

# Formulation Development and Physicochemical Analysis of a Herbal Cream Containing Extract of *Tridax Procumbens* (*Jayanti*)

TUSHAR NAGTODE<sup>1</sup>, SHUBHAM R BOBADE<sup>2</sup>

## ABSTRACT

**Introduction:** The use of herbs in medicine, tracing back to ancient cultures, reflects a rich history of discerning beneficial uses from plants through trial and error. Standardising herbal medicines involves establishing criteria for inherent characteristics, consistent parameters and qualitative and quantitative values to ensure quality, efficacy, safety and reproducibility. *Tridax procumbens*, known as *Jayanti* in Sanskrit, exhibits diverse pharmacological activities, making it a potential agent for wound healing. This herbal cream consists of a single herbal component. This simplifies the formulation, physicochemical analysis, and development processes while ensuring quality. Existing literature indicates the topical use of *T. procumbens* for wound healing.

**Aim:** To formulate, develop, and evaluate the physicochemical properties of a cream containing *Jayanti* (*T. procumbens*) intended for topical wound healing applications.

**Materials and Methods:** This was an experimental laboratory-based pharmaceutical formulation study conducted at Dattatray Ayurveda Rasashala, Mahatma Gandhi Ayurvedic College Hospital and Research Centre, Wardha, Maharashtra, India, from

July 2023 to July 2024. Raw drugs and materials were sourced from the local market. The cream development process began with the preparation of *ghee* according to the classical method of Ayurveda. The cream formulation was then developed using base ingredients commonly found in modern cosmetics. Four batches were prepared for formulation. Organoleptic parameters such as colour, odour, and texture, along with physicochemical parameters including loss on drying, pH, spreadability, rancidity, iodine value, peroxide value, and microbiological contamination, were evaluated.

**Results:** The study developed and assessed a herbal cream with satisfactory physicochemical properties. The results showed a loss on drying of 1.12%, a pH of 5.3, a spreadability test result of 1.3 gm/sec, the absence of rancidity, an iodine value of 18.78, a peroxide value of 7.99, and a negative microbiological contamination test.

**Conclusion:** The herbal cream meets all evaluation criteria and demonstrates acceptable physicochemical characterisation and formulation stability. The cream shows promise as a potential wound-healing formulation, attributable to its safe, effective and non toxic herbal composition.

**Keywords:** Drug, *Jayanti veda*, Medicine, Pharmaceutical formulation

## INTRODUCTION

The use of herbs as medicine is the oldest form of healthcare, often employed in primordial forms like pastes of plants. Through trial and error, primitive societies identified the medicinal values of plants. Formulation of herbal medicines involves establishing a set of criteria, including qualitative and quantitative values. These standards determine the quality, efficacy, safety and reproducibility of herbal medicine [1]. *Tridax procumbens* is commonly known as *Jayanti* in Sanskrit, *Kambarmodi* or *Dagadi pala* in Marathi, *Kansari* in Hindi and Coat Button in English [2]. This weed is abundantly distributed and readily available in the natural environment. A review of published articles regarding *T. procumbens* showed antioxidant, anti-inflammatory, antimicrobial, and antifungal properties [3]. The pharmacological properties possessed by this plant make it an effective wound healer [4]. Classical Ayurvedic preparations such as *Kalka* (paste) are susceptible to various environmental factors such as temperature, air, light and humidity [5]. Also, provide challenges in drug application to patients; hence, in the present study, *T. procumbens* cream preparation is done. The review of literature suggests the topical application of *T. procumbens* for wound healing, along with its extended use for conditions such as gout, dropsy, and anaemia. Additionally, it is used in the treatment of ulcers, urinary problems, asthma, haemorrhoids, and arthritic joint pain [6-8]. Although preclinical studies and existing literature suggest the topical use of *T. procumbens*, no study has been

reported on a single-drug formulation. Therefore, the study aimed to develop, evaluate, and formulate a single herbal cream, focusing on its wound healing potential, while adhering to established standard measures to ensure the quality of the product.

