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Formulation and Evaluation of Horse Gram Seed Extract (*Dolichos biflorus* Linn) Emulgel

V. V. Aravindh Kumar, B. Mander, V. Harish, R. Kiran, D. Yogitha and S. Latha*

Department of Pharmacognosy, Sri Ramachandra Faculty of Pharmacy, Sri Ramachandra Institute of Higher Education and Research (DU), Porur, Chennai - 600116, Tamil Nadu, India; rebekah.latha@gmail.com

Abstract

Background: *Dolichos biflorus* Linn, a plant traditionally used in Ayurvedic medicine, has shown promising results in treating arthritis. The present study investigates the formulation of an emulgel incorporating *D. biflorus* extract to enhance its topical application. **Aim:** To develop and evaluate emulgel formulations loaded with *D. biflorus* Linn extract for potential use in the management of arthritis. **Methods:** The extract was obtained via petroleum ether extraction, yielding 0.96% w/w of a dark yellowish substance. Preliminary phytochemical screening revealed the presence of alkaloids and steroids. The antioxidant activity of the extract was assessed using a DPPH radical scavenging assay, showing significant activity comparable to ascorbic acid. Six emulgel formulations (EG1-EG6) were prepared using Span 20 and Tween 20 as surfactants and varying concentrations of Carbopol 940. Physical evaluations, including pH, appearance, homogeneity, washability, spreadability, and grittiness, were conducted to identify optimal formulations. **Results:** EG2 and EG3 exhibited optimal characteristics (pH 6.1-7) and were selected for the incorporation of 2.5% w/w of *D. biflorus* extract (PEDB). The PEDB-loaded emulgels displayed pH values of 5.9 and 6.2, with good washability, even spreadability, and absence of grittiness. **Conclusion:** The PEDB-loaded emulgel formulations demonstrated potential as effective topical agents for arthritis, offering enhanced skin penetration and bioavailability. These findings support the use of emulgels for delivering hydrophobic herbal extracts like *D. biflorus*, potentially improving therapeutic outcomes and quality of life for arthritis patients.

Major Findings: The study successfully formulated an emulgel using *D. biflorus* extract, demonstrating significant antioxidant activity comparable to ascorbic acid. The optimised emulgel formulations, EG2 and EG3, loaded with 2.5% w/w extract, exhibited favourable pH, washability, and spreadability, making them potential topical agents for arthritis management.

Keywords: Arthritis, Black Horse Gram Seed, *Dolichos biflorus*, DPPH Assay

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1. Introduction

Traditional Medicines (TMs) make use of natural products and are of great importance. Antioxidants play a crucial role in both food systems and the human body by mitigating oxidative processes and minimising the harmful effects of Reactive Oxygen Species (ROS). Topical agents like ointments, creams, and lotions are commonly used but come with drawbacks such as stickiness, poor spreading when rubbed, and stability issues. These limitations have spurred interest in transparent gels, which offer advantages in both cosmetics and pharmaceuticals due to their non-sticky texture and improved stability. However, a significant challenge with gels is their inability to effectively deliver hydrophobic drugs. To overcome this limitation, recent approaches have focused on incorporating hydrophobic drugs into emulsions within the gel matrix. This strategy aims to maintain the favourable properties of gels while enhancing their capability to deliver a wider range of therapeutic agents effectively through the skin or mucous membranes[1-5]. *Ayurvedic* medicine has long utilised *D. biflorus* Linn for treating various ailments, including arthritis. Emulgels, which

*Author for correspondence

combine properties of both emulsions and gels, offer a promising delivery system for such herbal extracts. They provide controlled release, stability, and enhanced skin penetration, making them ideal for delivering hydrophobic drugs like those found in *D. biflorus*[6-9].

2. Materials and Methods

2.1 Preparation of Plant Extract

Dolichos biflorus Linn seeds had been coarsely ground and refluxed for three hours in petroleum ether solvent. To get the petroleum ether extract of *D. biflorus* Linn (PEDB), the mixture was filtered through Whatman filter paper, and the solvent was allowed to evaporate.

