

## **Journal of Integral Sciences [JIS]**

## [An International Open Access Journal]

Available at www.jisciences.com

ISSN: 2581-5679

# SIMULTANEOUS ESTIMATION OF EMTRICITABINE, TENOFOVIRDIHAIRCARE TREATMENT ON ALBINO RATS BY USING "ROSEMARY OIL"

K.Naga Hari Krishna<sup>1</sup>, M.Jalaiah<sup>1</sup>, B.Meghana<sup>2</sup>, G.Mercia Rani<sup>2</sup>, K.Anitha<sup>2</sup>, A. Jagadeesh<sup>3</sup>

- <sup>1</sup>Department of pharmacology, QIS College of Pharmacy, Vengamukkapalem, Ongole, Andhra Pradesh, India.
- <sup>2</sup>Research scholar, B.Pharmacy, QIS College of Pharmacy, Vengamukkapalem Ongole, Andhra Pradesh, India.
- <sup>3</sup>Department of Pharmacology, QIS College of Pharmacy, Vengamukkapalem, Ongole, Andhra Pradesh, India.

Received: 14 Jan 2024 Revised: 15 Feb 2024 Accepted: 25 Mar 2024

#### **Abstract**

Rosemary oil, derived from the aromatic herb Rosmarinus officinalis, has gained significant attention as a potential remedy for promoting hair growth. With a rich history in traditional medicine and an array of bioactive compounds, rosemary oil has emerged as a natural alternative in the quest for healthy and vibrant hair. This introduction explores the key constituents of rosemary oil, its historical use, and the growing body of scientific evidence supporting its efficacy in stimulating hair growth. A comparative analysis of minoxidil and rosemary oil for hair growth reveals distinct mechanisms and potential benefits associated with each. Minoxidil, a synthetic compound, is a vasodilator that widens blood vessels, enhancing blood flow to hair follicles. This increased blood circulation is thought to stimulate hair growth. In contrast, rosemary oil, a natural remedy, contains bioactive compounds like ursolic acid and rosmarinic acid, which exhibit antioxidant properties and may contribute to improved cellular health in hair follicles. While both minoxidil and rosemary oil have shown efficacy in certain studies, minoxidil' oil. Pharmaceutical nature often positions it as a standard topical treatment for hair loss. Rosemary oil, on the other hand, is considered a botanical alternative, appealing to those seeking natural remedies. However, comprehensive clinical trials comparing the long-term effectiveness, safety, and tolerability of these treatments are still limited.

Key words: Rosemary oil, minoxidil, natural remedies.

This article is licensed under a Creative Commons Attribution-Non-commercial 4.0 International License. Copyright © 2024 Author[s] retains the copyright of this article.



## \*Corresponding Author

K.Naga Hari Krishna

**DOI:** https://doi.org/10.37022/jis.v7i1.77

**Produced and Published by**South Asian Academic Publications

## Introduction

The World Health Organization defines health as a state of complete physical, mental, and social well-being, and not as and mental well-being, it is necessary to prevent the occurrence of pathologies and to promote anti-aging. Thus, caring for one's personal appearance and using cosmetic products are very important. This situation is not new, as humans have had a special interest in taking care of the external appearance of the body since ancient times. Recently, a work was published in which an improvement in self-esteem was observed in Australian women voluntarily subjected to the daily use of certain cosmetics. In recent decades, the use of cosmetics has become a mass phenomenon thanks to film, television, and, especially

now, the use of social networks. However, people not only want to appear beautiful, but also want to use natural, healthy, and safe products. For this reason, natural products such as plants are used as they are often considered non-toxic. Consumers also demand that personal care products must be of good quality, and are interested in the characteristics of the products they are using, seeking scientific backing to guarantee the properties that appear on brand labels, even if those products do not have drugs status. Fortunately, the cosmetic industry is aware and is becoming more demanding with the products they make.

### Methodology

Web of Science (WoS), Scopus, PubMed, and Wiley Online Library databases were used for this bibliographical review. The keywords used were "Rosmarinus officinalis" and "cosmetics", appearing in the titles of the works or in the keywords. The data obtained included 140 results from WoS, 95 from Scopus, 65 from PubMed, and 48 from Wiley, some of which were duplicated or did not contain information relevant to this study. A total of 63 works

were selected from these databases. Almost all were written between the year 2000 and the present. This information was complemented by another bibliography, consisting mainly of books, which are difficult to access online.

