colour ranges from white to purple that are assembled in terminal spikes,
• **Seeds:** The leaves of sweet basil are black in colour, small in size and are oviform [17].

Phytochemistry

The phytochemical constituents of Ocimum basilicum are
• **Phenolic compounds:** They include Rosmarinus acid, caffeic acid, and chicory acid which contribute to its antioxidant activity.
• **Flavonoids:** These include Orientin, Isorientin and Vicenin-2 which contribute to its antitoxidant and anti-inflammatory properties.
• **Essential oils:** They include linalool, eugenol, methyl chavicol, and 1,8-cineole. The composition of essential oil diifers on the basis of geographical location, environmental conditions and chemotype.
• **Other Compounds:** They include Titerpenoids, tannins and saponins which provide many pharmacological applications [12].

Properties of Ocimum basilicum

Recent studies on the properties of Ocimum basilicum are:
• **Antimicrobial activity:** It has shown effectiveness against a range of bacteria, fungi and viruses because it disrupts cell membrane and inhibit the formation of biofilms [11].
• **Anti-inflammatory effects:** It is useful to inhibit pro-inflammatory mediators and cytokines which shows its anti-inflammatory effect [12].
• **Antioxidant Activity:** It quashes the effect of high oxidizing agents such as hydrogren peroxide. It also scavenges free radicals. Research conducted on mice proved that it contained anti-oxidant biomarkers (thiol, SOD and CAT) [12].
• **Wound healing properties:** The wound healing property of sweet basil was observed in mice in which they were treated with honey in combination with alcoholic leave extract of sweet basil in combination with solcoseryl-jelly, showed signs of dermal healing. (Synergistic_effects_of_alcoholic_extract_of_sweet_, n.d.)
• **Anti diabetic properties:** Researchers has conducted experiments on mice which has proved that this plant is antidiabetic. It has a compound called catechin which causes hypoglycemia by suppressing postprandial glucose. It also lowers blood glucose, improves lipid profile, and increase the enzymes of liver [18].
• **Antimicrobial Properties:** A recent study has shown that essential oil of Ocimum basilicum inhibits many strains of bacteria which includes Staphylococcus Aureus and Escherichia Coli. This study also proved the antifungal activity against Candida Ablicans and Aspergillus Niger [19].
• **Anti-inflammatory Properties:** Studies have shown the curative effect of Ocimum basilicum and strengthens its authenticity to use it in general medicine. It contains high amount of Rosmarinic acid and flavonoids which exhibit potential affect against colitis by inhibiting inflammatory signals through NF-kB suppression. Rosmarinic acid and flavonoids content of Ocimum basilicum is also known to inhibit pro-inflammatory cytokines [12].

Traditional Uses of Ocimum basilicum

It was used in folk medicine to treat respiratory and gastrointestinal disorders [20]. Egyptions has used this plant to preserve dead bodies and also used on skin to treat infections and injuries [21]. Ocimum basilicum was used in folk medicine by Indonesians used to treat malaria by consuming fresh raw leaves of Ocimum basilicum. They also used it to make ointments to treat acne, boils, several skin conditions, rheumatism, high cholesterol, hypertensive disorders, headaches, and strokes and also as an anti-helminthic remedy [22]. This plant was also used in middle eastern ethnomedicine to make bombs and oils to treat skin conditions, injuries, inflammations, and also as an anti-septic for cleaning purposes [23].

Modern Uses of Ocimum basilicum

Dermatological uses Recent research has demonstrated that polyphenolic flavonoids present in Ocimum basilicum removes free radicals and inhibits waterloss which prevent acne outburst. Its effectiveness was also shown as an alternative to prior antibiotic cure to overcome antibacterial resistance, which developed in bacterial strains leading to acne [24]. Food industry Oils obtained from Ocimum basilicum are used as flavoring agents in food industry and also used for aroma in perfumery industry [25].

