

## A STUDY OF ANTI MICROBIAL EFFICACY OF TRADITIONAL FORMULA USED FOR HAIR OILS

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### ABSTRACT

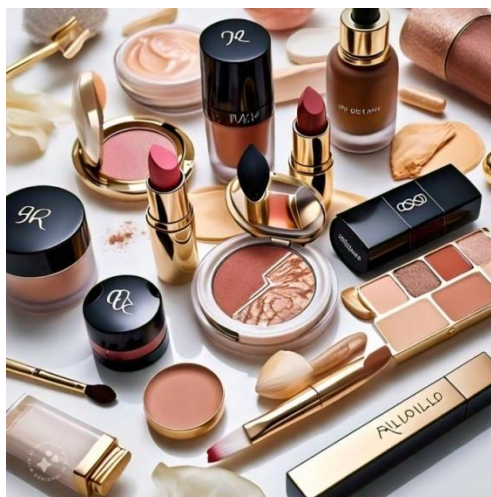
This work investigated the antimicrobial activity of traditional formulations containing Phyla nodiflora, Eclipta prostrate, Phyllanthus emblica, and Nigella sativa against pathogens. Cold-pressed oils containing these plants with coconut and sesame oil were prepared for testing antimicrobial activity by using the disk diffusion method. These results show the antibacterial activities against Streptococcus pyrogenes and Escherichia coli faecalis as well as the antifungal activities against Candida albicans and Aspergillus Niger. Formulations A and TF had the highest inhibition zones, suggesting strong antimicrobial potential and the need for further study on their uses in treating scalp infections.

**KEYWORDS:** Traditional formulation, Anti microbial activity, cold pressed oil, hair oil, scalp infectious disease, zone of inhibition, cosmetics, disk diffusion method.

### INTRODUCTION

#### Cosmetics

Cosmetics are health and beauty products used to care for and enhance the appearance of the face and body. They serve not only to change the looks but to also maintain good skin and health of the body, including perfume. Though greatly recognized for use in skin care, there exist so many in terms of serving a specific type of purpose. Cosmetics represent something significant throughout the cultures due to self-expression and identity. Many in the Western world perceive cosmetics as solely makeup despite how well the industry does. The US FDA defines cosmetics as products for altering appearance or promoting beauty without changing the body's structure or functions. However, pure soap is excluded from this definition.



### Varieties of cosmetic preparations

According to Route of administration:-

- Skin: Powder, Lipstick, Rouge, Creams, Lotions and Solutions etc.
- Hairs: Shampoo, Conditioners, Creams, Bleach, Colouring preparation etc.
- Nails: Nail lacquers, Lacquers removers etc.
- Teeth: Powder, Paste, Gel and Dentifrices etc.
- Eyes: Eyeliner, Mascara, Eye shadow and Eyebrow pencil etc.

According to Purpose of cosmetics:-

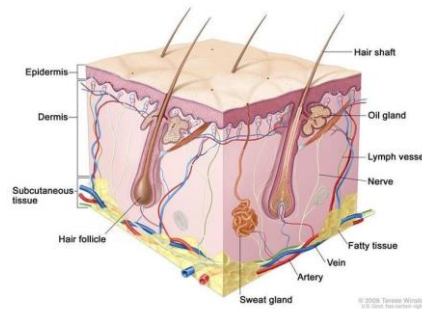
- Emollient Preparation: Cold creams, Vanishing creams, Foundation creams, Lotions and Solutions etc.
- Cleansing Preparation: Creams, Shampoo and Rinses etc.
- Decorative Preparations: Lipsticks, Rouges, Eyeliner, lacquers and Dressing preparations.
- Deodorant / Antiperspirant: Spray, Sticks and Mouthwashes.
- Protective Preparations: Creams and Powders.
- Preparation for Enjoyment: Salts, Powders, Oils and Milks.

According to composition of cosmetics:-

- Powder
- Lotions
- Emulsions
- Solutions
- Suspensions
- Creams
- Paste

### HAIR

Hair is a common feature in mammals, playing an important role like protection against both heat and cold. This part of the body plays the role of protective appendages, cooperating with sebaceous and sweat glands. It comprises three major parts: bulb, root, and shaft. Its common disorders are hair fall, dandruff, lice, split ends, and gray hair.



