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Research Article

DEVELOPMENT OF TOPICAL GEL OF *TERMINALIA CHEBULA* FOR EFFECTIVE MICROBIAL TREATMENT USING MEDICINAL PLANTSNikhil Singh, Dr. Vivekanand Katare*¹, Mr. Shivam Nema¹, Mr. Prabhat Kumar Jain ²¹Vivekanand College of Pharmacy, Bhopal (M.P.), ²Scan Research Laboratories, Bhopal (M.P.)**Article Received:** December 2022 **Accepted:** December 2022 **Published:** January 2023**Abstract:**

Traditional Medicine as the sum total of all knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental, or social imbalance and relying exclusively on practical experience and observation handed down from generation to generation Terminalia chebula Retzius (T. chebula Retz) is a medium to large-sized tree that belongs to the Combretaceae family and is widely distributed throughout Asia. It is an evergreen flowering tree, and leaves, fruits, seeds, and barks are widely used in conventional folk medicine. It is a plant with anti-bacterial, antifungal, anti-carcinogenic, antioxidant, antidiabetic, anti-inflammatory, anti-HIV and anti-aging activities. T. chebula is rich in bioactive compounds like tannins, flavonoids, sterols, amino acids, fructose, and resins. However, tannins like chebulinic acid, chebulagic acid, gallic acid, chebulic acid, corilagin, and ellagic acid may be responsible for the application. This study deals with development & evaluation of gel of Terminalia chebula. The fruits of plant was collected and extracted with distilled water. The gel was formulated and evaluated for all the parameters including antimicrobial activity. The result showed yields of 6.47% w/w of crude drug of Aqueous extract Terminalia chebula Fruits. Phytochemical test showed the presence of various bioactive compounds such as Alkaloids, Carbohydrates, Flavonoids, Saponins and Phenols. The colour of gel was Green, Clogging was absent. It exhibited good homogeneity with smooth texture. The washability was good but Extrudability was average. The Spreadability was found to be 4 (gcm/sec) & pH recorded as 8.25. The gel showed sensitivity against Staphylococcus aureus and Escherichia coli. At 100mg/ml concentration the gel showed zone of inhibition of 12mm for both S. aureus & E.coli. Thus, results indicate that the formed topical gel of Terminalia chebula exhibits perfect gel characteristics along with antimicrobial effect.

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INTRODUCTION:

The emphasis on the use of medicinal plants had hitherto been placed on the treatment rather than prevention of diseases. However, there exists in the literature considerable report in recent times on research work on the use of medicinal plants and their constituents in disease prevention. A World Health Organisation (WHO) Expert Group defined Traditional Medicine as the sum total of all knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental, or social imbalance and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing. Global demands of medicinal plants to search for novel pharmacologically active compounds are increasing rigorously as they are available locally, in natural origin, with higher safety margins and lesser or no side effects. Moreover, over half of the modern drugs are derived from medicinal plants in one way or another. According to the ancient references, there are approximately 500 plants that have potential therapeutic uses, and about 800 plants are being exercised in domestic medicinal practices. The Indian subcontinent is a massive depository of healthy plants utilised as conventional medicines (Rasool,2012; Eshete *et al.*, 2021)

Terminalia chebula Retzius (T. chebula Retz) is a medium to large-sized tree that belongs to the Combretaceae family and is widely distributed throughout Asia. It is an evergreen flowering tree, and leaves, fruits, seeds, and barks are widely used in conventional folk medicine. It is a plant with anti-bacterial, antifungal, anti-carcinogenic, antioxidant, antidiabetic, anti-inflammatory, anti-HIV and anti-aging activities. T. chebula is rich in bioactive compounds like tannins, flavonoids, sterols, amino acids, fructose, and resins. However, tannins like chebulinic acid, chebulagic acid, gallic acid, chebulic acid, corilagin, and ellagic acid may be responsible for the application. (Mahesh *et al.*, 2009)

T. chebula can be remarked as a resourceful plant having a surfeit of therapeutic activities. The broad spectrum of biological activities of *T. chebula* has been documented in numerous pathophysiological conditions and found to be relatively safe. Several phytochemical studies revealed many chemically diversified biologically active compounds, which need further studies to confirm their therapeutic effects in vitro and in vivo (Kumar,2006)

MATERIALS AND METHODS:**Collection of Plant:**

The Fruits of selected plant namely *Terminalia chebula* were identified and collected from local areas of Bhopal, (M.P). The entire plant drug was authenticated by expert botanist of Department of Botany Geetanjali College Bhopal. All collected plant drug were cleaned, shade dried, pulverized into moderately coarse powder and stored in airtight container for further use.

