International Journal of Phytopharmacy
ISSN: 2277-2928 (Online)
Journal DOI: https://doi.org/10.7439/ijpp

Research Article

Formulation and Evaluation of Polyherbal Antimicrobial Gel

Viraj Dalal, Shivan Bhonde, Monali Dumore* and Ujwala Mahajan

Dadasaheb Balpande College of Pharmacy, Nagpur 440037, Maharashtra, India

Abstract

Introduction: Neem *(Azadirachta indica, Meliaceae*), Turmeric (*Curcuma longa L., Zingeberaceae*), Aloe vera *(Aloe barbadensis Miller, Liliaceae*) are been used as traditional Ayurvedic medicine in India since ancient times. These herbal plants have been reported in the literature having good antimicrobial, anti-oxidant and anti-inflammatory activity. Herbal remedies are more acceptable in the belief that they have fewer side effects compared to synthetic ones.

Objective: The present research aimed to formulate and evaluate polyherbal antimicrobial gel containing Neem *(Azadirachta indica, Meliaceae*), Turmeric (*Curcuma longa L., Zingeberaceae*), Aloe vera *(Aloe barbadensis Miller, Liliaceae*).

Method: F1 and F2 formulation were prepared using varied concentration of extract and the control formulation prepared without extract. The Prepared formulations were evaluated for various parameters like colour, appearance, viscosity, pH, spreadability, washability, extrudability, skin irritation. Antimicrobial screening was performed and compared it with control formulation.

Result: The result of study shows that F1 and F2 show good antimicrobial property on E. coli micro-organism as compare to control formulation.

Conclusion: The developed polyherbal gel shows good antimicrobial property therefore it can be use in microbial infections of skin.

Keywords: Neem, Turmeric, Aloe vera, Antimicrobial activity.

***Correspondence Info:**
Ms. Monali Dumore
Assistant Professor,
Department of Pharmaceutical Chemistry,
Dadasaheb Balpande College of Pharmacy,
Nagpur 440037, Maharashtra, India

***Article History:**
Received: 13/12/2020
Revised: 24/12/2020
Accepted: 28/12/2020
DOI: https://doi.org/10.7439/ijpp.v10i6.5566

QR Code

How to cite: Dalal V, Bhonde S, Dumore M and Mahajan U. Formulation and Evaluation of Polyherbal Antimicrobial Gel. *International Journal of Phytopharmacy* 2020; 10(6): e5566. Doi: 10.7439/ijpp.v10i6.5566 Available from: https://ssjournals.com/index.php/ijpp/article/view/5566

1. Introduction

The skin is the largest organ of the body, accounting for about 15% of total adult body weight [1]. It is continuous, with the mucous membranes lining the body's surface. To keep skin healthy, clear, glossy, a balanced nutrition is required. Apart from the balanced nutrition, hormonal changes during puberty in both sexes cause changes in the body. This may give rise to problems like dryness, roughness and pimples are most common and that can be caused by bacterial over growth and inflammation [2].

Herbal remedies are more acceptable in the view that they are safe with fewer side effects than the synthetic ones [3]. Neem, Aloe Vera and turmeric are traditional Ayurvedic medicines known to have antimicrobial activities against many bacteria such as *Escherichia coli* and *Staphylococcus aureus* [4,5].

Gels are defined as a substantially dilute cross-linked system, which exhibits no flow when in the steady-state. Gels are a dispersion of molecules of a liquid within a solid in which liquid particles are dispersed in the solid medium. They are mostly liquid, yet they behave like solids due to a three-dimensional cross-linked network within the liquid. The rigidity of a gel arises from the presence of a network formed by the interlinking of particles gelling agent [6]. To overcome this problem, the herbal remedies such as Turmeric, Neem and Aloe vera are used for formulation of polyherbal antimicrobial gel. These plants have been reported in the literature having good antimicrobial, activity [7].

2. Materials and methods

2.1 Collection of plants material

Leaves of Neem, Aloe vera were collected from medicinal garden of Dadasaheb Balpande College of Pharmacy, Nagpur. Turmeric dried rhizomes were purchased from local market of Nagpur.

Chemicals: All chemicals used were of analytical reagent grade.