Hair grows from the hair follicle, held in place in the epidermis and extending into the dermis, which is lined by inner and outer sheaths. The hair shaft has three layers of keratin: the inner layer, called medulla, the middle layer, called cortex, and the outer layer, called cuticle.

### Hair Types

Hair type is primarily classified based on curl pattern, a result of genetics and hair follicles. The curl pattern for hair was made to be put into four classes by Andre Walker: Type 1 (Straight), Type 2 (Wavy), Type 3 (Curly), and Type 4 (Coily).

### Hair Growth Cycle

Hair growth cycle comes in three stages:

- Anagen (growth phase): The majority of hairs are growing. It lasts many years for every strand.
- Catagen (transitional phase): Hair growth slows and the follicle shrinks over a few weeks.
- Telogen (resting phase): Hair growth stops for months, leading to the old hair detaching while new hair grows.

### Hair Oil

Hair oil is a type of hair care product that helps cleanse, nourish, and maintain healthy hair. It also cures ailments like baldness, greying, and hair fall. People prefer herbal oils these days since they are not only effective but also cause less side effects. Herbal hair oil feeds the hair and makes them grow with necessary moisture and nutrition. The popular herbal hair oil in the list is Amla, Coconut, Bhringraj, Jasmine, Brahmi, Cantharidine, and Onion.

### Types of Hair Oil

1. **Medicated Oil:** Contains ingredients like menthol and natural oils for soothing effects.
2. **Non-Medicated Oil:** Lacks active ingredients and is often used for cooking or other purposes.

### How do you maintain healthy hair with oil?

To oil your hair, apply oil on your scalp, massage, apply to hair, cover overnight, shampoo, and condition the next day.

### Method of Formulation in Hair Oil

The hair oil formulation is classified into two main types: the industrial production method and the traditional method. In the industrial production method, hair oil is made by combining base oils, active ingredients, and essential oils for specific hair and scalp needs.

It begins with the selection of base oils such as coconut oil for hair growth, almond oil for shine, olive oil for conditioning, and castor oil for reducing hair fall.

Active ingredients include herbal extracts such as Amla, Brahmi, Bhringraj, Neem, Hibiscus, and vitamins like E or D. The base oil is heated lightly, and herbs or powders are simmered in it for several hours before cooling and straining. Optional ingredients include essential oils such as tea tree, rosemary, and lavender. Natural fragrance and preservatives could also be added to the oil before placing it in sterilized bottles for storage. The old method, mainly in Ayurveda, employs natural processes to enhance the therapeutic properties. This includes the choice of base oils and herbs, boiling the herbs to produce a decoction, and then mixing it with the heated base oil. The mixture is left to simmer for a few hours, constantly stirred, and then filtered. The finished oil is placed in sterilized glass or metal containers in a cool, dark place.

### Traditional Techniques

- Clay or Iron Pots: Traditionally, oils are prepared in clay or iron vessels, believed to enhance the properties of the oil.
- Cow Dung Fire: In some cultures, the oil is simmered over a cow-dung fire for uniform, slow heating.
- Manual Infusion: Herbs are crushed using mortar and pestle to release their essence before adding them to the oil.

### Wooden Cold Pressed Oil Process

Cold-pressed oils, also known as wood pressed oils, are becoming popular all over the world for their health benefit and high quality. Unlike regular oils that are heated and chemicals treated, the process of production of wood pressed oils is entirely natural, which helps the oil retain its nutrients and the pure flavour intact.



These oils are indeed more costly, as their productions are careful in nature and with limited outputs for raw materials. The wood-pressed oils may be pricier due to their distinctive flavours, aroma, and health benefit.

Thousands of years ago, wood-pressed oils have their history whereby ancient Egyptians, Romans, and Greeks made use of wooden presses to squeeze oil from olives. This process, long ago, used wooden slabs where olives were pressed for the extraction of oil, which is then kept in clay pots. Industrialization led to adopting modern machinery and chemical processes in order to mass-produce but at lower quality.