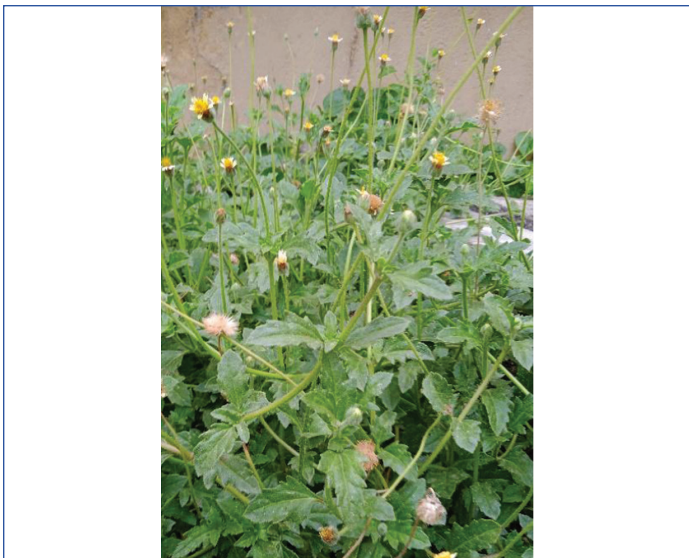
## MATERIALS AND METHODS

This was an experimental laboratory-based pharmaceutical formulation and evaluation study conducted at Dattatray Ayurveda Rasashala, Mahatma Gandhi Ayurvedic College Hospital and Research Centre, Wardha, Maharashtra, India, from July 2023 to July 2024. Ethics committee approval was not required as the study involved laboratory-based pharmaceutical formulation and physicochemical evaluation without human or animal participation. Authentication of *T. procumbens* is carried out at *Dravyaguna* Department of Mahatma Gandhi Ayurvedic College Hospital and Research Centre, Wardha, with Ref. No. MGAC/DG/2023/10.

### Study Procedure

**Collection of plant and raw materials:** Fresh plant of *T. procumbens* [Table/Fig-1], cow's ghee, stearic acid, cetostearyl alcohol, pure white beeswax, and petroleum jelly were procured from the local market.

**Preparation of *T. procumbens* Kwatha (decoction extract):** One kg (1 part) of fresh *T. procumbens* plant was gathered



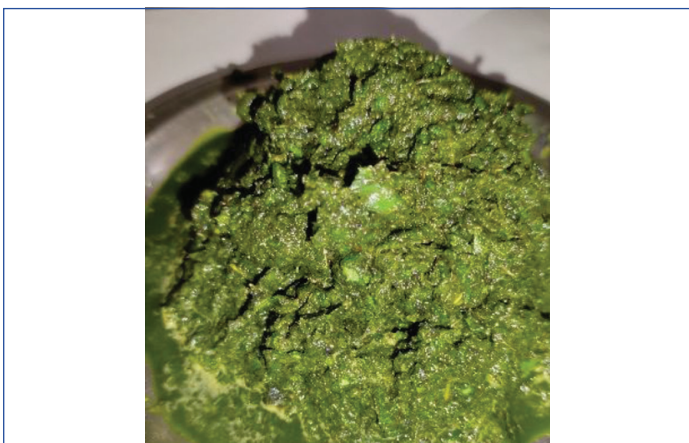
[Table/Fig-1]: *T. procumbens* plant.

and washed with water. Subsequently, the plants were cut into pieces and thoroughly mixed with 16 litres (16 parts) of water in a container. Constant mild heat was then provided until the mixture was concentrated to two litres (1/8<sup>th</sup> of its initial quantity). Throughout the heating process, constant stirring was employed to ease evaporation and prevent material deterioration through burning [Table/Fig-2]. Once a desirable reduction in volume was achieved, the decoction underwent filtration using a single folded cotton cloth, and the resulting preparation was collected in a separate vessel. *T. procumbens* decoction extract was prepared by *Kwatha Kalpana* [9].



[Table/Fig-2]: *T. procumbens* decoction (*Kwatha*) preparation.

