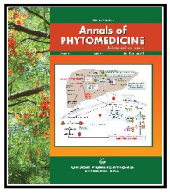
Annals of Phytomedicine 12(2): 1012-1016, 2023

DOI: http://dx.doi.org/10.54085/ap.2023.12.2.121

Annals of Phytomedicine: An International Journal

http://www.ukaazpublications.com/publications/index.php

Print ISSN : 2278-9839 Online ISSN : 2393-9885



Original Article : Open Access

Characterization of a polyherbal cosmetic cream infused with ethanolic extracts of antioxidant herbs

K. Gana Manjusha◆, D. Aruna Kumari, P. Bala Krishnaiah*, M. Radha Krishna and B. Lakshmi Prasanna

Vignan Institute of Pharmaceutical Technology, Duvvada-530049, Andhra Pradesh, India

** Srikrupa Institute of Pharmaceutical Sciences, Medak-502277, Telangana, India*

Article Info

Article history

Received 28 August 2023

Revised 20 October 2023

Accepted 21 October 2023

Published Online 30 December 2023

Keywords

Herbs

Antioxidant

Polyherbal cream

Skin lightening

Tyrosinase inhibition

Abstract

The current project is planned to compound and assess polyherbal cosmetic cream infused with ethanolic extracts of roots of *A. galanga*, *S. lappa*, *G. glabra*, bark extracts of *S. racemosa* and resin of *V. indica*. Various types of cream bases were prepared by altering the concentrations of stearic acid and cetyl alcohol (F1 to F6). The prepared base was checked for its pH, spreadability and stability. The F2 base was found to be more relevant for cream preparation. *A. galanga* rhizome extract, root extracts of *S. lappa*, *G. glabra*, bark extract of *S. racemosa* and resin of *V. indica* of various concentrations were integrated into the F2 base to prepare HF1, HF2 and HF3 skin whitening herbal cream. Herbal-formulated creams unveiled better appearance, spreadability, pH, homogeneity, consistency, removal ease, and phase separations are not evident and are safe for the skin. Pretreatment with antioxidants can prevent the oxidation of cellular contents that occurs after being exposed to UV radiation. In virtue of this, *A. galanga*, *S. lappa* and *V. indica* do have the potential to be used in fairness preparations. Hence, there is a great demand for herbal cream that can act as an antioxidant and can inhibit tyrosinase.

1. Introduction

For millennia, the fundamental needs of primary healthcare have been effectively addressed by traditional systems of medicine rooted in the use of plants (Maroti *et al*., 2022; Manju and Pushpa, 2020). Antioxidants derived from plants play a crucial role in alleviating cellular oxidative stress and related health conditions even at low concentrations (Jyothilekshmi *et al*., 2022; Duraisami *et al*., 2021). Every individual has an intense desire to look beautiful and fair. This is becoming more pronounced in more people with natural products than their synthetic counterparts. The market potential for herbal cosmetics in India is high and has going to expand by 20% every year (Gana Kondepudi, 2018; Valarmathi *et al*., 2020). The synthetic fairness creams available, possess many side effects ranging from rashes to cancers. Hence, people developed an interest for safe and effective alternatives; herbal creams are one of those alternatives. Ayurveda, the traditional medicinal system of India paces a strong emphasis on the idea of synergy or "samyoga" which is the understanding of integrating various elements to optimize safety and efficacy. An Ayurvedic treatise called the Sarangdhar samhitha proposed the concept of polyherbalism to improve the effectivenesss of treatment. Since the combination of several ingredients in these traditional medicines makes them well suited for treating complicated ailments and holds considerable potential for creating synergistic effects; synergism plays a crucial role in the effectiveness of herbal treatments and formulations (Pulok *et al.,* 2018). Hence, polyherbal formulations offer different actions or a more pounced action. Therefore, polyherbal creams are of interest. The plant extracts utilized in these creams must possess antibacterial, antioxidant, tyrosinase inhibition, antiseptic and keratolytic (Gupta *et al*., 2015).

