JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Formulation and Evaluation of Tablets Prepared from Crape Jasmine (*Tabernaemontana divaricata*) Bud Milk Extract for Anticancer Activity

Mr. Zanwar Vijaykumar Jugalkishor[1], Ms. Kale Ajwita Satishrao[2],

Mr. Deshmukh Amit Manohar[3], Mr. Pradeep Madhukar Jadhav[4]

Associate Professor[1], Assistant Professor[2], Research Scholar[3-4]

Rajarshi Shahu College of Pharmacy, Markhel[1,2,3], Satara College of Pharmacy, Satara[4]

Abstract

Natural plant-derived compounds have attracted increasing attention as potential anticancer agents. *Tabernaemontana divaricata* (Crape jasmine) contains several indole alkaloids and bioactive constituents that exhibit cytotoxic and antiproliferative properties. The present study aimed to formulate herbal tablets containing bud milk extract of *T. divaricata* and evaluate their physicochemical properties and in-vitro anticancer activity.

The bud milk extract was obtained from fresh buds and incorporated into tablets using wet granulation technique. Pre-compression parameters including bulk density, tapped density, Carr's index, Hausner ratio, and angle of repose were evaluated. Post-compression parameters such as hardness, friability, weight variation, disintegration time, and drug content were determined. Anticancer activity was assessed using an MTT assay against MCF-7 breast cancer cell lines.

The formulated tablets showed acceptable pharmacopeial characteristics with hardness ranging from 4.2–5.1 kg/cm², friability below 0.9%, and disintegration time of 7.8 ± 0.6 min. The extract-containing tablets demonstrated significant cytotoxic activity with an IC50 value of 42.6 µg/mL against MCF-7 cells. These findings suggest that tablets formulated from *T. divaricata* bud milk extract may serve as a potential herbal anticancer formulation.

Keywords: Tabernaemontana divaricata, Crape jasmine, herbal tablets, anticancer activity, formulation.

1. Introduction

Cancer is one of the leading causes of mortality worldwide, characterized by uncontrolled cell proliferation and metastasis. Despite the availability of chemotherapy and radiotherapy, current treatments are often associated with severe adverse effects and drug resistance. Therefore, the search for safer and more effective anticancer agents from natural sources has gained considerable attention.

Medicinal plants have historically played an important role in cancer therapy. Several well-known anticancer drugs such as vincristine and paclitaxel originate from plant sources. *Tabernaemontana divaricata*, commonly known as crape jasmine, belongs to the family Apocynaceae and is widely distributed in tropical regions. The plant contains numerous bioactive compounds including indole alkaloids such as voacangine, coronaridine, and tabernaemontanine.

Previous phytochemical investigations have revealed that the latex or "bud milk" of *T. divaricata* possesses antimicrobial, anti-inflammatory, antioxidant, and cytotoxic activities. However, limited studies have explored its potential for pharmaceutical formulation development.

The present study aimed to develop an oral tablet formulation containing bud milk extract of *T. divaricata* and evaluate its physicochemical properties and anticancer potential against breast cancer cell lines.

2. Materials and Methods

2.1 Plant Material Collection

Fresh flower buds of *Tabernaemontana divaricata* (Family: Apocynaceae), commonly known as Crape jasmine, were collected during the early flowering season from healthy plants cultivated in the botanical garden and surrounding areas of Kandhar, Maharashtra, India. The collection was carried out during the early morning hours to ensure maximum latex yield and to prevent degradation of bioactive constituents due to heat and sunlight exposure.

The plant material was carefully examined to ensure that only healthy, disease-free, and mature buds were selected for the study. Approximately 1–1.5 kg of fresh buds were collected manually using sterile scissors and gloves to avoid contamination. Immediately after collection, the buds were placed in clean polyethylene bags and transported to the laboratory for further processing.

Botanical identification and authentication of the plant material were performed by a qualified taxonomist from the Department of Botany. The identification was carried out based on morphological characteristics such as leaf arrangement, flower structure, and latex secretion typical of *Tabernaemontana divaricata*. A voucher specimen of the plant material was prepared, labeled, and deposited in the departmental herbarium for future reference.

The bud milk (latex) was collected by making a small incision on the surface of freshly harvested buds using a sterile scalpel blade. The milky latex exuding from the buds was carefully collected in sterile glass containers. Care was taken to avoid contamination with other plant tissues or environmental impurities. The collected latex was filtered through sterile muslin cloth to remove any particulate matter and immediately stored at 4°C until further processing.