2. Materials and Methods

• **Reagents:** The reagents Coconut oil (Carrier oil), Shea butter, Lavender oil (essential oil), and Vitamin E oil(preservative) were purchased online. The instruments, chemicals, and glassware were used from LUMHS research laboratory.
• **Plant material:** Leaves of Ocimum basilicum plant were collected from the Bhirya village, District Jamshoro, Sindh, Pakistan. They were washed with distilled water to remove dust and impurities. Then they were dried with the help of clean cloth.

Table1: List of Material.

Sr No.	Ingredients used	Role of ingredients	Amount taken
1.	Leaves of Ocimum basilicum	Desired dermatological properties	250 g
2.	Coconut oil	Carrier Oil	125 g
3.	Shea Butter	Moisturizing and solidifying agent	125 g
4.	Lavendar Oil	Essential oil used as fragrance	0.15 ml
5	Vitamin E oil	preservative	0.15ml

Table no 1 (Madake Pawar, 2024)

Preparation of ointment: The dried leaves were chopped with the help of mortar and pestle in order to increase the surface area for infusion. Then they were covered with coconut oil. This mixture was then heated in double boiler on electric stove of laboratory for 1.5 hour and was continuously stirred. After infusion, the oil was strained with fine strainer to remove leafy mixture. The used leaves were discarded. Shea butter was melted in a double boiler on electric stove. The melted shea butter and the infused oil were combined in a double boiler by stirring. Then few drops of carrier oil i.e. lavendar oil was added for additional benefits and fragrance. Finally, some drops of vitamin E was added into that mixture to preserve for long term use. The mixture was then poured in clean glass container while still hot and allowed to cool and solidify at room temperature without sealing the lids. When the mixture was cooled, the lid of the container was closed and stored in dark place until use.

Evaluation Parameters

The ointment was evaluated by following parameters

- **Colour:** The colour of the ointment was visibly examined.
- **Odour:** A few amounts of the ointment was taken on a test strip and was smelled and the initial impression was noted.
- **Safety Assessment:** A small amount of ointment was applied on hand by two volunteers to check for irritancy or any allergic reaction.
- **Consistency:** The consistency was checked by backward and forward extrusion tests.
- **Washability:** Three volunteers applied the ointment on hand and washed it with tap water to check for easiness of washability.
- **Solubility test:** The ointment was dissolved in ethanol, ether and boiling water to check for solubilty.
- **Stability test:** The stability test was carried out according to the method [26].
- **Spreadabilty test:** The spreadability test of the ointment was evaluated according to the method [26].
- **Diffusion study:** The diffusion test was carried out according to the method [14].
- **Ph:** The ph of the ointment was determined with the help of ph meter.

Effectiveness test of the ointment

The ointment was tested for 10 days on a group containing six volunteers of different age group (four females and two males) to check its efficacy on acne, scar, hive, redness, minor cut, scrape wound and inflammation. The volunteers applied this ointment on their affected skin for 10 days.

3. Result and Discusion

In literature survey it was found that this plant has been used for therapeutic purposes in past in order to treat injuries, protection of skin, snake bites and for several dermatological purposes. The current study was carried out to formulate safe ointment using leaves of Ocimum basilicum with a simple method without using any alchohol and bees wax, instead chea butter was used as thickening agent for this herbal ointment. The formulation, evaluation and its efficacy test were done. When it was formulated as an ointment, it was tested for physiochemical properties which produced very satisfactory results. The study of physiochemical parameters of the ointment and its efficacy test on skin produced acceptable results. The physiochemical parameters like colour, odour, ph, safety assessment, consistency, washability test, solubility test, stability, spreadabilty, diffusion study showed following result (Table no 2) When it was applied to affected skin of a group of six volunteers of different age group (four females and two males) of varying skin conditions (wounds, hive, minor cut, scar, acne) over a period of 10 days, it produces very heeling and effective results. This plant showed wound healing and anti-inflammatory properties This plant also prove to be antibacterial for its ability to get rid of acne(the common bacterial skin infection),as when it was applied to the acne on the face of a female volunteer of group ,it helped to cope with the acne .Also the result of efficacy test is shown in figure no 1.However there are limitations encountered in this study that the ointment was used only for superficial layers of skin, there is no experimental evidence for this ointment to be used in subcutaneous and systemic conditions of skin ,post-surgical wounds ,extreme bacterial and fungal diseases, tooth ache. Also, this ointment formulation has coconut oil, so some people can be allergic to it.