#### **Ouick Facts**

- Family: Lamiaceae (Labiatae)
- Latin Name : Rosmarinus officinalis
- Growth: evergreen perennial Hardiness: zone [8-10]
- Light: full sun Soil: well-drained, sand or gravel mix
- Water : slightly moist, not too wet
- Pests : thrips, spider mites, white fly
- Diseases :root rot
- Propagation: cuttings, layering, seeds (species only)
- Use: culinary, landscaping, crafts.

#### **History & Uses**

In ancient times rosemary was believed to strengthen the memory; in literature and folklore it is an emblem of remembrance and fidelity. Rosemary is slightly stimulating. In traditional medicine it was a popular aromatic constituent of tonics and liniments. Today its fragrant oil is an ingredient in numerous toiletry products and in vermouth. The essential oil content is from 0.3 to 2 percent, and it is obtained by distillation; its principal component is borneol.

#### **Procedure**

Using rosemary oil for hair care treatment on albino rats can be a promising approach due to the potential benefits of rosemary oil for hair health. Rosemary oil has been traditionally used for its purported hair growth-promoting properties and scalp stimulation.

**Research and Preparation:** Start by reviewing existing literature on the effects of rosemary oil on hair growth and scalp health in animal models. This will help you understand the potential benefits and any possible side effects.

**Ethical Considerations:** Ensure that your study complies with ethical guidelines for animal research. Obtain approval from relevant ethics committees or institutional review boards.

**Experimental Design:** Design your experiment, including factors such as dosage, frequency of application, duration of treatment, and control groups.

**Animal Selection and Grouping:** Select albino rats as your animal model and divide them into different groups: a control group and one or more experimental groups receiving rosemary oil treatment.

**Application of Rosemary Oil:** Administer rosemary oil to the experimental groups according to your predetermined dosage and schedule. This may involve direct application to the skin or mixing the oil with a carrier substance for easier application.

**Monitoring and Data Collection:** Regularly monitor the rats for any signs of adverse reactions or changes in hair

growth. Collect data on parameters such as hair length, density, and condition.

**Analysis:** Analyze the data collected from your experiment to determine the effects of rosemary oil treatment on the hair health of albino rats. Use appropriate statistical methods to assess the significance of any observed differences between the control and experimental groups.

**Conclusion and Reporting:** Draw conclusions based on your findings and consider implications for future research or applications in human hair care. Document your methodology and results in a clear and comprehensive manner for publication or presentation.

Essential oils from plants are used extensively in the pharmaceutical, food, cosmetic, and medical industries. Since they are found in plants in low concentrations of substances, high-performance extraction methods would be necessary in order to offer large yield. Essential oils are typically made using a variety of techniques, such as the extraction of solvents, supercritical fluid extraction, steam distillation, hydro distillation, the use of superheated steam, and combinations of the aforementioned methods with additional processes like ultrasound and microwave assistance (Chemat et al. 2006 and Masango 2005). According to Rajeswara (2002), steam distillation is a widely used technique due to its affordability when more sophisticated methods compared to extraction, supercritical fluid well as as environmentally friendly nature when compared to solvent extraction retrieval. This approach has been actively developed since the early 1980s. A few studies on the extraction of oil using steam distillation can be found in the literature. Masango, 2005. examined how to maximize energy usage and increase the extraction yield by raising the steam flow rate, adding a steam jacket, and properly insulating the distillation column for extracting essential oil from lavender and artemisia plants. In order to prepare Pimpinella anisum oil, Romdhane et al. and Tizaoui (2005) proposed a mathematical model for steam distillation process optimization. Chemat and others (2006) The quality of Artemisia oil was enhanced and the extraction period was shortened by using a microwave heater rather than an electric one. Another study examined the impact of plant crushing and extraction duration on the production and chemical composition of coriander oil (Smallfield 2001). The 1.5-meter-tall, aromatic, medicinal, and condiment plant Rosemary (Rosemarinuse officinialis L.) is a member of the labiatae family. Steam distillation of fresh leaves and twigs yields rosemary essential oil, also referred to as rosemary oil. (Mateus et al., 2006) The yield varies from 0.5 to 1.5% (w/w). There have been reports regarding the chemical composition and physicochemical properties of rosemary essential oil. It is a clear, nearly colorless to pale yellow liquid with a distinct, energizing scent. There are two distinct methods by which the impact of extraction time on