All procedures involving plant collection and latex extraction were carried out under hygienic laboratory conditions to maintain the purity and stability of the extract prior to phytochemical extraction and formulation development.

2.2 Preparation of Bud Milk Extract

The freshly collected bud milk (latex) of *Tabernaemontana divaricata* was processed immediately to prevent degradation of its bioactive constituents. Approximately **120 g of fresh bud milk** was collected in sterile glass containers and initially filtered through a double layer of sterile muslin cloth to remove dust particles and other impurities.

The filtered bud milk was then subjected to **drying at a controlled temperature of 40 °C** in a hot air oven for 24–36 hours. The temperature was carefully maintained to avoid thermal degradation of thermolabile phytoconstituents such as alkaloids, flavonoids, and phenolic compounds present in the latex. Drying was continued until a constant weight was obtained, resulting in the formation of a semi-solid dried mass.

The dried latex material was finely pulverized using a mortar and pestle to obtain a uniform powder, which facilitates efficient solvent penetration during extraction.

For extraction, the powdered material was subjected to **maceration using hydroalcoholic solvent (70% ethanol:30% distilled water)**, which is widely used for extracting both polar and moderately non-polar phytoconstituents. Approximately **18.6 g of dried latex powder** was transferred into a clean amber-colored glass container and soaked in **200 mL of 70% ethanol**.

The mixture was kept for **48 hours at room temperature (25 ± 2 °C)** with intermittent shaking every 4–6 hours to enhance solvent penetration and improve extraction efficiency. The container was tightly closed to minimize solvent evaporation and prevent contamination.

After completion of the maceration period, the extract was filtered first through muslin cloth and then through **Whatman No. 1 filter paper** to obtain a clear filtrate. The filtrate was subsequently concentrated using a **rotary evaporator under reduced pressure at 40–45 °C** to remove excess solvent. The concentrated extract was further dried in a hot air oven to obtain a thick, semi-solid extract.

The final dried extract was weighed and stored in an **airtight container at 4 °C** until further use in tablet formulation and pharmacological evaluation.

The extraction yield was calculated using the following formula:

$$\text{Percentage Yield} = \frac{\text{Weight of dried extract}}{\text{Weight of fresh bud milk}} \times 100$$

Table: Yield of Bud Milk Extract

Parameter	Value
Fresh bud milk collected	120 g
Dried extract obtained	18.6 g
Percentage yield	15.5 %

The obtained hydroalcoholic extract appeared as a **dark brown semi-solid mass with characteristic odor**, indicating successful extraction of phytoconstituents from the bud milk of *Tabernaemontana divaricata*. The extract was preserved under refrigerated conditions until further formulation studies.

2.3 Tablet Formulation

Herbal tablets containing *Tabernaemontana divaricata* bud milk extract were prepared using the **wet granulation method**, which is one of the most widely used techniques in tablet manufacturing to improve powder flow, compressibility, and content uniformity. The formulation was designed to obtain tablets with acceptable mechanical strength, uniform drug distribution, and appropriate disintegration characteristics.

Initially, the required quantities of **bud milk extract, microcrystalline cellulose (MCC), and lactose** were accurately weighed according to the formulation composition. The bud milk extract served as the **active pharmaceutical ingredient (API)**, while microcrystalline cellulose was used as a **diluent and compressibility enhancer**, and lactose acted as a **filler to increase tablet bulk and improve palatability**.

All solid ingredients except lubricants were passed through **sieve no. 60** to obtain uniform particle size and to remove any lumps. The sieved powders were then transferred into a clean mortar and **mixed thoroughly using geometric dilution technique** to ensure uniform distribution of the extract throughout the powder blend.

A **5% starch paste** was prepared separately by dispersing starch in distilled water and heating it gently with continuous stirring until a clear viscous paste was obtained. This starch paste served as the **binder** to facilitate granule formation.

The binder solution was gradually added to the powder mixture with continuous mixing until a **damp cohesive mass** suitable for granulation was formed. The wet mass was then passed through **sieve no. 16** to produce uniform wet granules.

The prepared wet granules were **dried in a hot air oven at 45 °C for 30–40 minutes** until the moisture content was reduced to an acceptable level. The dried granules were then passed through **sieve no. 20** to break aggregates and obtain uniformly sized granules.