Corresponding author: Dr. K. Gana Manjusha

Associate Professor, Department of Pharmacognosy, Vignan Institute of Pharmaceutical Technology, Duvvada-530049, Andhra Pradesh, India

E-mail: manjusha.kondepudi.g@gmail.com

Tel.: +91-9885574803

2. Materials and Methods

2.1 Materials

Based on proven tyrosinase inhibition activity and anti-inflammatory activity, the following plants were selected for the formulation. Rhizomes and roots of *Alpinia galanga*, *Saussera lappa*, *Glycyrrhiza glabra*, bark of *Symplocos racemosa* and resin of *Vateria indica*. The purpose of this study is to develop a polyherbal cream with potent antioxidant activity.

2.1.1 *A. galanga*

Phytoconstituents: Phytochemical analysis of the roots of *A. galanga* in petroleum ether extract divulges fatty acids, steroids and terpenoids. Alkaloids and glycosides are found in chloroform extract, whereas flavonoids and tannins are revealed in methanolic extract (Pal Jain *et al*., 2012).

Pharmacological activities: This plant's rhizomes are used extensively in the treatment of gastrointestinal disorders, respiratory, cardiovascular and skin disorders (Chopra *et al*., 1956). Rhizomes are reported to possess antibacterial, antioxidant, immunostimulant, antiprotozoal, antifungal and expectorant activities (Pal Jain *et al*., 2012).

2.1.2 *S. lappa*

Phytoconstituents: Carbohydrates, saponins, alkaloids, flavonoids, tannins and other phenolics are present in the root extracts of *S. lappa* (Chandur *et al*., 2011).

Pharmacological activities: Treatments for dysentery, ulcers, stomachaches, quartan malaria, leprosy, typhoid fever, asthma, and skin conditions all involve the usage of *S. lappa* roots. Additionally, it is used as an anti-inflammatory, hepatoprotective, and anticancer agent and also immunomodulant, hypolipidemic, hypoglycemic, antimicrobial agent and CNS depressant (Pandey *et al*., 2007).

2.1.3 *G. glabra*

Phytoconstituents: The preliminary phytochemical screening of the ethanolic extract of *G. glabra* root revealed the presence of alkaloids, glycosides, carbohydrates, phenolic compounds, flavonoids, proteins, saponins, lipids, tannins and steroids (Husain and Ahmad., 2015; Bradley., 1992).

Pharmacological activities: The pharmacological screening of *G. glabra* roots showed memory enhancement, antidepressant, antimicrobial, anticancer, antioxidant, anti-inflammatory, protective, antiulcer, antidiabetic, hypolipidemic and many other pharmacological effects (Al-Snafi, 2018; Kriker *et al*., 2021).

2.1.4 *S. racemosa*

Phytoconstituents: The preliminary phytochemical tests indicated the presence of phenols, flavonoids, saponins, tannins, glycosides and steroids (Maitra and Satardekar, 2017).

Pharmacological activities: *S. racemosa* has antiulcer, anti-inflammatory, antioxidant, anthelmintic, antibacterial, antiangiogenic, anticancer and hepatoprotective activities (Nagur *et al*., 2014).

2.1.5 *V. indica*

Phytoconstituents: The resin is a mixture of many triterpene hydrocarbons, ketones, alcohols and acids, along with small amounts of sesquiterpenes. On distillation, the oleoresin gave an essential oil (76%) that contains phenolic constituents and azulenes (Khare, 2007).

Pharmacological activities: Resin shows antirheumatic, antiseptic and anti-inflammatory activities (Ambar *et al*., 2019).