In recent times, with the growing health awareness, traditional wood pressed oils are in demand again. Production of these oils is a mix of art and science, from the selection of quality seeds, natural drying, low-temperature pressing, filtration, and finally, packaging pure oil for use.

### Anti Microbial Activity of Plants

One of the essential sources of health-promoting elements has been medicinal plants. Since the long back ages, these plants have been used for their natural antibacterial, antifungal, and antiviral properties. Researchers nowadays are working on natural products that find better therapeutic agents against cancer and infections which are caused by viruses and microbes. Synthetic antibiotics treat infections, but drug-resistant bacteria have been raised as a great challenge. Resistance of bacteria to these drugs necessitates the reduction of antibiotic use, study of microbial resistance, and development of new antibiotics and immune-modulating compounds with different structures and actions. It has been found that Gram-negative bacteria show more resistance than Gram-positive bacteria, which may be attributed to the protective outer membrane. While many plant species have been studied for their antimicrobial properties, most remain unexplored. Indian flora holds promise for the identification of new medicines against infections and immune system enhancements, especially against resistant strains of important pathogens like *Candida albicans* and *Escherichia coli*.

### Human Pathogenic Microbes

Human pathogenic microbes are the diverse forms of bacteria and fungi that can cause diseases in humans.

- **Streptococcus pyogenes:** commonly known as group A streptococcus (GAS), is a gram-positive, spherical bacterium that is non-motile and non-spore producing.
- **Escherichia coli faecalis:** typically referred to as E. coli, is a gram-negative rod-shaped bacterium that lives within the lower intestines of warm-blooded animals. Most are harmless, while others cause potentially life-threatening disease, such as gastroenteritis and urinary tract infections, mostly in young children and those who have compromised immunity.
- **Pseudomonas aeruginosa:** This is a gram-negative, rod-shaped bacterium that can infect plants as well as animals, thriving in most environments. It causes severe infections and severe complications in immune compromised patients.
- **Staphylococcus aureus:** is a gram-positive bacterium that belongs to the human upper respiratory tract and skin. This organism exists without any problems arising in its host but sometimes causes infections affecting the skin and even bacteraemia in its human host.
- **Aspergillus flavus:** is a pathogenic fungus that creates harmful toxins responsible for causing liver problems in humans. *Aspergillus niger* is a fungus, too. It occurs in many habitats; crucially, it forms citric acid, but it contaminates food, too.
- **Candida albicans:** is a polymorphic fungus that changes shape based on environmental conditions.

### MATERIALS AND METHODS

Drug development always requires the crucial process of drug formulation. Unless a drug has stability and approval from patients, it can face failure after testing for the first time. Drug formulation development includes both clinical and final products to be used, which Ascendia Pharmaceutical Solutions provides. This is due to the historical utilization of herbal medications by most in developing countries as an alternative medical source. Even with modern medical treatment, natural herbal remedies stay popular for a number of culturally motivated reasons. The availability also is increasing considerably in developed economies. More often, people will opt for traditionally compounded herbal therapies to treat myriad ailments because most consider them as less harmful drugs. Materials collected for studying antimicrobial activity includes dried powdered forms of specific plants, various traditional and commercial oils, and

several laboratory supplies from different suppliers. These include nutrient media, test samples, and other necessary equipment.

### Collection of Materials

The collection of various plant products is taken to study its antimicrobial activity. The four selected plants used are *Phyla nodiflora* Linn, *Eclipta prostrata*, *Nigella sativa*, and *Phyllanthus emblica*. These plants were bought in the dried powdered form from Lakshminarayanan traditional store located in Namakkal. The traditional oils available are coconut and sesame, bought from Sanggamithra chekku oil mill, whereas commercial oils purchased from Apollo pharmacy. MTCC and Himedia, India have been procured the microbial samples and laboratory reagents.