Table 2: Physiochemical evaluation

Physiochemical Test	Observation
Colour	Dark Green
Odour	Sweet
Ph	5.9
Consistency	Smooth and greasy
Safety Assessment	Slightly irritant for few seconds due to presence of coconut oil
Washability test	Effortless washing
Solubity test	Soluble in boiling water, Ether and Alcohol
Stability test	Stable at room temperature
Spreadabilty test	12g.cm/sec
Diffusion Study	0.9 cm

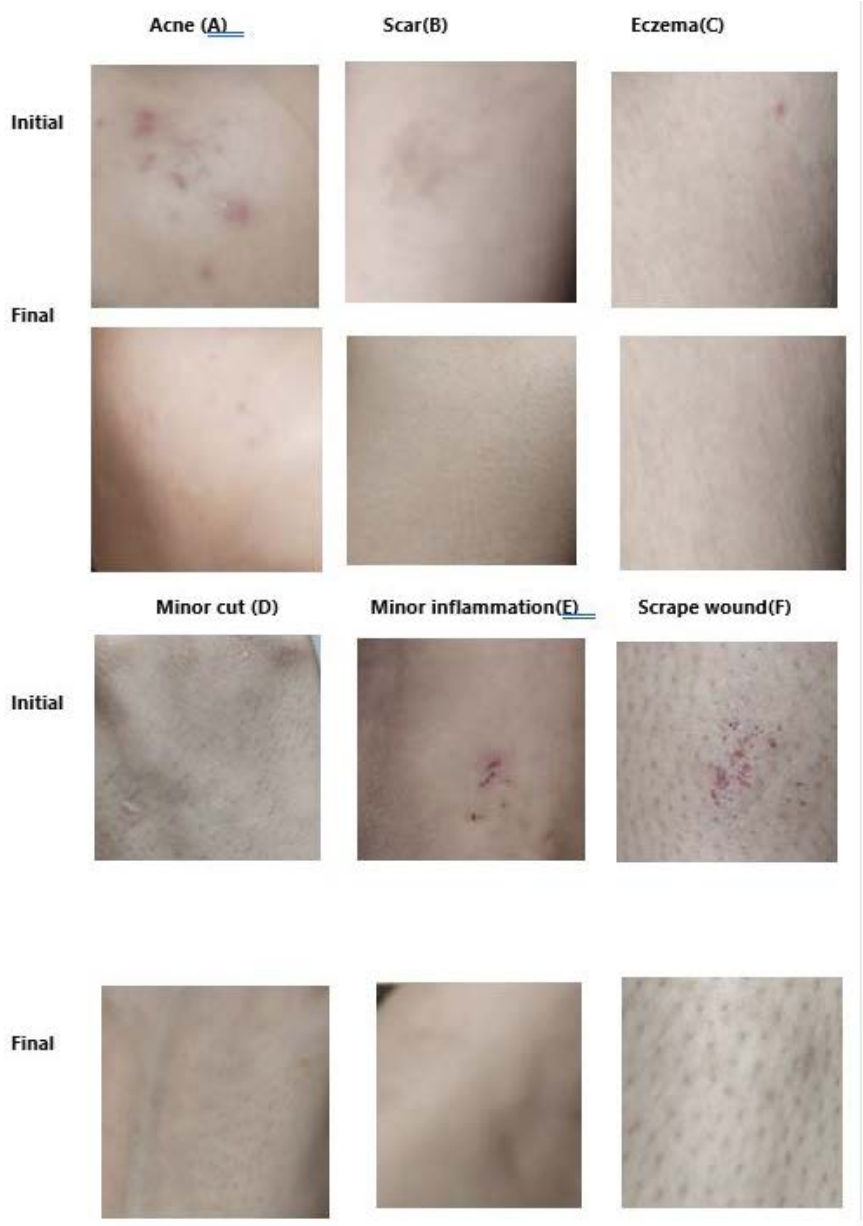


Figure1: The pictures are representing initial and final examination of treatment group with various skin conditions. Ocimum Basilicum herbal ointment was applied to intact skin for 10 days. (A). Acne on the face of a female volunteer. (B)Scar on the skin of Arm of a female volunteer(C) eczema on the arm of a female volunteer(D)Minor cut on the hand of a female volunteer(E)Minor inflammation on feet of a male volunteer(F)Scrape wound on the leg of a male volunteer.

4. Conclusion and Future Directions

This study showed that the plant Ocimum basilicum has ability to treat dermatological conditions and this plant possesses antibacterial, anti-inflammatory and wound healing properties. Findings reveal that plants are the natural heelers so can be used for many skin conditions and most effective ointments can be made from them that can serve as an effective alternative to chemical treatments used in conventional medicine. Continued research in its formulation and mechanism of action is needed to elucidate its applications in modern medicine. Further research is needed for conducting clinical trials to determine its safety and effectiveness on serious bacterial and fungal infections and surgical wounds including deep layers of skin. Further investigations on novel drug delivery technologies (niosomes, miospheres etc) are needed to increase the deep penetration of this ointment into the skin. Furthermore, this ointment should be safely assessed for the evaluation of extended safety profile, including toxicity and allergic reactions.