2.2 Preliminary Phytochemical Screening of *Dolichos biflorus*

Preliminary phytochemical analysis of the horsegram extract was performed for the constituents like terpenoids, flavonoids, steroids, anthraquinone, glycosides, carbohydrates, quinones, saponins, protein and amino acids using standard methods of chemical tests[10-14].

2.3 Gas Chromatography-Mass Spectroscopy

The PEDB was analysed with GC-MS spectroscopy. The equipment used was Agilent, 8890 series. Separations were accomplished using an Agilent 1909 1S-433UI column (30 mm in length, 250 µm in diameter, and 0.25 µm in film thickness). Spectroscopic detection by GC–MS involved an electron ionisation system that utilised high-energy electrons (70 eV). Injector temperature set to 230 °C; transfer line temperature set to 280 °C; oven temperature programmed to range from 75 to 350 °C, at a rate of 50 °C/0.5 min. Pure helium at a flow rate of 1.2 mL/min was used as a carrier gas. At 250 °C, 1.0 L of prepared extracts was injected in a split-less mode. The initial temperature was set at 75-350 °C with an increasing rate of 3 °C/min and a reading time of about 10 min. Finally, the temperature was raised to 350 °C at a rate of 10 °C/min. The detection was carried out in full scan mode between 50 and 600 m/z, and the bioactive compounds were identified using the National Institute of Standards and Technology (NIST 17) MS Library database.

2.4 *In Vitro* Antioxidant Activity Using DPPH Radical Scavenging Assay

The reaction mixture containing 1ml of DPPH solution (200 ml in ethanol) with different concentrations of the PEDB was shaken and incubated for 20 min at room temperature in dark conditions. The absorbance was recorded at 517 nm, and the percentage inhibition was calculated[15-18].

2.5 Formulation and Evaluation of Emulgel[19-30]

2.5.1 Formulation of Emulgel

2.5.1.1 Preparation of Gel Base

The required amount of Carbopol 940 was weighed, and a sufficient amount of water was added to it. It was mixed well continuously to get a uniform gel base.

2.5.1.2 Preparation of Emulsion

The aqueous phase was prepared by dissolving the required amount of methyl paraben in propylene glycol and Tween 20, and water was then added. The mixture was mixed well to form an aqueous phase. The oil phase was prepared by mixing well the required amount of liquid paraffin, PEDB, and Span 20. Both the bases were heated to 70˚C. The oil phase was added to the aqueous phase slowly with constant stirring to form an emulsion.

2.5.1.3 Preparation of Emulgel

The prepared emulsion was cooled to room temperature, and it was added to the prepared gel base little by little with continuous stirring in the same direction. To this, triethanolamine was added to adjust the pH, which results in the formation of emulgel.

2.5.2 Evaluation of Emulgel Formulation

Emulgel was evaluated for appearance, homogeneity, consistency, pH, washability and spreadability.

2.6 Preparation of PEDB-loaded Emulgel

The optimised emulgel bases were chosen based on their evaluation characteristics, and the PEDB was loaded at 2.5% w/w concentration.

2.7 Evaluation of PEDB-loaded Emulgel

Emulgel, which was loaded with PEDB, was evaluated for appearance, homogeneity, consistency, pH, washability and spreadability.

3. Results And Discussion

3.1 Preparation of Extract

The coarsely powdered seeds of *Dolichos biflorus* were refluxed with petroleum ether. The extract was designated as PEDB, and the percentage yield was found to be 0.96% w/w.

3.2 Phytochemical Analysis of PEDB

The therapeutic activity of the medicinal plants and herbal medicinal products relies on the phytochemical composition. So, screening of plant material and plant products is an important criterion to correlate the therapeutic efficacy of the substance with the phytoconstituents present in it. Preliminary phytochemical analysis of PEDB was carried out, and the results showed the presence of alkaloids and steroids. Alkaloids were found to be present, as confirmed by multiple qualitative tests. Dragendorff's test produced an orange-red precipitate, Wagner's test showed a reddish-brown precipitate, Hager's test yielded a yellow precipitate, and Mayer's test resulted in the formation of a white precipitate, all indicating positive results for alkaloids. Presence of steroids was evidenced by the sequential appearance of red, blue, and finally green colouration. While terpenoids, flavonoids, carbohydrates, phenols, tannins, saponins, proteins, and amino acids were observed to be absent in the sample.