### Plant Profile and Medicinal Uses

S. No	Ingredients	Biological Name	Uses of Ingredients
1.	Lippia incise	<i>Phyla nodiflora</i>	<ul style="list-style-type: none"> <li>• Anti inflammatory</li> <li>• Antimicrobial activity</li> </ul>
2.	False daisy	<i>Eclipta prostrata</i>	<ul style="list-style-type: none"> <li>• Anti inflammatory</li> <li>• Liver health</li> </ul>
3.	Amla	<i>Phyllanthus emblica</i>	<ul style="list-style-type: none"> <li>• Anti –bacterial</li> <li>• Astringent</li> <li>• Reduces stress</li> </ul>
4.	Black cumin seed	<i>Nigella sativa</i>	<ul style="list-style-type: none"> <li>• Anti –bacterial</li> <li>• Anti inflammatory</li> </ul>

### Preparation of Herbal Hair Oil Preparation

#### (Maceration Process)

- All the plant drugs like *phyla nodiflora* linn, *eclipta prostrata*, *nigella sativa*, and *phyllanthus emblica*, were collected. Then they dried powdered form have been sieved through sieve no:-120.
- They powdered form *phyla nodiflora* linn (250g), *eclipta prostrata* (250g), *nigella sativa* (100g), and *phyllanthus emblica* (150g) are mixed together and immersed uniformly with cold pressed (chekku) oil such as coconut (600ml), sesame (600ml) oil is uniformly mixed.
- This mixer of oil formulation is kept under sunlight 15days by maceration method and filtered by muslin cloth.
- The formulation was stored in air tight container for further studies.

#### Method of Evolution Process

The physical examination of the traditional and commercial hair oil was performed to determine their color, smell, viscosity, specific gravity, and pH. The organoleptic properties of both types of oil were checked manually.

For the antimicrobial study, antibacterial activity was checked by letting antimicrobials in samples diffuse into the medium and react with test organisms on a newly seeded plate. The zones of inhibition were measured in millimetres. The materials used include bacterial strains like *S. pyogenes* and *E. faecalis* procured from MTCC, nutrient agar medium, nutrient broth, gentamicin solution from Himedia, etc.

The agar-well diffusion method involved the preparation of nutrient agar medium by the dissolution and autoclaving of specific amount's commercially available nutrient medium. The nutrient broth was prepared similarly, and sterilized. The procedure included seeding the plates with a 24-hour culture of bacterial strains, cutting wells, adding the test samples, incubation at 37°C for 24 hours, and measuring the inhibition zone.



The same principle of preparation was adopted as for the antibacterial activities but with an antifungal agent and using potato dextrose agar medium. Some amount of dissolving, autoclaving, seeding the plates by fungal strains taken at 72-hour culture were prepared. It was incubated at 28°C for 72 hours after measurements of inhibition zone and an antifungal positive control from Amphotericin B were obtained. Analysis was done in Graph Pad Prism 6.0 software.

**RESULT**

**1. Physical Evaluation of Hair Oils**

S. No	Parameters	Different Hair Oils					BIS Specification
		A	B	T1	T2	TF	
1.	COLOUR	Seaweed Green	Light Green	Pale yellow	Brownish yellow	Greenish brown	-
2.	ODOUR	Aromatic	Characteristic	Good	Pleasant	Naturally pleasant	-
3.	VISCOSITY	28.32 kg/m/s	28.29 kg/m/s	29.00 kg/m/s	31.89 kg/m/s	30 kg/m/s	30 kg/m/s
4.	DENSITY	0.82g/ml	0.84g/ml	0.91g/ml	0.89g/ml	0.98g/ml	≤0.01g/ml
5.	pH	7.5	7.3	5.98	7.5	7.1	4-7
6.	ACID VALUE	0.9mg KOH/g oil	0.86mg KOH/g oil	1.9mg KOH/g oil	0.5mg KOH/g oil	1.9mg KOH/g oil	≤1 mg KOH/g oil
7.	PEROXIDE VALUE	2.9meq/1000gm	3.0meq/1000gm	1.16meq/1000gm	4.2meq/1000gm	1.16meq/1000gm	≤10 meq/1000gm

**2. Determination of anti-bacterial activity of different hair oils**

S. No.	Name of the test organism	Zone of inhibition (mm) Mean ± SD				
		Product (A)	Product (B)	Product (TF)	Product (T1)	Product (T2)
1.	<i>S.pyogenes</i>	11.25±0.35	10.6±0.56	13.5±0.70	10.85±0.49	11.5±0.70
2.	<i>E.faecalis</i>	13.1±0.14	12.5±0.70	11.85±0.21	12.2±0.70	12.25±0.35