the quantity and content of rosemary oil has been recorded; the processes of hydrodistillation and steam distillation (Masango 2005). The arrangement of oil might differ significantly according on the extraction technique employed. The process of steam distillation was represented as an essential project stage. industrial facilities in good working order (Cassel et al. 2009 andAccording to Bimakr et al. (2011), traditional soxhlet extraction of Three grams of dried and crushed spearmint required six hours to yield flavonoids at 40°C.using solvents like methanol and ethanol. Thus, they suggested supercritical high efficiency extraction using CO2 (Bimakr et al 2011). Solvent extraction performs poorly as a result. In this investigation, a High extraction yields were achieved by determining the ideal working parameters. Additionally, the impact of various factors on the chemical makeup of the extracted rosemary oil can be examined. The procedure is new in that it introduces multistage plant beds to improve mass transfer operation and better extract target components.

## Material and Methods Plant material

The rosemary samples were collected obtained from the farm. Fresh plant materials were carefully separated into leaves and stems. The samples were dried in the shade for 5 days for use in the research experiments and the primary moisture of the leaves was 60.2% (w.b). For the extraction of essential oils, 100 grams of each powder sample was used and then the essential oils isolated by hydro distillation and steam distillation are isolated for 5, 15, 30, 60 and 120 minutes. Then separating essential oils from the water layer and drying them over anhydrous sodium sulphate, and calculating the average yield of aromatic oil.



**Essential Oil** 

Essential oil was extracted from each of the plant parts by two extraction methods.

## Hydrodistillatin

The Clevenger-type apparatus hydro distillation was used for this purpose. A mixture of Rosemary leaves or powder (200 g) and 1000 ml of water was put into a 2000 ml round bottomed flask The temperature was set at 80C for the extraction of essential oil. The process in Clevenger-type apparatus was run for the time till no further oil could be extracted. The essential oil was vaporized with

the steam. Condensation occurred as the vapours of essential oil and steam mixture passed through a condenser. The condensate, a mixture of oil and water, was then separated. Essential oil being lighter settled above water and it was collected. To study the kinetics of extraction of oil, essential oil was collected at regular intervals during the extraction process.

#### Steam distillation apparatus and procedure

A schematic diagram of the steamdistillation apparatus used for essential oil extraction .The apparatus has a cylindrical Pyrex body (6 cm inside diameter and 60 cm height). A batch of 100 -200 g of dried and ground leaves of rosemary was packed in the column with 2000 ml water in steam source. The raw material forms the packed bed. The lid was closed and the process of distillation began with the injection of steam to the bottom of the column. Each plant bed was exposed to several flow rates of steam. Steam and essential oil were condensed and collected in time intervals of 5, 15, 30, 60 and 100 minutes. Following condensation, the mixture was decanted to separate phases of oil and water. The essential oil was collected, dried with anhydrous sodium sulfate and stored at 40 C until analyzed. In these experiments, the steam jacket of the column was insulated by foam cover having 1 cm thickness. After doing the experiments and determining the yield of each experiment, the obtained samples from the three experiments with steam flow rates of 3, 6 and 9 l/min and a packed bed of 100 g that were collected at five intervals, namely 5, 15, 30, 60 and 100 minutes, were analyzed by GC -MS and GC instruments. Each experiment was repeated at least three times and mean of results was reported.

#### Results

GROUP.1 table no. 6.1 control group

GRO UP	ANI MA	1 <sup>st</sup> w	2 <sup>n</sup>	3r d	4 <sup>t</sup>	5 <sup>t</sup>	6 <sup>t</sup>	7 <sup>t</sup>	8 th
UF	LS	ee	W	w	W	w	w	w	w
		k	ee	ee	ee	ee	ee	ee	e
			k	k	k	k	k	k	e
									k
CON	HEA	0	0	0	0	0	0	0.	0.
TRO	D							06	1
L									С
									m
	BOD	0	0	0	0	0	0	0.	0.
	Y							04	1
									2
									c
									m
	TAI	0	0	0	0	0	0	0.	0.
	L							05	1
									4