**Preparation of *T. procumbens* Kalka (paste):** A paste of fresh *T. procumbens* plants with little water was created using a mortar and pestle, resulting in the formation of *Kalka* (paste) [Table/Fig-3]. *Kalka* of 125 gm was used for the further formulation process [10].



[Table/Fig-3]: *T. procumbens* Paste (*Kalka*).

**Preparation of *T. procumbens* ghee:** A 500 gm (4 parts) *ghee* was gently heated, and when it reached a slightly warm temperature, *T. procumbens Kalka* 125 gm (1 part) was added and thoroughly mixed. Subsequently, the 2 litres (16 parts) of *Kwatha* of *T. procumbens* was introduced into the mixture and thoroughly blended. Continuous stirring of the entire mixture was maintained throughout the blending process. The heating process endured until the moisture-free *Sneha Siddhi Lakshana* characteristics were achieved. Disappearance of froth (*Phena shanti*) and *varti*, exhibiting absence of crackling sound on fire (*sabdhinoagni nikshipto*) and meeting the criteria of *Sneha Siddhi Lakshana*, were observed throughout the procedure. Upon attainment of these characteristics, the mixture underwent filtration using a cotton cloth, and *T. procumbens ghee* 492 gm (approximate 1/4<sup>th</sup> part) was obtained [11] [Table/Fig-4].



[Table/Fig-4]: *Ghee* preparation exhibiting *Sneha Siddhi Lakshana*.

**Preparation and formulation of *T. procumbens* cream:** The cream base was developed by mixing stearic acid, cetostearyl alcohol, pure white beeswax, petroleum jelly, and water in various proportions, as mentioned in [Table/Fig-5]. The selection of excipients and their concentrations was based on their established pharmaceutical roles in topical cream formulations and evidence from existing literature [12]. The concentrations of excipients were varied across different batches to evaluate their influence on physicochemical characteristics such as viscosity, spreadability, homogeneity, and stability. Previously made *ghee* using *T. procumbens* was added to the cream base with continuous triturating and heating. The formulated cream was stored until further use [Table/Fig-6]. Standardisation was achieved through various batch formulations, with batch one found to be better in terms of stability and consistency [13].

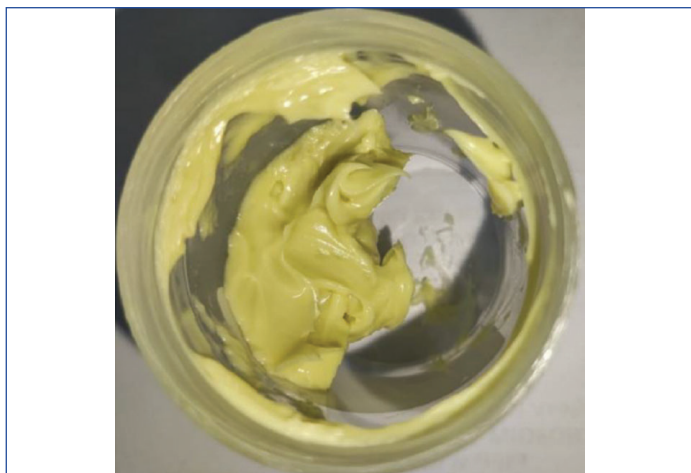
**Evaluation of organoleptic parameters:** The formulated cream was inspected for its colour, odour, and texture by visual observation.

**Evaluation of physicochemical parameters:** Determination of loss on drying at 105°C: A formulation n sample was taken in a petri dish in a water bath and dried at a temperature of 105±5°C to determine the loss on drying at 105°C [14].

Determination of the pH value: 1g of the sample cream was weighed and dissolved in 100 mL of distilled water and the pH was measured by using a digital pH meter [15].

Sr. No.	Composition	Formula % w/w			
		Batch-1	Batch- 2	Batch- 3	Batch- 4
1	Stearic acid	10%	10%	10%	10%
2	Cetostearyl alcohol	10%	5%	10%	15%
3	Pure white beeswax	5%	10%	15%	15%
4	Petroleum jelly	5%	15%	15%	10%
5	Water	20%	20%	20%	30%
6	Jayanti ( <i>T. procumbens</i> ) <i>ghee</i>	50%	40%	30%	20%

[Table/Fig-5]: Formulation of various batches of cream.