2.2 Extraction of Neem [8]

25g of dried leaf powder of Azadirachta indica were taken in a separate container. To this 125 ml of ethanol was added and kept for 48 h with periodic shaking. Filtered and the filtrate was collected and dried.

2.3 Extraction of Aloe Vera[9]

The leaves of Aloe vera were air dried and powdered in an electric grinder. The powdered plant material was subjected for successive soxhlet extraction with methanol for 24hr. The extracts were concentrated to dryness.

2.4 Extraction of Turmeric[10]

The turmeric rhizomes are air dried and powdered in an electric grinder. The 15gm of powdered plant material taken in conical flask. To this 125 ml of methanol was added and kept for 48 h with periodic shaking. The extract was concentrated to dryness.

Fig. 1: Extract of Neem, Aloe vera and Turmeric

Table 1: Composition of Extract

Ingredient	Quantity
Extract of Neem	1gm
Extract of Aloe Vera	2gm
Extract of Turmeric	1gm

Table 2: Composition of Polyherbal gel

Ingredients	C	F1	F2
Extract	-	2.5 gm	5 gm
Carbopol 940	1 gm	1 gm	1 gm
Methyl paraben	0.2 gm	0.2 gm	0.2 gm
Propyl paraben	0.1 gm	0.1 gm	0.1 gm
Triethanolamine	1.2 ml	1.2 gm	1.2 gm
Propylene glycol 400	5 gm	5 gm	5 gm
Purified water QS	100gm	100gm	100gm

2.5 Method of Preparation of Gel [11]

1g of carbopol 940 was dispersed in 50 ml of distilled water with continuous stirring and kept the beaker aside and to swell to form gel. Take 50 ml of distilled water and required quantity of methyl paraben and propyl paraben were dissolved by heating on water bath. Solution was cooled and propylene glycol 400 was added. Further required quantities of extract was mixed to the above mixture and add this solution into the carbopol 940 gel with continuous stirring and add triethanolamine was added dropwise to the formulation for adjustment of required skin pH and to obtain the gel of desired consistency. Control formulation (C) was prepared without herbal extract.

Control **F1** **F2**

Fig. 2: Poly Herbal Gel Formulations

2.6 Evaluation parameters of gel

2.6.1 Physical Evaluation [12]

Physical parameters such as color, consistency were checked manually.

2.6.2 pH [12]

pH of 1% aqueous solution of the formulation was measured by using a calibrated digital pH meter at constant temperature.

2.6.3 Spreadability [13]

Two sets of glass slides were taken. 500mg of the gel formulation was sandwiched between 2 slides. 100 gm weight was placed upon the upper slides so that the cream between the two slides was pressed uniformly to form a thin layer. The weight was removed and the excess of gel was scrapped off. The two slides in position were fixed to a stand in such a way that only the upper slide to be slip off freely by the force of weight tied to it. A 20 gm weight was tied to the upper slide carefully. The time taken by upper slide to slip off over lower slide was noted. The experiment was repeated by three times and the mean time taken to separate the two slides were calculated.

2.6.4 Washability [1]

Formulations were applied on the skin and then ease and extent of washing with water were checked manually.

2.6.5 Viscosity [14]

The measurement of viscosity of prepared polyherbal gel was done with Brookfield viscometer (S-62, model LVDV-E) at 25^0C with a spindle speed of the viscometer rotated at 12 rpm.

2.6.6 Irritancy Test [15]

50 mg of each herbal gel formulation was applied on left hand dorsal side surface of one square centimeter of area and observed in equal time intervals up to 24 hrs for any sign of irritancy, redness, inflammation and edema.

2.6.7 Stability of Polyherbal gel [16]

The stability study was carried out as per ICH and European guidelines at 40℃±2℃ at 75±5% RH for 30 days.

2.6.8 Antimicrobial activity of polyherbal gel [17]

Agar disc diffusion method

Media preparation:

Nutrient agar is added to 100 ml distilled water and autoclaved at 121° C for 15 minutes and poured in each petri plates.

Disc Preparation:

Three disc of 1cm diameter were prepared from Whatmann filter Paper number 1 the discs were sterilized by autoclave at 121°C. After the sterilization the moisture discs were dried on hot air oven at 50°C. Various gel formulation discs (F1 and F2) and control discs (C) were prepared.