3.3 GC-MS Analysis for PEDB Extract

GC-MS analysis of PEDB extract was carried out, and the chromatogram and extract profile are presented in Figure 1 and Table 1, respectively.

3.4 *In Vitro* Antioxidant Activity

3.4.1 DPPH Radical Scavenging Assay

The PEDB was screened for its antioxidant potential using the DPPH radical scavenging assay. The PEDB reduces the colour of DPPH as a measure of the power of hydrogen-donating ability. The percentage inhibition was calculated, and the result is shown in Table 2. The results of the DPPH radical scavenging assay showed that PEDB exhibited minimal scavenging activity at lower concentrations, while increasing concentrations led to a corresponding increase in radical scavenging activity, comparable to that of the standard ascorbic acid.

3.5 Formulation of Emulgel

About 6 emulgel bases were prepared using different concentrations of Carbopol. The composition of emulgel bases is presented in Table 3.

3.6 Evaluation of Formulated Emulgel

3.6.1 Appearance and Homogeneity

The prepared Emulgel formulations were white with a smooth, homogeneous texture and glossy appearance. The result is given in the following Table 4.

3.6.2 Measurement of pH

The pH of all the prepared formulations ranged from 6.1 to 7.0, which is acceptable and helps avoid the risk of skin irritation upon application. The values are presented in Table 4.

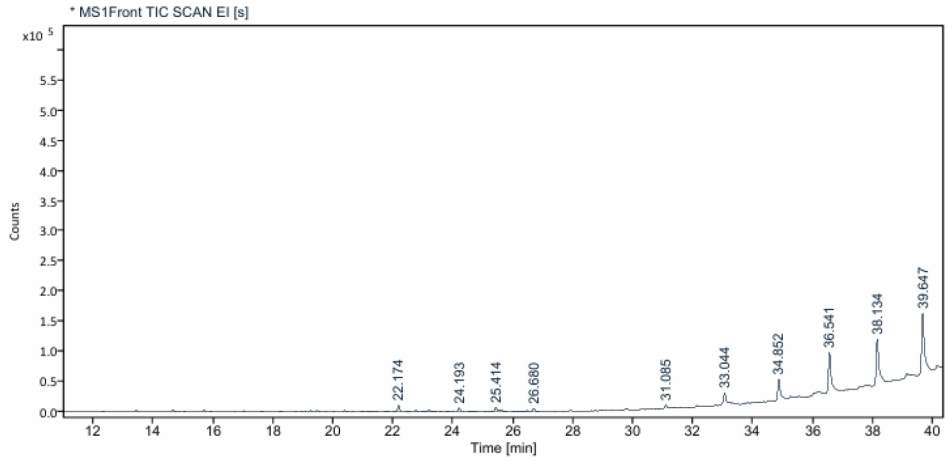


Figure 1. GC-MS chromatogram of PEDB extract.