[Table/Fig-6]: Formulated *T. procumbens* cream.

**Spreadability test:** Spreadability was calculated using the formula -

$$S = m \times l/t,$$

where S represents spreadability, m is the weight attached to the upper slide one denotes the length moved on the glass slide, and 't' represents the time taken.

The cream sample was applied between two glass slides, and a predetermined weight was placed on these slides to compress them uniformly. A weight of 70 g was added, and the duration needed to separate the two slides was recorded [16].

**Rancidity test:** A peroxide value test was performed to evaluate the rancidity [17].

**Determination of iodine value and peroxide value:** These values were calculated by standard methods of analysis (Official Methods of Analysis of the Association of Official Analytical Chemists, AOAC 1998) [18].

**Evaluation of microbiological contamination (growth):** The formulated cream was tested for microbial contamination. The streak plate method was employed by inoculating the sample cream and the control (without cream) in agar media plates. The plates were incubated in the incubator for 24 hours at a temperature of 37°C to examine any microbial growth [19].

**Long-term stability:** Stability studies for all formulated batches were conducted at a temperature of 25°C±2°C with 60±5% RH to observe all physical characteristics, homogeneity, and separation for 30 days [20].

## RESULTS

Four batches of the herbal cream were prepared using increasing quantities of *Jayanti (T. procumbens) ghee* as mentioned in [Table/Fig-5]. Formulation batch-1, containing the maximum amount of *T. procumbens* (50%), exhibited a stable homogenous appearance, and no separation phase occurred for batch-1 compared to other batches. Batch-1 was selected based on visual homogeneity, absence of phase separation, and acceptable consistency during storage; however, quantitative rheological assessment was not performed.

Various parameters of physicochemical analysis and organoleptic assessment were carried out for the formulated herbal cream. Organoleptic parameters enlisted in [Table/Fig-7], such as colour- light green, odour- characteristic, and texture- smooth, were found. Physicochemical parameters enlisted in [Table/Fig-8] showed the following results: loss on drying at 105°C was 1.12%, pH- 5.3, spreadability test yielded 1.3 gm/sec, and rancidity was absent. Additionally, the iodine value measured 18.78 and the peroxide value was 7.99. Microbiological contamination tests mentioned in [Table/Fig-9] confirmed the absence of total viable count, *Enterobacteriaceae*, total fungus count, *E. coli*, *Salmonella*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*.

S. No.	Test parameters	Test results
1	Colour	Light green
2	Odour	Characteristic
3	Texture	Smooth

[Table/Fig-7]: Evaluation of organoleptic parameters.

S. No.	Test parameters	Test results
1	Loss on drying at 105°C	1.12%
2	pH	5.3
3	Spreadability test	1.3 gm/sec
4	Rancidity	Absent
5	Iodine value	18.78
6	Peroxide value	7.99

[Table/Fig-8]: Evaluation of physicochemical parameters

S. No.	Test parameters	Test results
1	Total viable count	Absent
2	<i>Enterobacteriaceae</i>	Absent
3	Total fungus count	Absent
4	<i>E-coli</i>	Absent
5	<i>Salmonella</i>	Absent
6	<i>Staphylococcus aureus</i>	Absent
7	<i>Pseudomonas aeruginosa</i>	Absent

[Table/Fig-9]: Evaluation of microbiological contamination.

## DISCUSSION

The development and standardisation of an herbal cream containing *Jayanti (T. procumbens)* for wound healing demonstrates the significant potential of utilising traditional herbal knowledge in modern pharmaceutical formulations. The present study aimed to prepare a safe and efficacious cream from *T. procumbens* that has pharmacological properties like antioxidant, anti-inflammatory, antifungal, and antimicrobial [21]. Literature searches also support the use of *T. procumbens* in wound healing [22]. In the current study, the Ayurvedic method of drug preparation and the modern method for cream preparation were both used. This cream was formulated using traditional Ayurvedic methods, such as *Kwatha* used as an extract to prepare ghee. Stearic acid, cetostearyl alcohol, pure white beeswax, and petroleum jelly were then added to prepare its final form of cream [23]. The authentication of raw materials was carried out to achieve the efficacy of the cream [24]. The prepared cream was evaluated using organoleptic, physicochemical parameters, and microbiological tests to confirm stability, consistency, and safety [25].