Pathogenic microbes used:

The pathogenic bacteria and fungus used in the current study obtained from Microbial Culture collection, J.P.Hospital, Bhopal, Madhya Pradesh (India).

Methods:**Extraction of Plant Drug:**

The Collected plant drug (Fruits) was cleaned properly and washed with distilled water to remove any kind of dust particles. Cleaned and dried plant drug was converted into moderately coarse powder in hand grinder. Powdered plant drug was weighed (68 gm) and packed in air tight glass container.

The plant Material (Fruits) was extracted with distilled water as a solvent for about 24 hrs with randomly shaking. Shaking of the drug during maceration is essential in order to replace the saturated layers around the drug with fresh menstruum. The liquid extract was collected in a tarred conical flask. The solvent removed by evaporating the solvent using hot plate. The dry extract obtained was weighed to calculate the percentage yield (Pandey & Tripathi,2014; Shukla *et al.*, 2019).

Preliminary Phytochemical Screening:

Preliminary phytochemical screening means to investigate the plant material in terms of its active constituents. In order to detect the various constituents present in the Aqueous extracts of *Terminalia chebula*, was subjected to the phytochemical tests as per standard methods (Kokate, 1994; Harborne,1973).

Preparation of gel base:

Carbopol 934 was dissolved slowly with stirring in 60 mL of demineralized water for 1 h to avoid agglomeration. Then disodium edentate and triethanolamine were dissolved in 10 mL of demineralized water separately and stirred for 10 min. Mixed 4.83 mL of propylene glycol in 12 mL of demineralized water with stirring for 10 min. Disodium edentate and triethanolamine solution were added to Carbopol solution and the pH was then adjusted to 7.4 by stirring the solution for 10 min.

Then propylene glycol solution was added with stirring for 10 min until a clear consistent gel base was obtained.

Preparation of Topical Gel:

Measured quantity of methyl paraben, glycerine, polyethylene glycol and aqueous extract of *Terminalia chebula* was dissolved in about 35 ml of water in beaker and were stirred at high speed using

mechanical stirrer (or sonicator). Then carbopol 940 was added slowly to the beaker containing above liquid while stirring. Neutralized the solution by slowly adding triethanolamine solution with constant stirring until the gel is formed. All the samples were allowed to equilibrate for 24 hours at room temperature prior to performing rheological measurements (Table 1).

Table 1 Formulation of herbal Gel

Ingredients (%)	HG1	HG2	HG3	HG4	HG5	HG6
<i>Terminalia chebula</i> extract	1gm	1gm	1gm	1gm	1gm	1gm
Carbopol 940	0.25mg	0.5mg	0.75mg	1.0 gm	1.25 gm	1.5 gm
Polyethylene Glycol	0.2ml	0.2ml	0.2ml	0.2ml	0.2ml	0.2ml
Methyl Paraben	0.08mg	0.08mg	0.08mg	0.08mg	0.08mg	0.08mg
Triethanolamine	1.0ml	1.0ml	1.0ml	1.0ml	1.0ml	1.0ml
Distilled Water (q.s)	100ml	100ml	100ml	100ml	100ml	100ml

Evaluation of herbal gel

Appearance and consistency

The physical appearance was visually checked for the texture of herbal gel formulations.

Washability

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

Extrudability determination of formulations

The herbal gel formulations were filled into collapsible metal tubes or aluminum collapsible tubes. The tubes were pressed to extrude the material and the extrudability of the formulation was checked.