## GROUP.2 table no. 6.2 standard group (monoxidil)

GROUP.2 table no. 6.2 Standard group (monoxidii)									
GR OU P	ani ma ls	1s t w ee k	2n d w ee k	3r d w ee k	4 <sup>th</sup> W ee k	5 <sup>t</sup> h	$_{_{h}}^{6^{t}}$	7 <sup>th</sup>	8 th
						w ee k	w ee k	we ek	w e e k
									2.
					1.	1.	1.	2.0	0
	HE	0	0	0	2c	4c	6c	6c	6
	AD				m	m	m	m	с
Sta									m
nda									2.
rd	ВО				1.	1.	1.	2.0	0
(hig	DY	0	0	0	4c	5c	7c	6c	5
h	וע				m	m	m	m	С
Dos									m
e)	TAI L	0	0	0					2.
					1.	1.	1.	2.0	0
					5c	6c	8c	5c	7
					m	m	m	m	С
									m
	HE AD			0	4	4	4	2.0	2.
		0	0		1.	1.	1.	2.0	0
					1c m	3c	7c m	2c m	1 c
Sta					111	m	111	111	m
nda rd (lo w Dos e)									2.
		0	0	0	1.	1.	1.	2.0	0
	BO DY				2c	4c	6c	3c	3
					m	m	m	m	С
									m
									2.
	тлт				1.	1.	1.	2.0	0
	TAI L	0	0	0	4c	2c	5c	1c	2
	L				m	m	m	m	c
									m

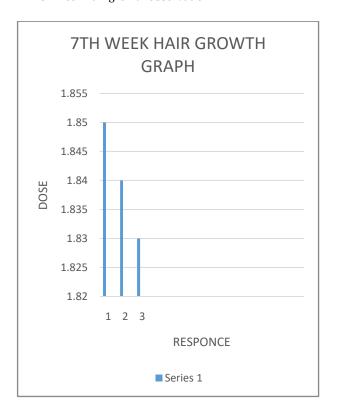
## GROUP.3 Table no. 6.3 test group(rosemary oil)

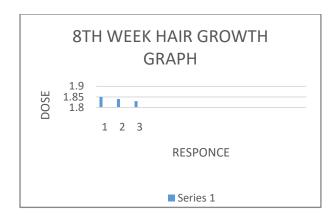
GR	ani	1s	2 <sup>n</sup>	3r	4 <sup>th</sup>	5 <sup>t</sup>	6 <sup>th</sup>	7 <sup>th</sup>	8t
OU	ma	t	d	d	W	h	we	we	h
P	ls	w	w	w	ee	w	ek	ek	w
		ee	ee	ee	k	ee			e
		k	k	k		k			e
									k
Sta	HE	0	0	0	0.5	1.	1.4	1.6	1.
nda	AD				7c	2c	cm	cm	8
rd					m	m			5
(hig									С
h									m
Dos	ВО	0	0	0	0.5	1.	1.4	1.6	1.
e)	DY				9c	0c	4c	3c	8
					m	m	m	m	4
									с
									m

	TAI	0	0	0	0.6	1.	1.4	1.6	1.
		U	U	U					
	L				0c	3c	3c	5c	8
					m	m	m	m	3
									С
									m
Sta	HE	0	0	0	0	1.	1.4	1.6	1.
nda	AD					0c	2c	cm	8
rd						m	m		С
(lo									m
w	ВО	0	0	0	0	1.	1.4	1.6	1.
Dos	DY					1c	1c	1c	8
e)						m	m	m	1
									3
									С
									m
	TAI	0	0	0	0	1.	1.4	1.6	1.
	L					2c	0c	2c	8
						m	m	m	2
									С
									m

## GROUP.1 fig no. 6.1&6.2 control grou

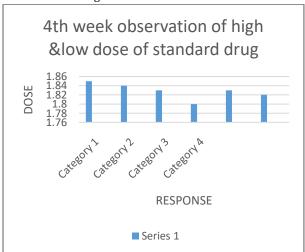
- $\bullet \quad 1^{st}$  ,2  $^{nd}$  , 3  $^{rd}$  ,4  $^{th}$  ,5  $^{th}$  & 6  $^{th}$  week no observation of hair growth
- 7th week hair growth observation
- 8th week hair growth observation