SD – Standard Deviation, \*Significance - p< 0.05

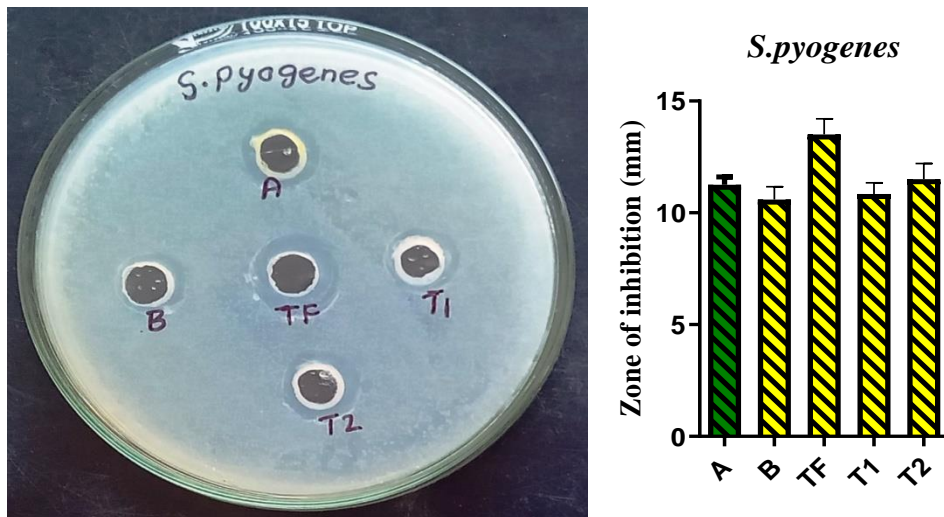


Figure no (6): Zone of inhibition of streptococcus pyogenes on different hair oils.

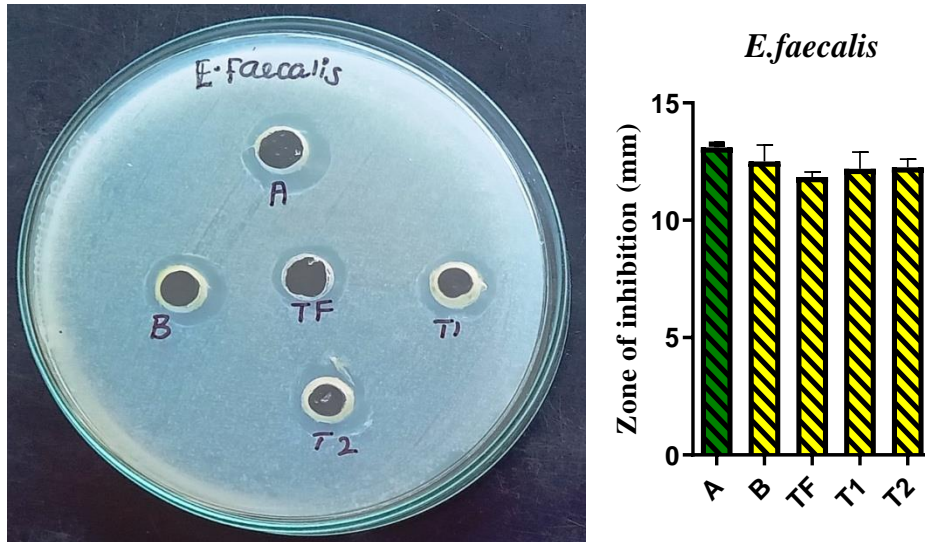


Figure no (7): Zone of inhibition of E.coli faecalis on different hair oils.