References

1. Scott, S. E., Rozin, P., Small, D. A. (2020). Consumers prefer "natural" more for preventatives than for curatives. *Journal of Consumer Research, 47*(3), 454-471.
2. Arnason, J. T., Harris, C. S., Guerrero-Analco, J. A. (2022). Phytochemistry in the ethnopharmacology of North and Central America. *Frontiers in Pharmacology, 13,* 815742.
3. Ekor, M. (2014). The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. *Frontiers in pharmacology, 4,* 177.
4. Tilburt, J. C., Kaptchuk, T. J. (2008). Herbal medicine research and global health: an ethical analysis *Bulletin of the World Health Organization, 86,* 594-599.
5. Majtan, J., Bucekova, M., Jesenak, M. (2021). Natural products and skin diseases. *Molecules, 26*(15), 4489.
6. BURRY, J. N. (1973). Topical drug addiction: adverse effects of fluorinated corticosteroid creams and ointments. *Medical Journal of Australia, 1*(8), 393-396.
7. Madake, M., Pawar, P. Formulation and Evaluation of Antifungal Ointment from Galinsoga Parviflora.
8. Simon, J. E., Quinn, J., Murray, R. G. (1990). Basil: a source of essential oils. *Advances in new crops, 1*, 484-489.
9. Pandey, A. K., Kumar, P., Singh, P., Tripathi, N. N., Bajpai, V. K. (2017). Essential oils: Sources of antimicrobials and food preservatives. *Frontiers in microbiology, 7*, 2161.
10. Shahrajabian, M. H., Sun, W., Cheng, Q. (2020). Chemical components and pharmacological benefits of Basil (Ocimum basilicum): A review. *International Journal of Food Properties, 23*(1), 1961-1970.
11. Bozin, B., Mimica-Dukic, N., Simin, N., Anackov, G. (2006). Characterization of the volatile composition of essential oils of some Lamiaceae spices and the antimicrobial and antioxidant activities of the entire oils. *Journal of agricultural and food chemistry, 54*(5), 1822-1828.
12. Kamelnia, E., Mohebbati, R., Kamelnia, R., El-Seedi, H. R., Boskabady, M. H. (2023). Anti-inflammatory, immunomodulatory and anti-oxidant effects of Ocimum basilicum L. and its main constituents: A review. *Iranian Journal of Basic Medical Sciences, 26*(6), 617.
13. Zhakipbekov, K., Turgumbayeva, A., Akhelova, S., Bekmuratova, K., Blinova, O., Utegenova, G., ... Karasova, Z. (2024). Antimicrobial and other pharmacological properties of Ocimum basilicum, Lamiaceae. *Molecules, 29*(2), 388.
14. Abhishek, Y., Krishanu, S. (2021). Formulation and evaluation of herbal ointment using Emblica officinalis extract. *World Journal of Advanced Research and Reviews, 9*(2), 032-037.