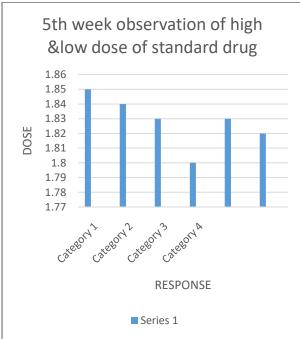


## GROUP.2 fig no. 6.3, 6.4, 6.5, 6.6, &6.7 standard group (MINOXIDIL)

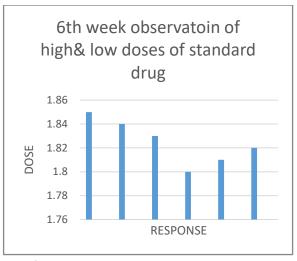
- 1st 2nd & 3rd week no observation of hair growth
- 4th week hair growth observation.



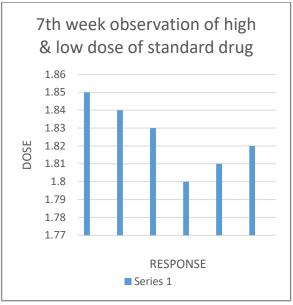
• 5th week hair growth observation



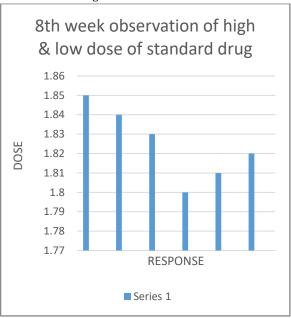
• 6th week hair growth observation



7<sup>th</sup> week hair growth observation

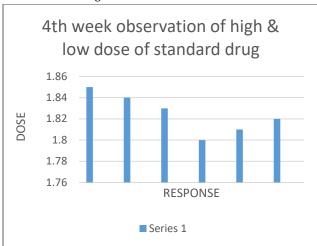


• 8th week hair growth observation

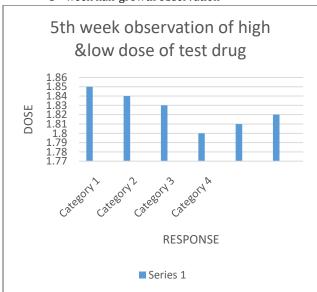


## GROUP.3 fig no. 6.8, 6.9, 6.10, 6.11 & 6.12 Test group (ROSEMARY OIL)

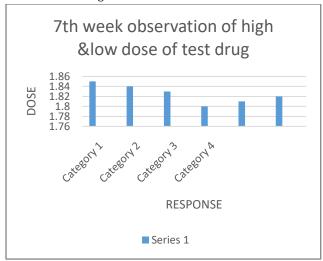
- 1st, 2nd & 3rd week no observation of hair growth
- 4th week hair growth observation.



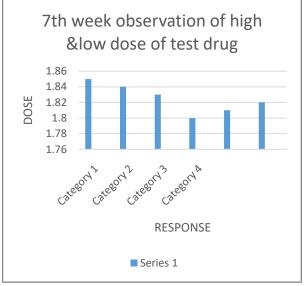
• 5<sup>th</sup> week hair growth observation



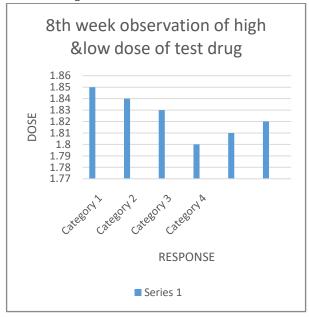
• 6th week hair growth observation



7<sup>th</sup> week hair growth observation



8th week hair growth observation



### Discussion

Hair care is an overall term for hygiene and cosmetology involving the hair which grows from the human scalp, and to a lesser extent facial, pubic and other body hair, Hair care routines differ according to an individual's culture and the physical characteristics of one's hair Hair may be colored, trimmed, shaved, plucked, or otherwise removed with treatments such as waxing, sugaring, and threading. Hair care services are offered in salons, barbershops, and day spas, and products are available commercially for home use. This hair typing system is the most widely used system to classify hair. The system was created by the hairstylist of Oprah Winfrey, Andre Walker. According to this system there are four types of hair. Straight, wavy, curly, kinky. Care of the hair and care of the scalp skin may appear separate, but are actually intertwined because hair grows from beneath the skin. The living parts of hair (hair