2.1.6 Tyrosinase inhibitory activity

Several natural substances are known to inhibit tyrosinase such as arbutin, catechins, hydroquinone and resveratrol (Bernard and Berthone, 2000). However, the search for potent antityrosinase substances is continued. Several benzaldehyde derivatives demonstrated tyrosinase inhibitory potential, but most of them are less potent and more toxic (Yi *et al*., 2010). Two compounds isolated from the rhizomes of *A. galanga* significantly inhibited the proliferation of melanoma cells (Lo *et al*., 2013). Most skin whitening preparations are commonly infused with liquorice. In a study, clinical trials were conducted on 100 females where 2.5% g of *G. glabra* cream was applied for 4 weeks. The results indicated that the symptoms of melasma were improved with *G. glabra* treatment when compared to the placebo group without any side effects (Badria, 2015). *S. lappa* showed moderate tyrosinase inhibitory (Lee *et al*., 1997), *V. indica* showed no tyrosinase inhibitory activities but their excellent antioxidant activity indicates their potential use in future skin whitening formulations (Katiyar *et al*., 2014; Siddiqui *et al*., 2019).

All the plants were procured from local market, identified and authenticated by Dr. S. B. Padal, Professor, Department of Botany, Andhra University, Viskhapatnam. A voucher specimen was deposited in the department herbarium (*A. galanga*: Voucher No-ag-05-/R/19, *S. lappa* : Voucher No-sl-15-/R/19, *G. glabra*: Voucher No-gg-09-/R/19).

2.2 Extracts preparation

The shade-dried and coarsely powdered 500 g of rhizomes of *A. galanga*, and roots of *S. lappa*, *G. glabra*, the bark of *S. racemosa* were defatted using petroleum ether and subjected to Soxhlet extractor separately using ethyl alcohol. Then, under controlled temperature and low pressure, the plant extracts were concentrated until dry; the concentrates were then kept in the refrigerator till use.

2.3 Cream base preparation

The O/W (oil in water) emulsion's base was made of cream. Cetyl alcohol and almond oil were dissolved, and then heated to 75°C with the emulsifier stearic acid (Part A). Triethanolamine, propylene glycol, and glycerol were all dissolved in an aqueous portion (Part B) and heated to 75°C together with the preservative (sodium benzoate). After heating, the aqueous phase was gradually added to the oil phase while being stirred constantly until emulsification was achieved (Sahu *et al*., 2012; Matangi *et al*., 2014; Mishra *et al*., 2014; Aswal *et al*., 2013; Gidwani *et al*., 2010; Sahu *et al*., 2011; Vinod *et al*., 2011; Jagtap *et al*., 2009; Rajvanshi *et al*., 2011; Grimm., 1998; Forster *et al*., 1995; Singh *et al*., 2011). The Cream base formula is given in Table 1.

Table 1: Composition of cream base

Ingredients	Formula %W/W					
	F1	F2	F3	F4	F5	F6
Stearic acid	15	12	13	12	15	10
Cetyl alcohol	2	4	3	4	3	4
Almond oil	4	4	4	4	4	4
Sodium benzoate	0.04	0.04	0.04	0.04	0.04	0.04
Propylene glycol	4	5	4	4	5	5
Glycerol	3	3	3	3	3	3
Triethanolamine	q.s	q.s	q.s	q.s	q.s	q.s
Water	q.s	q.s	q.s	q.s	q.s	q.s

q.s.: Quantity sufficient.

2.4 Cream formulation

After evaluating all the formulated bases, F2 was found to be appropriate and was selected for cream preparation. All oil soluble components like stearic acid, cetyl alcohol, almond oil were dissolved at 75°C (Part A). The preservative (sodium benzoate) and triethanolamine, propylene glycol, glycerol, all extracts were dissolved in an aqueous part (Part B) at 75°C. By altering the concentrations of various extracts, three formulations were prepared (HF1, HF2, and HF3). Table 2 describes the composition of the formulated creams.

Table 2: Composition of cream

Ingredients	Formula %W/W		
	HF1	HF2	HF3
A. galanga	0.20	0.30	0.20
S. lappa	0.25	0.20	0.30
G. glabra	0.50	0.30	0.75
S. racemosa	0.30	0.25	0.25
V. indica	0.30	0.20	0.25
Stearic acid	12	12	12
Cetyl alcohol	4	4	4
Almond oil	4	4	4
Sodium benzoate	0.04	0.04	0.04
Propylene glycol	5	5	5
Glycerol	3	3	3
Triethanolamine	q.s	q.s	q.s
Water	q.s	q.s	q.s

q.s.: Quantity sufficient.