Method:

The bacterial test organism *Escherichia coli* was spread over the three nutrient agar plates by using separate sterile cotton buds. After the microbial lawn preparation different gel formulation (Control, F1 and F2) discs were placed on each organism inoculated agar plate surface using sterile forceps. All bacterial plates were incubated at 35-37°C for 24 hrs. Zone of inhibition of bacterial growth around each disc is measured and the susceptibility is determined.

Fig 3: Bacterium E. coli colony on agar plates

3. Result and discussion

The polyherbal antimicrobial gel was formulated and evaluated as per evaluation parameter. The results of evaluation test are depicted in table no.3, 4, 5 and in Fig.5 The formulated gel (F1, F2) was yellowish brown in color whereas control formulation was transparent. Formulation C, F1 and F2 was found to have semisolid consistency. All the formulation has slightly alkaline pH which was compatible with skin physiology. F1 and F2 show good antimicrobial property on *E.coli* micro-organism. Whereas control formulation C doesn't show antimicrobial property.

Table 3: Result of evaluation parameter of polyherbal gel

Formulation batch	Color	Consistency	pH*	Spreadability*	Washability	Viscosity*	Skin Irritation
C	Transparent	Semisolid	6.5	Good	Easily washable	0.3880cp	No sign
F1	Yellowish brown	Semisolid	6.7	Good	Easily washable	0.3884cp	No sign
F2	Yellowish brown	Semisolid	6.6	Good	Easily washable	0.3885cp	No sign

*Values mentioned are the average of five determinations

Table 4: Accelerated Stability studies of FCA at 40℃ ± 2℃ with 75 ± 5% RH

Parameter	F1			F2		
	0day	15 day	30 day	0day	15 day	30 day
Appearance	No change	No change	No change	No change	No change	No change
pH	6.7	6.72	6.71	6.6	6.62	6.61

Antimicrobial activity of polyherbal gel

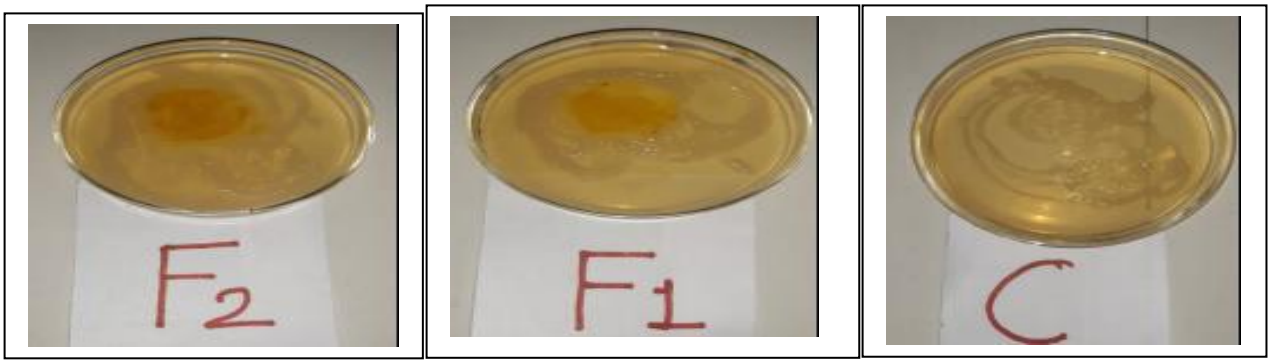

Fig 5: Zone of Inhibition of formulation C, F1 and F2

Table 5: Results of antimicrobial activity of C, F1, F2

Microorganism used	Zone of inhibition (mm)		
	F1	F2	Control
E. coli	24.63±0.07	25.50±0.07	No zone

4. Conclusion

Herbal formulations are safe due to fewer side effects therefore herbal formulation had a growing demand in word market. From the research, it is concluded that, the developed formulation shows good result of antimicrobial activity as well as it does not show any signs of skin irritation.Therefore the developed polyherbal gel is considered to be safe for use in various microbial infections.