Table 1. GC-MS analysis for PEDB extract

Sl. no	R_t (min)	Peak Area (%)	Compound name	Molecular formula	Mw (gm/mol)	Nature of compound	% probability	Biological activity
1	22.174	2.08	Neophytadiene	$C_{20}H_{38}$	278.52	Diterpene	48.97	Anti-inflammatory[32]
2	24.193	1.63	N-Acetyl-S geranylgeranyl-L cysteine	$C_{25}H_{41}NO_3S$	435.7	Terpenoid	9.59	Anti-oxidant, Anti-inflammatory
3	25.414	1.36	9,9 Dimethoxybicyclo[3.3.1] nona-2,4-dione	$C_{11}H_{16}O_4$	212.24	Bicyclic ketone	38.9	Antimicrobial, Antifungal properties
4	26.680	1.13	Lamotrigine	$C_9H_7Cl_2N_5$	256.09	Phenyltriazine compound	98.19	Epilepsy and treat bipolar disorder[33]
5	31.085	1.19	Hydroxylamine, O-decyl-	$C_{10}H_{21}NOH.$	173.30	Hydroxylamines	5.41	Carcinostatic activity
6	33.044	4.67	Methoxyacetic acid, 3-tridecyl ester	$C_{17}H_{34}O_3$	298.54	Ester of methoxyacetic acid	6.25	Surfactant, Emulsifiers
7	34.852	10.91	Tetradecane, 2,6,10 trimethyl	$C_{17}H_{36}$	240.47	Branched alkane	7.14	Fuel additive, solvent
8	36.541	18.97	Ethanol, 2 (octadecyloxy)	$C_{20}H_{41}OH$	305.54	ether derivative of ethanol	7.19	Surfactant, solvent
9	38.134	25.34	Ethanol, 2 (octadecyloxy)	$C_{20}H_{41}OH$	305.54	ether derivative of ethanol	6.44	Surfactant, solvent
10	39.647	32.72	Octadecane, 3-ethyl-5-(2 ethylbutyl)	$C_{26}H_{54}$	366.72	alkane	8.86	Lubricants

Table 2. DPPH radical scavenging assay

Concentration (µg/ml)	Percentage inhibition DPPH radical scavenging assay	
	Ascorbic acid	PEDB
100	92.25 ± 2.4	86.28 ± 2.1
200	94.83 ± 2.1	88.17 ± 1.9
400	95.61 ± 2.0	89.06 ± 1.7
600	96.42 ± 1.5	90.84 ± 1.4
800	97.27 ± 1.3	93.26 ± 1.2
1000	98.31 ± 1.1	94.42 ± 0.8

Values expressed as Mean ± SD, n = 3.

3.6.3 Washability, Spreadability, Grittiness

Spreadability, washability, and grittiness are important parameters. These were evaluated, and the results are presented in Table 5. All formulations were found to be easily washable, evenly spreadable, and devoid of gritty particles.

Evaluation of the formulated emulgel bases indicated that EG2 and EG3 were the optimal formulations. These formulations showed consistent dosing and uniform distribution of ingredients, as well as good homogeneity compared to the other emulgel base formulations. These results demonstrate that EG2 and EG3 have potential as effective emulgel formulations for therapeutic applications.

3.7 Preparation of PEDB-loaded Emulgel

Based on the physical characteristics of the formulated emulgel bases, EG2 and EG3 were selected as the best bases for incorporation of PEDB. The composition of the PEDB-loaded emulgel is shown in Table 6.

3.8 Evaluation of PEDB-loaded Emulgel

3.8.1 Appearance and Homogeneity

The prepared emulgels containing PEDB were white, with a smooth, homogeneous texture and a glossy appearance.

Table 3. Composition of emulgel formulation

Ingredients (%)	EG1	EG2	EG3	EG4	EG5	EG6
Liquid Paraffin	1.5	1.5	1.5	1.5	1.5	1.5
Carbopol 940	0.5	1	1.5	2	2.5	3
Propylene Glycol	1.5	1.5	1.5	1.5	1.5	1.5
Span 20	0.3	0.3	0.3	0.3	0.3	0.3
Tween 20	0.15	0.15	0.15	0.15	0.15	0.15
Triethanolamine	0.03	0.03	0.03	0.03	0.03	0.03
Methyl Paraben	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009
Water	q.s	q.s	q.s	q.s	q.s	q.s

Table 4. Appearance, homogeneity and pH of formulated emulgel

Formulation	Color	Homogeneity	Consistency	Phase Separation	pH
EG1	White	Smooth	Good	None	6.2
EG2	White	Smooth	Good	None	6.4
EG3	White	Smooth	Good	None	7.0
EG4	White	Smooth	Good	None	6.8
EG5	White	Smooth	Good	None	6.6
EG6	White	Smooth	Good	None	6.1