2.4.1 Evaluation of cream

2.4.1.1 Specific cream properties

In this experiment, some specified cream properties are assessed as follows:

i. 50 ml distilled water was taken and 0.5 g of cream was added then the pH meter was calibrated against a standard buffer solution and then pH was measured (Rajvanshi *et al.*, 2012; Grimm, 1998).

ii. Brookfield viscometer was used to determine the viscosity of the formulation at 60 rpm, employing spindle number 4.

iii. Homogeneity of the formulation was assessed by visual inspection for appearance and affinity to touch.

iv. Colour, pearlescence and roughness of the cream played a role in grading the appearance of the cream.

v. After applying a specific amount of cream, the after-feel effects, including emollience, slipperiness, and the amount of residue left, were evaluated (Jagtap *et al.*, 2009).

vi. To assess the spreadability, wetness, and other characteristics of a given volume of cream, human volunteers dorsal skin surfaces were exposed.

vii. After applying a small amount of cream to the skin, the type of smear or film that developed on it was examined.

viii. By washing the area where the cream had been administered with tap water, the cream's removal ease was evaluated.

2.4.1.2 Type of emulsion under dye test

The cream was mixed with the scarlet red dye. A drop of the cream was placed on a microscopic slide, then a cover slip was placed on it and it was observed microscopically. The cream is W/O type, if the dispersed globules are colorless and the ground red. If, the countermand happens then it is O/W type cream (Forster *et al.*, 1995).

2.4.1.3 Irritancy test

On the left hand's dorsal side mark an area of 1cm^2 and cream was applied on that designated area and the time was noted. At regular intervals of upto 24 h, irritancy, erythema, and edema were checked and reported (Chandur *et al.*, 2011).

2.4.1.4 Testing of accelerated stability

If, the prepared formulations were stable for 7 days at room temperature, then accelerated stability can be tested for two stable formulations. For 20 days 2nd and 3rd formulations kept at 40°C ± 1°C. On the 0th, 5th, 10th, 15th and 20th day, all the herbal formulations kept at normal and accelerated temperature were observed for specific parameters (Nagore *et al.*, 2014; Aswal *et al.*, 2013; Sahu *et al.*, 2011; Jagtap *et al.*, 2009; Grimm, 1998; Siddqui *et al.,* 2019; Lo *et al.*, 2013).

3. Results

3.1 Specific cream properties

The cream's pH was discovered to be between 6-7, which is suitable for the pH of the skin (Table 3).

Table 3: pH of cream

Formulation	pH
HF1	6.0
HF2	7.0
HF3	6.2

The viscosity of the cream was spotted around 31360-36113 centipoise (cps). This indicated the spreadability of the cream with little shear. There was a uniform distribution of extracts in the base, which was further established by touch and visual appearance (Table 4). There was no particular change in cream colour, even after keeping the formulations for a longer period. Non greasy smear was formed after the cream was applied on the skin and the feel was also good. The applied cream can be easily removed by washing with tap water (Table 4).

Table 4: Accelerated stability testing

Days		pH	Temperatures			Parameters		
			E1	E2	E3	E4	E5	E6
0	Room temp.	6.2	**	NCC	**	EM	NG	ES
	40 ± 1°C	5.9	**	NCC	**	EM	NG	ES
5	Room temp.	6.21	**	NCC	**	EM	NG	ES
	40 ± 1°C	6.0	**	NCC	**	EM	NG	ES
10	Room temp.	6.21	**	NCC	**	EM	NG	ES
	40 ± 1°C	5.9	**	NCC	**	EM	NG	ES
15	Room temp.	6.2	**	NCC	**	EM	NG	ES
	40 ± 1°C	5.9	**	NCC	**	EM	NG	ES
20	Room temp.	6.22	**	NCC	**	EM	NG	ES
	40 ± 1°C	6.0	**	NCC	**	EM	NG	ES
25	Room temp.	6.23	**	NCC	**	EM	NG	ES
	40 ± 1°C	6.0	**	NCC	**	EM	NG	ES

E1: Homogenity, E2: Appearance, E3: Spreadibility, E4: After feel, E5: Type of smear, E6: ease of removal. **: Good, NCC: No Change in Colour, EM: Emollient, NG: Non-Greasy, ES-Easy.