15. Kaya, I., Yigit, N., Benli, M. (2008). Antimicrobial activity of various extracts of Ocimum basilicum L. and observation of the inhibition effect on bacterial cells by use of scanning electron microscopy. *African Journal of Traditional, Complementary and Alternative Medicines, 5*(4), 363-369.
16. Radulović, N. S., Blagojević, P. D., Miltojević, A. B. (2013). α-Linalool–a marker compound of forged/synthetic sweet basil (Ocimum basilicum L.) essential oils. *Journal of the Science of Food and Agriculture, 93*(13), 3292-3303.
17. Simon, J. E., Morales, M. R., Phippen, W. B., Vieira, R. F., Hao, Z. (1999). Basil: A source of aroma compounds and a popular culinary and ornamental herb. *Perspectives on new crops and new uses, 16*, 499-505.
18. Qasem, A., Assaggaf, H., Mrabti, H. N., Minshawi, F., Rajab, B. S., Attar, A. A., ... Bouyahya, A. (2023). Determination of Chemical Composition and Investigation of Biological Activities of Ocimum basilicum L. *Molecules, 28*(2), 614.
19. Imran, M., Khan, A. S., Khan, M. A., Saeed, M. U., Noor, N., Warsi, M. H., Qadir, A. (2021). Antimicrobial activity of different plants extracts against Staphylococcus aureus and Escherichia coli. *Polymers in medicine, 51*(2), 69-75.
20. Yasmin, A. R., Chia, S. L., Looi, Q. H., Omar, A. R., Noordin, M. M., Ideris, A. (2020). Herbal extracts as antiviral agents. In *Feed additives* (pp. 115-132). Academic Press.
21. Zohary, D., Hopf, M., Weiss, E. (2012). *Domestication of Plants in the Old World: The origin and spread of domesticated plants in Southwest Asia, Europe, and the Mediterranean Basin.* Oxford University Press.
22. Azizah, N. S., Irawan, B., Kusmoro, J., Safriansyah, W., Farabi, K., Oktavia, D., ... Miranti, M. (2023). Sweet Basil (Ocimum basilicum L.) —A Review of Its Botany, Phytochemistry, Pharmacological Activities, and Biotechnological Development. *Plants, 12*(24), 4148.
23. Aziz, M. A., Adnan, M., Khan, A. H., Shahat, A. A., Al-Said, M. S., Ullah, R. (2018). Traditional uses of medicinal plants practiced by the indigenous communities at Mohmand Agency, FATA, Pakistan. *Journal of ethnobiology and ethnomedicine, 14*, 1-16.
24. Han, H. J. (2018). Development of an effective formulation for an acne treatment cream with Ocimum basilicum using invasomes. *J. Cosmet. Med, 2,* 69-75.
25. Kale, S., Sonawane, A., Ansari, A., Ghoge, P., Waje, A. (2010). Formulation and in-vitro determination of sun protection factor of Ocimum basilicum, Linn. leaf oils sunscreen cream. *Int. J. Pharm. Pharm. Sci, 2*(4), 147-149.
26. Sabale, V., Kunjwani, H., Sabale, P. (2011). Formulation and in vitro evaluation of the topical antiaging preparation of the fruit of Benincasa hispida. *Journal of Ayurveda and integrative medicine, 2*(3), 124.