follicle, hair root. root sheath, and sebaceous gland) are beneath the skin, while the actual hair shaft which emerges (the cuticle which covers the cortex and medulla) has no living processes. Damage or changes made to the visible hair shaft cannot be repaired by a biological process, though much can be done to manage hair and ensure that the cuticle remains intact. The sebaceous glands in human skin produce sebum, which is composed primarily of fatty acids The psychology of hair thinning is a complex issue. Hair is considered an essential part of overall identity: especially for women, for whom it often represents femininity and attractiveness. Men typically associate a full head of hair with youth and vigor. Although they may be aware of pattern baldness in their family, many are uncomfortable talking about the issue. Hair thinning is therefore a sensitive issue for both sexes. For sufferers, it can represent a loss of control and feelings of isolation. Care of the hair and care of the scalp skin may appear separate, but are actually intertwined because hair grows from beneath the skin. The living parts of hair (hair follicle, hair root, root sheath, and sebaceous gland) are beneath the skin, while the actual hair shaft which emerges (the cuticle which covers the cortex and medulla) has no living processes, Damage or changes made to the visible hair shaft cannot be repaired by a biological process, though much can be done to manage hair and ensure that the cuticle remains intact. The sebaceous glands in human skin produce sebum, which is composed primarily of fatty acids. Sebum acts to protect hair and skin, and can inhibit the growth of microorganisms on the skin. Sebum contributes to the skin's slightly acidic natural pH somewhere between 5 and 6.8 on the pH spectrum. This oily substance gives hair moisture and shine as it travels naturally down the hair shaft, and serves as a protective substance by preventing the hair from drying out or absorbing excessive amounts of external substances. Sebum is also distributed down the hair shaft "mechanically" by brushing and combing. When sebum is present in excess, the roots of the hair can appear oily, greasy, and darker than normal, and the hair may stick together.

- By observing standard drug (minoxidil) for 60 days hair growth up to 2.2cm.
- By observing test sample (low dose of Rosemary oil) for 60 days hair growth up to 1.8cm.
- By observing test sample -II (High dose of Rosemary oil) for 60 days hair growth up to 2.0cm
- Observing minoxidil (standard drug) the hair growth was faster than emu oil (low and high dose) but Rosemary oil do not produce any side effect.

Observing the low and high doses of Rosemary oil. The high dose Rosemary oil will hair growth faster than low dose Rosemary oil.

#### **Conclusion**

The present study was carried out to find out evaluation of hair care treatment on albino rats by using ROSEMARY OIL From the results, the rosemary oil used of high and low doses produces significant effect in minoxidil hair care treatment in rats. However the rosemary oil prodeces effect compared to standard drug the observed haircare treatment activity of rosemary oil is due to the presence of chemical constituents Rosemarinic acid, Rosmanol, Linalool, Thymol, Carsonic acid, Chrysanthenone, Carnosol.

### **Funding**

No Funding.

#### **Conflict of interest**

Authors are decaled that no conflict of interest.

#### **Author Contribution**

All authors are contributed equally.

#### References

- Begum, Asia, et al. "Evaluation of herbal hair lotion loaded with rosemary for possible hair growth in C57BL/6 mice." Advanced Biomedical Research 12.1 (2023): 60.
- Begum, A., Sandhya, S., Kumar, A. N., & Ali, S. S. (2023). Evaluation of herbal hair lotion loaded with rosemary for possible hair growth in C57BL/6 mice. Advanced Biomedical Research, 12(1), 60.
- Begum, Asia, S. Sandhya, Anoop N. Kumar, and Syed S. Ali. "Evaluation of herbal hair lotion loaded with rosemary for possible hair growth in C57BL/6 mice." Advanced Biomedical Research 12, no. 1 (2023): 60.
- Begum, A., Sandhya, S., Kumar, A.N. and Ali, S.S., 2023. Evaluation of herbal hair lotion loaded with rosemary for possible hair growth in C57BL/6 mice. Advanced Biomedical Research, 12(1), p.60.
- Begum A, Sandhya S, Kumar AN, Ali SS. Evaluation of herbal hair lotion loaded with rosemary for possible hair growth in C57BL/6 mice. Advanced Biomedical Research. 2023 Mar 1;12(1):60.
- Uronnachi, Emmanuel, et al. "Formulation and evaluation of hair growth enhancing effects of oleogels made from Rosemary and Cedar wood oils." Scientific African 16 (2022): e01223.
- Uronnachi, E., Atuegwu, C., Umeyor, C., Nwakile, C., Obasi, J., Ikeotuonye, C., & Attama, A. (2022). Formulation and evaluation of hair growth enhancing effects of oleogels made from Rosemary and Cedar wood oils. Scientific African, 16, e01223.
- 8. Uronnachi, Emmanuel, Chidiogo Atuegwu, Chukwuebuka Umeyor, Calistus Nwakile, Josephat Obasi, Chidalu Ikeotuonye, and Anthony Attama. "Formulation and evaluation of hair growth enhancing effects of oleogels made from Rosemary