Table 5. Washability, spreadability and grittiness of formulated emulgel

Formulation	Washability	Spreadability	Grittiness
EG1	Easily washable	Even Spreaded	No gritty particles
EG2	Easily washable	Even Spreaded	No gritty particles
EG3	Easily washable	Even Spreaded	No gritty particles
EG4	Easily washable	Even Spreaded	No gritty particles
EG5	Easily washable	Even Spreaded	No gritty particles
EG6	Easily washable	Even Spreaded	No gritty particles

Table 6. Composition of emulgel formulations containing PEDB

Ingredients (%)	PEDB – EG2	PEDB-EG3
PEDB	2.5	2.5
Liquid Paraffin	1.5	1.5
Carbopol 940	1	1.5
Propylene Glycol	1.5	1.5
Span 20	0.3	0.3
Tween 20	0.15	0.15
Triethanolamine	0.03	0.03
Methyl Paraben	0.0009	0.0009
Water	q.s	q.s

3.8.2 Measurement of pH

The pH of the PEDB-loaded emulgels, PEDB-EG2 and PEDB-EG3, was found to be 5.9 and 6.2, respectively, which is acceptable to avoid the risk of skin irritation upon application.

3.8.3 Washability, Spreadability, Grittiness

Spreadability, washability, and grittiness are important parameters. These were evaluated, and both formulations were found to be satisfactory.

4. Discussion

For ages, *Ayurvedic* medicine has employed *D. biflorus* Linn, a traditional herbal cure, to treat a variety of

ailments, including arthritis. It is said to have analgesic and antioxidant qualities that might help lessen joint pain and inflammation. Petroleum Ether Extract (PEDB) of the seeds of *D. biflorus* Linn was selected for the study. Preliminary phytochemical screening revealed the presence of alkaloids and steroids. Further, the extract was screened for its chemical composition using GC-MS. About 10 compounds of diverse chemical nature have been reported. The principal constituent was found to be Neophytodiene, a diterpenoid compound. The compound was previously reported for its anti-inflammatory property, supporting the study that the developed emulgel from this extract would impart a beneficial effect in arthritic patients. Also, the study confirmed the antioxidant potential of the petroleum ether extract. An attempt has been made to deliver the selected extract in the form of an emulgel. Six emulgel bases (EG1-EG6) were formulated and evaluated for physical properties, and EG2 and EG3 were found to be satisfactory. These formulations were selected for the incorporation of PEDB. Finally, the developed formulations were found to be safe and satisfactory based on physical evaluation. *D. biflorus* Linn extract in the form of an emulgel could contribute to the management of arthritis and also could be a better substitute for already available synthetic analgesic and anti-inflammatory agents.

5. Conclusion

Dolichos biflorus Linn extract in the form of an emulgel appears to be a promising topical agent for arthritis with enhanced efficacy. By improving skin penetration and bioavailability, this emulgel may offer tailored relief and improve the quality of life for those managing arthritic symptoms.