A study conducted by Lokesh Prasad MS et al., prepared a cream using *T. procumbens* that shows similar organoleptic analysis, which was as follows: colour- pale green; odour- characteristic; consistency- smooth. Physicochemical evaluation of this formulation showed loss on drying- 30%, pH- 7.12, spreadability (seconds)- 6, solubility- soluble in boiling water, extrudability- 0.4 gm, washability- good, diffusion study (after 60 min)- 0.7 cm, miscible with alcohol, ether, chloroform, non irritant, and stability. Cream, ointment, and gel can be formulated using *T. procumbens* [26].

Antifungal activity against the fungal strain *Candida albicans* was demonstrated in a study conducted by Ashok Babu VL et al., Hence, *T. procumbens* cream can be recommended as an alternative topical formulation for the treatment of fungal and skin infections [27]. Also, antimicrobial activity was demonstrated against *Staphylococcus aureus* in another study. Gel was formulated using *T. procumbens*, which can be used for antiseptic and wound healing purposes [28]. Herbal soap formulation using leaf extract of *T. procumbens* was studied by Rani S et al., which can be used in treating skin infections [29].

A randomised clinical trial protocol was proposed to evaluate the use of *T. procumbens* for the management of anal fissure. The study aimed to assess the efficacy of *Jayanti* cream compared to topical lignocaine and nifedipine cream in treatment [30]. While clinical evaluation of cream was done in published randomised clinical trial, lignocaine and nifedipine cream (group A) and *Jayanti* (*T. procumbens*) cream (group B) were observed to be equally efficacious in the treatment of *Parikartika* (acute fissure-in-ano), with both groups showing statistically significant improvement in overall clinical assessment parameters [31].

A review of recently published literature indicates that *T. procumbens* has primarily been used in polyherbal formulations, and most studies have utilised alcoholic extracts [32,33]. In contrast, the present study employed a single-herb formulation of *T. procumbens*. A hot decoction was prepared according to Ayurvedic principles [34,35], followed by the preparation of *ghrita*, which was subsequently incorporated into the cream base to enhance therapeutic potency. Various formulations, such as cream, ointment, gel and soap, were prepared with potential use in wound healing. Topical formulations made using this plant showed various physicochemical values because of different methods of its preparation and variation in ingredients.

### Limitation(s)

The limitation of the current study is the lack of in-vitro evaluation to assess biological markers associated with wound healing, anti-inflammatory, and antioxidant activities that contribute to therapeutic efficacy. Statistical comparison among formulation batches was not performed due to the exploratory formulation development design. Comparative statistical analysis among all batches was also limited.

### CONCLUSION(S)

The formulated *T. procumbens* (*Jayanti*) cream was found satisfactory in all aspects of analysis. The herbal cream possesses all acceptable qualities, including loss on drying at 105°C, pH, spreadability test, rancidity, iodine value, peroxide value, and microbiological contamination test. The prepared herbal cream may be considered for further evaluation as a topical wound healing formulation. This herbal cream, formulated from non toxic, safe, and effective herbal extracts, shows great promise and is likely to be well-received for its therapeutic benefits.

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**PARTICULARS OF CONTRIBUTORS:**

1. Assistant Professor, Department of General Surgery, Jawaharlal Nehru Medical College, Wardha, Maharashtra, India.
2. Consultant Surgeon, Department of General Surgery, Bobade Clinic and Hospital, Yavatmal, Maharashtra, India.

**NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:**

Dr. Tushar Nagtode,  
Assistant Professor, Department of General Surgery, Jawaharlal Nehru Medical  
College, Wardha-442001, Maharashtra, India.  
E-mail: dr.tusharnagtode@gmail.com

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