After drying and sizing, **talc and magnesium stearate** were added to the granules as **glidant and lubricant**, respectively. Talc improved the flow properties of the granules during compression, while magnesium stearate reduced friction between the granules and the die wall of the tablet compression machine.

The final blend was mixed gently for **5–10 minutes** to ensure uniform distribution of lubricants. The lubricated granules were then compressed into tablets using a **single punch tablet compression machine fitted with flat-faced punches**. Each tablet was adjusted to obtain an average weight of **260 mg**.

The prepared tablets were stored in **airtight containers at room temperature** until further evaluation studies such as hardness, friability, weight variation, disintegration time, drug content, and dissolution testing.

Table 1. Composition of Formulated Tablets

Ingredient	**Quantity (mg/tablet)**
Bud milk extract	100
Microcrystalline cellulose	80
Lactose	60
Starch paste (binder)	15
Talc	3
Magnesium stearate	2
Total weight	**260 mg**

In this formulation, the excipients were selected to provide **good flowability, compressibility, and mechanical strength**, ensuring the production of tablets with acceptable pharmaceutical quality.

2.4 Evaluation of Pre-Compression Parameters

Before tablet compression, the prepared granules were evaluated for **pre-compression parameters** to determine their flow properties and compressibility. These parameters are important because good flow characteristics ensure **uniform die filling during compression**, which ultimately results in tablets with consistent weight, hardness, and drug content.

The prepared granules were analyzed for **bulk density, tapped density, Carr's compressibility index, Hausner ratio, and angle of repose** using standard pharmaceutical evaluation methods.

Bulk Density

Bulk density refers to the **mass of powder divided by the bulk volume occupied by the powder**, including the spaces between particles. It provides information about the packing behavior of granules.

Bulk density was determined by accurately weighing **10 g of the prepared granules** and transferring them into a **100 mL graduated measuring cylinder** without compacting the material. The volume occupied by the powder was noted and bulk density was calculated using the formula:

$$\text{Bulk Density} = \frac{\text{Weight of Powder}}{\text{Bulk Volume}}$$

The bulk density of the granules was found to be **0.48 g/cm³**, indicating moderate packing of particles.

Tapped Density

Tapped density indicates the **density of powder after mechanical tapping**, which helps in determining the compressibility of granules.

The measuring cylinder containing the powder used for bulk density determination was tapped **100 times using a tapped density apparatus** until a constant volume was obtained. The tapped volume was recorded and tapped density was calculated using the formula:

$$\text{Tapped Density} = \frac{\text{Weight of Powder}}{\text{Tapped Volume}}$$

The tapped density of the granules was found to be **0.56 g/cm³**.

Carr's Compressibility Index

Carr's index provides information about the **flowability and compressibility of powder blends**. It is calculated using bulk density and tapped density values.

$$\text{Carr's Index} = \frac{\text{Tapped Density} - \text{Bulk Density}}{\text{Tapped Density}} \times 100$$

Hausner Ratio

Hausner ratio is another parameter used to assess powder flow properties. It is calculated as the ratio of tapped density to bulk density.

$$\text{Hausner Ratio} = \frac{\text{Tapped Density}}{\text{Bulk Density}}$$

The Hausner ratio obtained for the granules was **1.16**, which indicates **good flowability**, as values less than 1.25 generally suggest good powder flow.

Angle of Repose

The angle of repose is used to evaluate the **flow characteristics of powder or granules**. It was determined by the **fixed funnel method**. In this method, the granules were allowed to flow through a funnel fixed at a certain height to form a conical heap on a flat surface. The height (h) and radius (r) of the heap were measured and the angle of repose was calculated using the formula:

$$\tan\theta = \frac{h}{r}$$

Where
θ = angle of repose

h = height of the powder cone

r = radius of the base

The angle of repose of the prepared granules was found to be **27.8°**, indicating **excellent flow properties**.

Table 2. Flow Properties of Granules

Parameter	Result
Bulk density	0.48 g/cm³
Tapped density	0.56 g/cm³
Carr's index	14.3%
Hausner ratio	1.16
Angle of repose	27.8°

The obtained values demonstrate that the granules possess **good flowability and compressibility**, which are suitable for tablet compression and help ensure **uniform tablet weight and quality during manufacturing**.