3.2 Type of emulsion under dye test

All the formulations were O/W (oil in water type) emulsions, which were confirmed by the dye test. The formulation HF3 is more stable in O/W (oil in water type) emulsion.

3.3 Irritancy test

Prepared creams are safe to use on human skin as they show no signs of irritation, swelling or redness (Table 5).

Table 5: Adverse effects of formulations

Formulations	Erythema	Edema	Irritation
HF1	None	None	None
HF2	None	None	None
HF3	None	None	None

4. Discussion

A. galanga, *S. lappa*, *G. glabra*, *S. racemosa*, and *V. indica* are known to possess excellent antioxidant, anti-inflammatory effect and antiseptic properties. *G. glabra* and *S. lappa* can also possess tyrosinase inhibitory potential. All the selected plants have the potential to be used in fairness preparations. *A. galanga*, *S. racemosa* and *V. indica* have excellent antioxidant activity. Several studies indicated that antioxidants can prevent the oxidative damage that occurs due to exposure to UV radiation. In virtue of this, *A. galanga*, *S. racemosa* and *V. indica* do have the potential to be used in fairness preparations. Hence, there is a great demand for herbal cream that can act as an antioxidant and can inhibit tyrosinase. Therefore, in this present study, we tried to formulate a polyherbal cream that can inhibit tyrosinase and act as an antioxidant.

The formulated polyherbal cream can be customer compliant as it is easily washed off with water since it was oil in water type emulsion. Base (F3) was more stable as per our research. The formulations made from this stable base were safe.

5. Conclusion

The present study revealed no change in the colour of the formulations and all the formulations were stable. These formulations showed constant pH, homogeneity, emollient and no greasy properties. From the above results, it was confirmed that the formulated polyherbal cream can be a safe, stable and effective skin whitening and antioxidant cream. Further, study and standardization of the cream will make it as a potent alternative to commercial polyherbal creams available in the market.

Acknowledgements

The facilities required to conduct this research were provided by Professor Y. Srinivasa Rao, Principal, Vignan Institute of Pharmaceutical Technology, and Lavu Educational Society, for which the authors are grateful.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

References

Al-Snafi, A. (2018). *G. glabra*: A phytochemical and pharmacological review. IOSR J. Pharm., **8**(6-1):1-17.

Aswal, A.; Kalra, M. and Rout, A. (2013). Preparation and evaluation of polyherbal cosmetic cream. Der. Pharm. Lett., **5**:83-88.

Badria, F. A. (2015). Evidence based strategies in herbal medicines, psychiatric disorders and emergency medicine. In A. H. Alobaidi, E. S. Hamad, K. A. Aslamarai (Eds), Evaluation of *G. glabra* cream as treatment for melasma. In tech Publishers, Croatia, 23-29.

Bernard, P. and Berthon, J. Y. (2000). Resveratrol: An original mechanism on tyrosinase inhibition. International Journal of Cosmetic Science, **22**(3):219-226.

Bradley, P. R. (Ed.). (1992). British Herbal Compendium, Volume 1. BHMA, Bournemouth, pp:95-97.

Chandur, U.; Shashidhar, S.; Chandrasek, S.; B., Bhanumathy, M. and Midhun, T. (2011). Phytochemical evaluation and antiarthritic activity of root of *S. lappa*. Pharmacologia, **2**(9):265-267.

Chopra, R. N.; Nayer, S. L.; and Chopra, I. C. (1956). Glossary of Indian medicinal plants. Council of Scientific and Industrial Research, New Delhi, pp:695-696.

Duraisami, R.; Sengottuvelu, S.; Prabha, T.; Sabbani, S.; Divya Presenna, S. and Muralitharan, C.K. (2021). Evaluation of antidiabetic efficacy potency of polyherbal formulations in experimentally induced hyperglycemic rats. Ann. Phytomed., **10**(2):286-291. http://dx.doi.org/10.21276/ap.2021.10.2.38

Forster, T.; Rybinski, W. V. and Wadle, A. (1995). Influence of microemulsion phases on the preparation of fine disperse emulsions. Advances in Colloid and Interface Science, **58**:119-149.