3. Determination of Anti-Fungal Activity of Different Hair Oils

S. No	Name of the test organism	Zone of inhibition (mm)				
		Product (A)	Product (B)	Product (TF)	Product (T1)	Product (T2)
1.	<i>Candida albicans</i>	13.5±0.70	11.5±0.70	0	0	0
2.	<i>Aspergillus Niger</i>	10.6±0.14	10.35±0.21	9.1±0.14	12.6±0.14	10.5±0.70

SD – Standard Deviation, \*Significance - p< 0.05

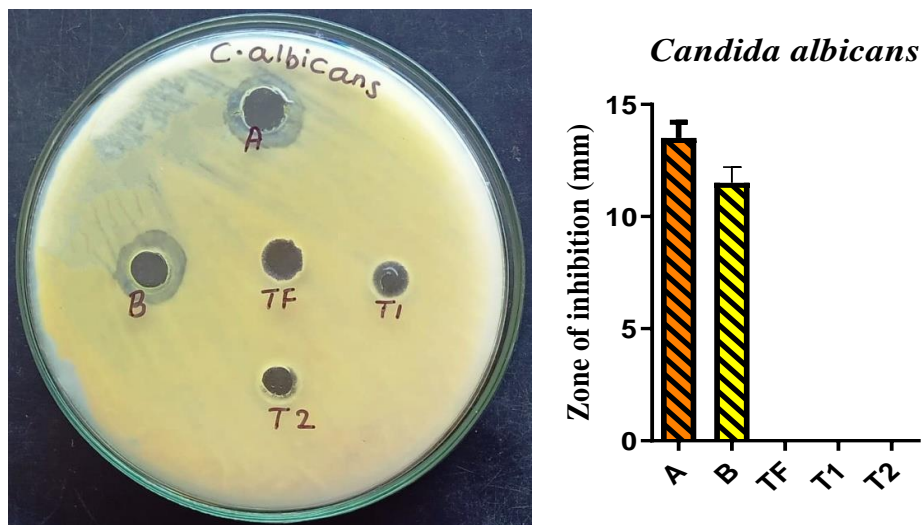


Figure no (8):-Zone of inhibition of Candida albicans on different hair oils.



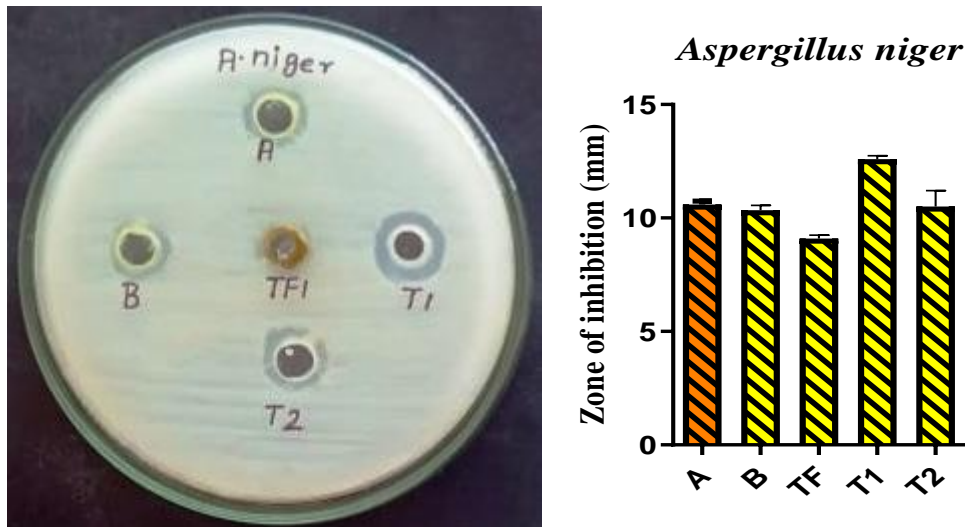


Figure no (9):-Zone of inhibition of Aspergillus Niger on different hair oils.

## DISCUSSION

### PHYSICAL EVALUATION

- **Viscosity:** The different hair oils have viscosity that varies between 29.24 to 40.82 (kg/m/s), which is appropriate for good pourability.
- **Density:** The different hair oils have density ranging from 0.700 to 0.950 (g/ml) helping to nourish follicles, increase thickness of hair, and allow for growth.