References

[1]. Fartade S. J, Dode A. B, Garje P. S, Ladda P. S. Formulation, development and evaluation of dual-purpose antimicrobial polyherbal gel: facewash and handwash. *World Journal of Pharmaceutical and Medical Research* 2020;6(6): 198-203

[2]. Singh H. P, Samnhotra N, Gullaiya S, Kaur I. Anti-acne synergistic herbal face gel: Formulation, evaluation and stabilies. *World Journal of Pharmaceutical and Medical Research* 2015; 4(9): 1261-73.

[3]. Baghel S. S, Larya S, Bhadouriya R. Formulation development of poly herbal gel for effective management of acne. *Asian Journal of Pharmaceutical Education and Research*. 2017; 6(2): 59-64.

[4]. Maragathavalli S., Brindha S., Kaviyarasi N.S., B. Annadurai B. & Gangwar S.K. Antimicrobial activity in leaf extract of neem (*Azadirachta indica* linn.). *International J. of Sci. & Nature*. 2012; 3(1): 110-13.

[5]. Kedarnath, Kamble Kaveri M, Chimkod V.B. and C S Patil. Antimicrobial activity of *aloe vera* leaf extract. *International J. of applied Bio. & Pharm. Tech*. 2013; 4(4): 286-90.

[6]. Kaur L. P, Guleri T. K. Topical Gel: A Recent Approach for Novel Drug delivery, *Asian Journal of Biomedical and Pharmaceutical Sciences*. 2013; 3(7): 1-5

[7]. Pandey A, Jagtap J. V, Patil A. A, Joshi R. N. and B. S. Kuchekar. Formulation and evaluation of anti-bacterial and anti-fungal activity of a herbal ointment containing *Aloe-vera*, *Azadirachta indica* and *Curcuma- longa. J. Chem. Pharm. Res.* 2010; 2(3):182-86.

[8]. Uwimbabazi Francine, Uwimana Jeannette, Rutanga Jean Pierre. Assessment of antibacterial activity of Neem plant (*Azadirachta indica*) on *Staphylococcus aureus* and *Escherichia coli*. *Journal of med. plants & studies.* 2015; 3(4): 85-91

[9]. Choche T, Shende S, Kadu P. Extraction and identification of bioactive components from *Aloe barbadensis* Miller. *Res Rev J Pharmacogn Phytochem*. 2014; 2: 14-23.

[10]. Ikpeama A, Onwuka GI, Nwankwo C. Nutritional composition of Tumeric (*Curcuma longa*) and its antimicrobial properties. *International Journal of Scientific and Engineering Research*. 2014; 5(10):1085-9.

[11]. Umadevi A., Champa kumari, P. Ajith kumar, Hameemath Shamana Nasmin AM, Divya K., Hisana P. V. Development and evaluation of polyherbal gel for antifungal activity. *Int J Curr Pharm Res*. 2018; 10(5):40-43.

[12]. Mendhekar S.Y., Thorat P.B., Bodke N.N., Jadhav S. L. and Gaikwad D. D. Formulation and evaluation of gel containing neem, turmeric, aloe vera, green tea and lemon extract with activated charcoal and honey. *European J. of Pharm. & Med. Research*. 2017; 4(12): 439-43.

[13]. Agnihotri S, Wakode S, Agnihotri A. Formulation and evaluation of herbal antiacne gel of *Myrica esculenta*. *Asian J Pharm Clin Res* 9 (4); 2016: 358-361

[14]. Aiyalu R, Govindarjan A, Ramasamy A. Formulation and evaluation of topical herbal gel for the treatment of arthritis in animal model. *Brazilian Journal of Pharmaceutical Sciences*. 2016 Sep;52(3):493-507.

[15]. Bhinge SD, Bhutkar MA, Randive DS, Wadkar GH, Todkar SS, Kakade PM, Kadam PM. Formulation development and evaluation of antimicrobial polyherbal gel. *Ann Pharm Fr*. 2017; 75(5):349-58.

[16]. Dumore M. N, Mishra M. R, Dumore N. G, Mahajan U. N. Formulation of ketoconazole ophthalmic ointment using cow ghee as a base and penetration enhancer. *Int. Res. J.Pharm.*2016; 7(7): 28-35

[17]. Patel NA, Patel M, Patel RP. Formulation and evaluation of polyherbal gel for wound healing. *International Research Journal of Pharmaceuticals.* 2011; 1(1):15-20.