Determination of Spreadability

A special apparatus has been designed to study the Spreadability of the formulations. Spreadability is expressed in terms of time in seconds taken by two slides to slip off from formulation, placed between, under the application of a certain load. Lesser the time taken for the separation of two slides, better the Spreadability.

Determination of pH

The pH of the herbal gels was determined by digital pH meter. One gram of gel was dissolved in 25 ml of distilled water and the electrode was then dipped in to gel formulation until constant reading obtained. And constant reading was noted. The measurements of pH of each formulation were replicated two times

Drug content

The drug content was determined by taking 1gm of gel in 10 ml volumetric flask diluted with methanol. 3 ml of stock solution was mixed with 1 ml of 2 % AlCl₃. The mixture was vortexed for 15s and allowed to stand for 30min at 40°C for colour development. The absorbance was measured at 420 nm using a spectrophotometer

Antimicrobial activity

The antimicrobial activity was performed by well diffusion method against *S. aureus* & *E. coli*.

RESULTS & DISCUSSION:

The yields were found to be 6.47% w/w of crude drug of Aqueous extract *Terminalia chebula* Fruits. Results of Phytochemical test showed the presence of various bioactive compounds such as Alkaloids, Carbohydrates, Flavonoids, Saponins and Phenols. The colour of gel was Green, Clogging was absent. It exhibited good homogeneity with smooth texture. The washability was good but Extrudability was average. The Spreadability was found to be 4 (gcm/sec) & pH recorded as 8.25. The gel showed sensitivity against *Staphylococcus aureus* and *Escherichia coli*. At 100mg/ml concentration the gel showed zone of inhibition of 12mm for both *S. aureus* & *E.coli*.

Table: 2 Extractive values obtained from *Terminalia chebula*

S.N.	Solvent	% Yield
1.	Distilled water	6.47%

Table: 3 Preliminary phytochemical screening of *Terminalia chebula*.

S.N.	Phytoconstituents	Test Name	Aqueous Extract
1	Alkaloids	Wagner's Test	+(ve)
2	Carbohydrates	Fehling's Test	+(ve)
3	Flavonoids	Lead acetate	+(ve)
		Alkaline reagent test	+(ve)
4	Proteins & Amino acids	Precipitation test	-(ve)
5	Phenols	Ferric chloride test	+(ve)
6	Diterpenes	Copper acetate test	-(ve)
7	Saponins	Foam test	+(ve)

Table 4 Results of psycho rheological characteristics

Formulation	Colour	Clogging	Homogeneity	Texture
HG	Green	Absent	Good	Smooth

Table 5 Results of washability, extrudability, Spreadability and pH

Formulation	Washability	Extrudability	Spreadability (gcm/sec)	pH
HG	Good	Average	4	8.25

Results of antimicrobial activity of aqueous extract of *Terminalia chebula*.**Table: 6 Results of sensitivity of aqueous extract of *Terminalia chebula*.**

S. No.	Microbes Codes	Microbes	Aqueous extract of <i>Terminalia chebula</i>
1.	Bact-1	<i>Streptococcus mutans</i>	No
2.	Bact-2	<i>Bacillus subtilis</i>	No
3.	Bact-3	<i>Staphylococcus aureus</i>	No
4.	Bact-4	<i>Salmonella Bongori</i>	No
5.	Bact-5	<i>Staphylococcus aureus</i>	Yes
6.	Bact-6	<i>Escherichia coli</i>	Yes

Table : 7 Antimicrobial activity of aqueous extract of *Terminalia chebula* against selected microbes

S. No.	Name of microbes	Zone of inhibition		
		25mg/ml	50 mg/ml	100mg/ml
1.	<i>Staphylococcus aureus</i>			
	Extract	9	11	12
2.	<i>Escherichia coli</i>			
	Extract	6	10	12

CONCLUSION:

The present study was aimed to developed herbal gels for topical application and treatment of skin diseases (Acne) using Aqueous extracts of *Terminalia chebula* Fruits an aqueous based Carbopol gel system and evaluated for their physicochemical properties, like pH and Spreadability. Further phytochemical studies are also required to isolate and characterize active ingredients that are responsible for its anti acne activity and to explore the existence of synergism if any, among the compounds.

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