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7. References

1. Yuan H, Ma Q, Ye L, Piao G. Traditional medicine and modern medicine from natural products. Molecules. 2016; 21(5):559. https://doi.org/10.3390/molecules21050559
2. Sam S. Importance and effectiveness of herbal medicines. J Pharmacogn Phytochem. 2019; 8(2):354-357. https://www.phytojournal.com/archives/2019.v8.i2.9074/importance-and-effectivenessof-herbal-medicines
3. Roberts JE, Tyler VE. Tyler's Herbs of Choice: The therapeutic use of phytomedicinals. New York: The Haworth Press. 1997. https://perpus.univpancasila.ac.id/repository/EBUPT181142.pdf
4. Saha S, Verma RJ. Antinephrolithiatic and antioxidative efficacy of *Dolichos biflorus* seeds in a lithiasic rat model. Pharm Biol. 2015; 53(1):16-30. https://doi.org/10.3109/13880209.2014.909501
5. Mathew LE, Sindhu G, Helen A. Dolichos biflorus exhibits anti-inflammatory and antioxidant properties in an acute inflammatory model. J Food Drug Anal. 2014; 22(4):455-462. https://doi.org/10.1016/j.jfda.2014.02.002
6. Basu S, Ghosh M, Bhunia RK, Ganguly J, Banik BK. Polysaccharides from *Dolichos biflorus* Linn and *Trachyspermum ammi* Linn seeds: Isolation, characterisation, and remarkable antimicrobial activity. Chem Cent J. 2017; 11(1):118. https://doi.org/10.1186/s13065-017-0349-2
7. Ali Khan B, Ullah S, Khan MK, Alshahrani SM, Braga VA. Formulation and evaluation of *Ocimum basilicum*-based emulgel for wound healing using an animal model. Saudi Pharm J. 2020; 28(12):1842-1850. https://doi.org/10.1016/j.jsps.2020.11.011
8. Mahajan VR, Goikane RP. Formulation and evaluation of herbal anti-inflammatory emulgel prepared from *Vitex negundo* leaves extract. World J Biol Pharm Health Sci. 2022; 12(3):119-124. https://doi.org/10.30574/wjbphs.2022.12.3.0226
9. Susmitha A, Devi AS. Formulation and evaluation of herbal emulgel of *Ocimum tenuiflorum* and *Mentha arvensis* leaves extract for anti-acne activity. Indo Am J Pharm Res. 2018; 8(11):1347-1384. https://zenodo.org/records/2530478
10. Narayanaswamy N, Balakrishnan KP. Evaluation of some medicinal plants for their antioxidant properties. Int J Pharm Tech Res. 2011; 3(1):381-385. https://sphinxsai.com/Vol.3No.1/pharm_jan-mar11/pdf/JM11(PT=65)%20pp%20381385.pdf
11. Kancherla N, Dhakshinamoothi A, Chitra K, Komaram RB. Preliminary analysis of phytoconstituents and evaluation of anthelmintic property of *Cayratia auriculata* (*in vitro*). Maedica. 2019; 14(4):350. https://doi.org/10.26574/maedica.2019.14.4.350
12. Shaikh JR, Patil M. Qualitative tests for preliminary phytochemical screening: An overview. Int J Chem Stud. 2020; 8(2):603-608. https://doi.org/10.22271/chemi.2020.v8.i2i.8834
13. Das BK, Al-Amin MM, Russel SM, Kabir S, Bhattacherjee R, Hannan JM. Phytochemical screening and evaluation of analgesic activity of *Oroxylum indicum*. Indian J Pharm