### ANTI MICROBIAL STUDY

**Antibacterial activity:** The antibacterial activity was tested against gram-positive and gram-negative bacteria. The formulation (TF) exhibited high antibacterial activity at various levels. The (TF & T2) formulations exhibited broad-spectrum activity against gram-positive bacteria, and the zones of inhibition were recorded to be high at 13 to 14 mm and 10 to 14 mm, respectively. The formulations (A & B) also exhibited broad-spectrum activity against gram-negative bacteria, with the zones of inhibition recorded to be 13 to 14 mm and 11 to 14 mm, respectively. TF showed maximum inhibition against *Streptococcus pyogenes* (13 to 14 mm) and the minimum against *Escherichia coli faecalis* (11 to 14 mm).

**Anti fungal activity:** The antifungal activity was tested against filamentous and non-filamentous fungi.

Formulation A shows significant antifungal activity against filamentous fungi *Candida albicans* with zone of inhibition of 13 to 14 mm. Traditional formulations T1, T2, and TF failed to inhibit filamentous fungi. Formulation T1 was strong against non-filamentous fungi, which included *Aspergillus Niger*, with inhibition zones ranging between 12 to 14 mm. Formulation A had the highest inhibition for *Candida albicans*, within the range of 13 to 14 mm, and was the least active against *Aspergillus Niger* with TF (10 to 14 mm).

## CONCLUSION

There is an urgent need to develop new antimicrobial compounds in view of emerging infectious scalp diseases such as scalp folliculitis and scalp ringworm, causing hair and skin disorders. In the pharmaceutical industry, new lead compounds with new chemical structures are being searched to overcome the growing problem of antibiotic resistance.

Results from the efficacy of extracts of *Phyla nodiflora*, *Eclipta prostrata*, and others having known antimicrobial properties are showing promising effects against specific bacteria and fungi. Formulation (TF) showed excellent antibacterial activity, while formulation (A) showed strong antifungal activity. Thus, both formulations are recommended for further investigations.

## REFERENCES

1. Parish LC, Crissey JT. Cosmetics: A historical review. *Clinics in Dermatology*, 1988; 6(3): 1-6.
2. Watts I. The pigments from Pinnacle Point Cave 13B, Western Cape, South Africa. *Journal of Human Evolution*, 2010; 59(3): 392–411.
3. Adkins. L, Roy A. Adkins AR, Handbook to life in Ancient Greece, Oxford: Oxford University Press, 1998.
4. Olson. K, Cosmetics in Roman Antiquity: Substance, Remedy, Poison. *The Classical World*, 2009; 102(3): 294-298.
5. Johnson. R, "What's That Stuff? Lipstick". *Chemical and Engineering News*, 1999; 77 (28): 31. doi:10.1021/cen-v077n028.p031.
6. Man niche. L, Forman. W, sacred luxuries: Fragrance, aromatherapy, and cosmetics in ancient Egypt, Ithaca NY: Cornell Univ. Press, 1999.
7. Buffoli B, Rinaldi F, Labanca M, Sorbellini E, Trink A, Guanzioli E, Rezzani R, Rodella LF. The human hair: from anatomy to physiology. *Int J Dermatol*, 2014 Mar; 53(3): 331-41.
8. Sarkar R, Podder I, Gokhale N, Jagadeesan S, Garg VK. Use of vegetable oils in dermatology: An overview. *Int J Dermatol*, 2017; 56: 1080–6. doi: 10.1111/ijd.13623.
9. Swarnlata saraf, Manjusha jharaniya, Anshita gupta, Vishal jain, Shailendra Saraf. Herbal hair cosmetics: Advancements and recent Findings, 2014; 3(2): 2277- 7105.
10. Erum Zahir, Rehana Saeed, Mehwish Abdul Hameed, Anjum Yousuf. Study of physicochemical properties of edible oil and evaluation of frying oil quality by Fourier Transform-Infrared (FT-IR) Spectroscopy. *Arabian Journal of Chemistry*, 2017; 10(2): S3870-S3876.DOI: <https://doi.org/10.1016/j.arabjc.2014.05.025>.
11. De Magaldi, Silvia W., and Teresa Camero. "Suceptibilidad de *Candida albicans*" In vitro" mediantelosposos de difusion." *Bol. venez.infectol*, 1997; 5-8.