- and Cedar wood oils." Scientific African 16 (2022): e01223.
- Uronnachi, E., Atuegwu, C., Umeyor, C., Nwakile, C., Obasi, J., Ikeotuonye, C. and Attama, A., 2022. Formulation and evaluation of hair growth enhancing effects of oleogels made from Rosemary and Cedar wood oils. Scientific African, 16, p.e01223.
- Uronnachi E, Atuegwu C, Umeyor C, Nwakile C, Obasi J, Ikeotuonye C, Attama A. Formulation and evaluation of hair growth enhancing effects of oleogels made from Rosemary and Cedar wood oils. Scientific African. 2022 Jul 1;16:e01223.
- Ahmed, Hiwa M., and Muhammed Babakir-Mina.
   "Investigation of rosemary herbal extracts (Rosmarinus officinalis) and their potential effects on immunity." Phytotherapy Research 34.8 (2020): 1829-1837.
- Ahmed, H. M., & Babakir-Mina, M. (2020). Investigation of rosemary herbal extracts (Rosmarinus officinalis) and their potential effects on immunity. Phytotherapy Research, 34(8), 1829-1837.
- 13. Ahmed, Hiwa M., and Muhammed Babakir-Mina. "Investigation of rosemary herbal extracts (Rosmarinus officinalis) and their potential effects on immunity." Phytotherapy Research 34, no. 8 (2020): 1829-1837.
- Ahmed, H.M. and Babakir-Mina, M., 2020. Investigation of rosemary herbal extracts (Rosmarinus officinalis) and their potential effects on immunity. Phytotherapy Research, 34(8), pp.1829-1837.
- 15. Ahmed HM, Babakir-Mina M. Investigation of rosemary herbal extracts (Rosmarinus officinalis) and their potential effects on immunity. Phytotherapy Research. 2020 Aug;34(8):1829-37.
- Al-Sereiti, M. R., K. M. Abu-Amer, and P. Sena. "Pharmacology of rosemary (Rosmarinus officinalis Linn.) and its therapeutic potentials." (1999).
- 17. Al-Sereiti, M. R., Abu-Amer, K. M., & Sena, P. (1999). Pharmacology of rosemary (Rosmarinus officinalis Linn.) and its therapeutic potentials.
- 18. Al-Sereiti, M. R., K. M. Abu-Amer, and P. Sena. "Pharmacology of rosemary (Rosmarinus officinalis Linn.) and its therapeutic potentials." (1999).
- 19. Al-Sereiti, M.R., Abu-Amer, K.M. and Sena, P., 1999. Pharmacology of rosemary (Rosmarinus officinalis Linn.) and its therapeutic potentials.
- 20. Al-Sereiti MR, Abu-Amer KM, Sena P. Pharmacology of rosemary (Rosmarinus officinalis Linn.) and its therapeutic potentials.
- 21. Rathi, Vaishali, et al. "Plants used for hair growth promotion: A review." Pharmacognosy Reviews 2.3 (2008): 185.
- 22. Rathi, V., Rathi, J., Tamizharasi, S., & Pathak, A. (2008). Plants used for hair growth promotion: A review. Pharmacognosy Reviews, 2(3), 185.

- 23. Rathi, Vaishali, Jagdish Rathi, S. Tamizharasi, and Anupam Pathak. "Plants used for hair growth promotion: A review." Pharmacognosy Reviews 2, no. 3 (2008): 185.
- 24. Rathi, V., Rathi, J., Tamizharasi, S. and Pathak, A., 2008. Plants used for hair growth promotion: A review. Pharmacognosy Reviews, 2(3), p.185.
- 25. Rathi V, Rathi J, Tamizharasi S, Pathak A. Plants used for hair growth promotion: A review. Pharmacognosy Reviews. 2008;2(3):185.