Gana, Kondepudi (2018). Herbs in cosmetics: A review. Int. J. Pharm. Res., **10**(1):9-16.

Gidwani, B.; Alaspure, R. N.; Duragkar, N. J.; Singh, V., Rao, S. P. and Shukla, S. S. (2010). Evaluation of a novel herbal formulation in the treatment of eczema with *P. corylifolia*. Iran. J. Dermatol., **13**:122-127.

Grimm, W. (1998). Extension of the International conference on harmonization tripartite guideline for stability testing of new drug substances and products to countries of climatic zones III and IV. Drug Dev. Ind. Pharm., **24**(4):313–325.

Gupta, N.; Dubey, A.; Prasad, P. and Roy, A. (2015). Formulation and evaluation of herbal fairness cream comprising hydroalcoholic extracts of *P. ostreatus*, *G. glabra* and *C. sinensis*. Pharm. Biosci. J., **3**(3):40-45.

Husain, A. and Ahmad, A. (2015). Quantitative analysis of total phenolic, flavonoid contents and HPTLC fingerprinting for standardization of *G. glabra* Linn. Roots, **1**(1):212-229.

Jagtap, N. S.; Khadabadi, S.; Farooqui, I. A.; Nalamwar, V. P. and Sawarkar, H. A. (2009). Development and evaluation of herbal wound healing formulations. Int. J. Pharm. Res., **1**(4):1104-1108.

Jain, A. P. and Pawar, R. S. (2016). Study of chemical composition and phytochemical analysis of *A. galanga* rhizomes extracts by HPTLC fingerprinting. Asian Journal of Pharmacy and Pharmacology, **2**(2) :54-57.

Jyothilekshmi, S.; Valsa, A. K. and Ramadasan, Kuttan (2022). Protective effect of the polyherbal formulation Nalpamaram on the oxidative stress induced by ethanol. Ann. Phytomed., **11**(2):296-301. http://dx.doi.org/10.54085/ ap.2022.11.2.34.

Katiyar, S.; Saify, K. Singh. and S. K., Rai, M. (2014). Botanical study of skin lightening agents. Int. J. Pharmacog., **1**(4):243-249.

Khare, C. P. (2007). Indian medicinal plants. Delhi: Rajkamal Electronic Press, pp:696-697.

Kriker Soulef.; Y. Bouatrouss.; Ramazan Erenler. and A. Yahia (2021). Antimicrobial, cytotoxic and antioxidant activity of saponins and tannins extracts of Algerian *G. glabra* L. Ann. Phytomed., **10**(2):318-326. http:// dx.doi.org/10.21276/ap.2021.10.2.43

Lee, K. T.; Kim, B. J.; Kim, J. H.; Heo, M. Y. and Kim, H. P. (1997). Biological screening of 100 plant extracts for cosmetic use (I): Inhibitory activities of tyrosinase and DOPA autooxidation. Int. J. Cosm. Sci., **19**(6):291-298.

Lo, C.Y.; Liu, P.L.; Lin, L.C.; Chen, Y.T.; Hseu, Y.C.; Wen, Z.H. and Wang, H.M. (2013). Antimelanoma and antityrosinase from *A. galanga* constituents. The Scientific World Journal, 186505.

Maitra, S. and Satardekar, K. (2017). Pharmacological study of *S. racemosa* Roxb. Int. J. Pharm. and Pharm. Res., **9**(1):106-113.

Manju, P. and Pushpa, A. (2020).Phytochemical analysis and *in vitro* free radical scavenging activity of rhizome of *Z.officinale* Rosc. Ann. Phytomed., **9**(2):257-262. http://dx.doi.org/10.21276/ap.2020.9.2.24

Maroti M, Jeurkar; Satish B, Kosalge.; Naheed Waseem A, Sheikh. and Umesh B. Telrandhe. (2022). *C. rotundus* L.: Phytochemistry and pharmacological activities. Ann. Phytomed., **11**(2):186-196. http://dx.doi.org/10.54085/ ap.2022.11.2.20.