Sci. 2014; 76(6):571. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4293694/
14. Dubale S, Kebebe D, Zeynudin A, Abdissa N, Suleman S. Phytochemical screening and antimicrobial activity evaluation of selected medicinal plants in Ethiopia. J Exp Pharmacol. 2023; 15:51-62. https://doi.org/10.2147/JEP.S379805
15. Olugbami JO, Gbadegesin MA, Odunola OA. *In vitro* free radical scavenging and antioxidant properties of ethanol extract of *Terminalia glaucescens*. Pharmacogn Res. 2015; 7(1):49. https://doi.org/10.4103/0974-8490.147200
16. Kefayati Z, Motamed SM, Shojaii A, Noori M, Ghods R. Antioxidant activity and phenolic and flavonoid contents of the extract and subfractions of *Euphorbia splendida* Mobayen. Pharmacogn Res. 2017; 9(4):362. https://doi.org/10.4103/pr.pr_12_17
17. Baliyan S, Mukherjee R, Priyadarshini A, Vibhuti A, Gupta A, Pandey RP, Chang CM. Determination of antioxidants by DPPH radical scavenging activity and quantitative phytochemical analysis of *Ficus religiosa*. Molecules. 2022; 27(4):1326. https://doi.org/10.3390/molecules27041326
18. Mohammed Khan K, Khan M, Ali M, Taha M, Hameed A, Ali S, Perveen S, Iqbal Choudhary M. Synthesis and DPPH radical scavenging activity of 5-Arylidene-N, N-Dimethyl barbiturates. Med Chem. 2011; 7(3):231-236. https://doi.org/10.2174/157340611795564231
19. Yokozawa T, Dong E, Nakagawa T, Kashiwagi H, Nakagawa H, Takeuchi S, Chung HY. *In vitro* and *in vivo* studies on the radical-scavenging activity of tea. J Agric Food Chem. 1998; 46(6):2143-50. https://doi.org/10.1021/jf970985c
20. Khullar R, Kumar D, Seth N, Saini S. Formulation and evaluation of mefenamic acid emulgel for topical delivery. Saudi Pharm J. 2012; 20(1):63-7. https://doi.org/10.1016/j.jsps.2011.08.001
21. Sabu KR, Basarkar GD. Formulation, development, and *in-vitro* evaluation of terbinafine hydrochloride emulgel for topical fungal infection. Indian J Res Pharm Biotechnol. 2013; 21:168-173. https://globalresearchonline.net/journalcontents/v21-2/31.pdf
22. Khalid SA, Kumar BP, Abhinov T. Formulation and *in-vitro* evaluation of Aceclofenac-loaded topical Emulgel. Indian J Res Pharm Biotechnol. 2014; 2(6):1487-1489. https://ijrpb.com/issues/Volume%202_Issue%206/ijrpb%202(6)%2011%20khalid%201487-1489.pdf
23. Das S, Vasudeva N, Sharma S. Chemical composition of ethanol extract of Macrotyloma uniflorum (Lam.) Verdc. using GC-MS spectroscopy. Org Med Chem Lett. 2014; 4:1-4. https://doi.org/10.1186/s13588-014-0013-y
24. Ali Khan B, Ullah S, Khan MK, Alshahrani SM, Braga VA. Formulation and evaluation of *Ocimum basilicum*-based emulgel for wound healing using an animal model. Saudi Pharm J. 2020; 28(12):1842-1850. https://doi.org/10.1016/j.jsps.2020.11.011
25. Muragi A, Samant S, Patil M. Formulation and evaluation of herbal emulgel loaded with extract of *Cedrus deodara* for its *in-vitro* anti-inflammatory activity. Int J Ayurvedic Med. 2022; 13(3):749-753. https://doi.org/10.47552/ijam.v13i3.2946
26. Samant SS, Jagtap VA, Kalangutkar P, Gadekar A, Rane R, Morye R, *et al.* Formulation and evaluation of herbal emulgel containing *Syzygium cumini* extract. Int J Res AYUSH Allied Syst. 2023; 10(6): 33-37. https://www.researchgate.net/publication/377395892
27. Mahajan VR, Goikane RP. Formulation and evaluation of herbal anti-inflammatory Emulgel prepared from *Vitex negundo* leaves extract. World J Biol Pharm Health Sci. 2022; 12(3):119-124. https://doi.org/10.30574/wjbphs.2022.12.3.0226
28. Susmitha A, Devi AS. Formulation and evaluation of herbal emulgel of *Ocimum tenuiflorum* and *Mentha arvensis* leaves extract for anti-acne activity. Indo Am J Pharm Res. 2018; 8(11):1347-1384. Available from: https://zenodo.org/records/2530478
29. Goyani M, Akbari B, Chaudhari S, Jivawala R. Formulation and evaluation of a topical emulgel of an antiacne agent. Int J Adv Res Rev. 2018; 3(7):52-68. https://www.ijarr.in/Admin/pdf/formulation-and-evaluation-of-topical-emulgel-ofantiacne-agent.pdf
30. Siddiqua A, Mittapally S. Pharmacological evaluation of *Cissus quadrangularis* herbal gel for wound healing activity. Int J Res Ayurvedic Pharm. 2017; 8(5):65-68. https://doi.org/10.7897/2277-4343.085246

Author Contribution

S. Latha conceptualised the study and supervised the overall research work. S. Latha, V. Harish, and V. V. Aravindh Kumar developed the study methodology. R. Kiran and D. Yogitha performed the experimental investigations and analysed the data. B. Mander contributed to the preparation of the manuscript and provided the necessary resources for the study. All authors have read and agreed to the published version of the manuscript.