Matangi, S. P.; Mamidi, S. A.; Gulshan, M. D.; Raghavamma, S. T. V. and Nadendla, R. R. (2014). Formulation and evaluation of anti-aging polyherbal cream. Int. J. Pharm. Sci. Rev. and Res., **24**:133-136.

Mishra, A. P.; Saklani, S.; Milella, L. and Tiwari, P. (2014). Formulation and evaluation of herbal antioxidant face cream of *N. jatamansi* collected from Indian Himalayan region. Asian Pac. J. Trop. Biomed., **4**:S679-S682.

Nagore, D. H.; Bhusnar, H. U. and Nipanikar, S. U. (2014). Phytopharmacological profile of *S. racemosa*: A review. Pharmacologia, **5**(2):76-83.

Pal Jain, A., Singh Pawara, R., Lodhia, S. and Singhaia, A. (2012). Immunomodulatory and antioxidant potential of *A. galanga* Linn. rhizomes. Pharmacognosy Communications, **2**(3):30-37.

Pandey, M. M.; Rastogi, S. and Rawat, A. K. S. (2007). *S. costus*: Botanical, chemical and pharmacological review of an ayurvedic medicinal plant. Journal of Ethnopharmacology, **110**(3):379-390.

Pulok, K. Mukherjee.; Subhadip, Banerjee and Amit, Kar (2018). Exploring synergy in ayurveda and traditional Indian systems of medicine. Synergy, **7**:30-33.

Rajvanshi, A.; Sharma, S.; Khokra, S. L.; Sahu, R. K. and Jangde, R. (2011). Formulation and evaluation of *C. rotundus* and *C. sativus* based herbal face cream. Pharmacology Online, **2**:1238-1244.

Sahu, A. N.; Jha, S. B. and Dubey, S. D. (2011). Formulation and evaluation of curcuminoid based herbal face cream. Indo Global J. Pharm. Sci., **1**(1):77-84.

Sahu, R. K.; Roy, A.; Kushwah, P.; Khare, M. and Mudotiya, R. (2012). Formulation and development of whitening polyherbal face cream. Res. J. Top. Cosm. Sci., **3**(1):23-27.

Siddiqui, A.; Tabassum, K. and Aisha Anjum, A. (2019). Pharmacological activities of kahruba (*V. indica* Linn.): A literary review. Int. J. Adv. Res. Dev., **4**(2):6-9.

Singh, M.; Sharma, S.; Khokra, S. L.; Sahu, R. K. and Jangde, R. (2011). Preparation and evaluation of herbal cosmetic cream. Pharmacology Online, **2**:1258-1264.

Valarmathi, S.; Kumar, M. S.; Sharma, V.; Imran, M. and Mohanasundaram. (2020). Formulation and evaluation of herbal face cream. Research J. Pharm. and Tech., **13**(1):216-218. doi: 10.5958/0974-360X.2020.00043.8

Vinod, K. R.; Santhosha, D. and Anbazhagan, S. (2011). Formulation and evaluation of piperine cream a new herbal dimensional approach for vitiligo patients. Int. J. Pharm. and Pharmac. Sci., **3**(2):29-33.

Yi, W., Cao, R., Peng, W., Wen, H., Yan, Q., Zhou, B., Ma, L. and Song, H. (2010). Synthesis and biological evaluation of novel 4-hydroxybenzaldehyde derivatives as tyrosinase inhibitors. Eur. J. Med. Chem., **45**(2):639–646.

Citation **K. Gana Manjusha, D. Aruna Kumari, P. Bala Krishnaiah, M. Radha Krishna and B. Lakshmi Prasanna (2023). Characterization of a polyherbal cosmetic cream infused with ethanolic extracts of antioxidant herbs. Ann. Phytomed., 12(2):1012-1016. http://dx.doi.org/10.54085/ap.2023.12.2.121.**