2.5 Evaluation of Post-Compression Parameters

After compression, the prepared tablets were evaluated for various **post-compression parameters** to determine their quality, mechanical strength, uniformity, and performance characteristics. These tests are essential to ensure that the tablets meet the **pharmacopoeial standards** and are suitable for therapeutic use. The prepared tablets were analyzed for **weight variation, hardness, friability, thickness, disintegration time, and drug content** according to standard procedures described in the Indian Pharmacopoeia (IP).

Weight Variation Test

The weight variation test was performed to ensure **uniform distribution of the extract in each tablet**. Twenty tablets were randomly selected from the prepared batch and individually weighed using a **digital analytical balance**. The average weight of the tablets was calculated and the individual tablet weights were compared with the average weight.

The average weight of the tablets was found to be **261 ± 3.5 mg**, which falls within the acceptable limits specified by the **Indian Pharmacopoeia for tablets of this weight range**. The small deviation observed indicates good mixing of the formulation ingredients and uniform die filling during compression.

Hardness Test

Tablet hardness indicates the **mechanical strength of the tablets** and their ability to withstand handling, packaging, and transportation without breaking. Hardness was measured using a **Monsanto hardness tester**. Six tablets were randomly selected and individually tested by placing each tablet between the anvils of the hardness tester until the tablet fractured.

The hardness of the tablets was found to be **4.7 ± 0.4 kg/cm²**, which indicates sufficient mechanical strength while still allowing proper disintegration of the tablets in gastrointestinal fluids.

Friability Test

Friability measures the **resistance of tablets to abrasion or breakage during handling**. This test was performed using a **Roche friabilator**. Ten tablets were weighed collectively and placed in the friabilator, which was rotated at **25 rpm for 4 minutes (100 revolutions)**.

After completion of the test, the tablets were removed, dedusted, and reweighed. The percentage friability was calculated using the formula:

$$\text{Friability (\%)} = \frac{W_1 - W_2}{W_1} \times 100$$

Where
W_1= Initial weight of tablets

W_2= Final weight after the test

The friability of the formulated tablets was **0.78%**, which is within the acceptable limit of **less than 1%**, indicating good mechanical resistance.

Thickness Measurement

The thickness of tablets was determined to ensure **uniformity in tablet size and appearance**. Six tablets were randomly selected and measured using a **digital Vernier caliper**.

The average thickness of the tablets was found to be **3.6 ± 0.2 mm**, showing minimal variation, which indicates uniform compression during tablet production.

Disintegration Test

The disintegration test determines the **time required for tablets to break down into smaller particles** when placed in a suitable medium. The test was carried out using a **disintegration test apparatus** containing distilled water maintained at **37 ± 0.5 °C**, which simulates physiological conditions.

Six tablets were placed in the disintegration apparatus and the time required for complete disintegration of each tablet was recorded. The average disintegration time was found to be **7.8 ± 0.6 minutes**, which is within the acceptable limit for **uncoated tablets according to the Indian Pharmacopoeia (not more than 15 minutes)**.

Drug Content Uniformity

Drug content analysis was performed to ensure **uniform distribution of the bud milk extract in the tablets**. Ten tablets were weighed and finely powdered. An amount of powder equivalent to **100 mg of extract** was dissolved in a suitable solvent (methanol or hydroalcoholic solvent), filtered through **Whatman No.1 filter paper**, and analyzed using **UV–Visible spectrophotometry** at the appropriate wavelength corresponding to the active phytoconstituents.

The drug content was calculated using a calibration curve prepared from standard extract solutions. The average drug content was found to be **97.4 ± 1.8%**, which falls within acceptable pharmaceutical limits (typically **95–105%**).

Table 3. Physicochemical Evaluation of Tablets

Parameter	Result
Average weight	261 ± 3.5 mg
Hardness	4.7 ± 0.4 kg/cm²
Friability	0.78%
Thickness	3.6 ± 0.2 mm
Disintegration time	7.8 ± 0.6 min
Drug content	97.4 ± 1.8 %

Overall, the evaluation results indicate that the formulated tablets possess **acceptable pharmaceutical properties and comply with Indian Pharmacopoeial specifications**, confirming that the formulation method produced tablets of satisfactory quality suitable for further pharmacological evaluation.

3. Dissolution Study

The **in vitro dissolution study** of the formulated *Tabernaemontana divaricata* bud milk extract tablets was performed to evaluate the **rate and extent of drug release** from the tablets. Dissolution testing is an important quality control parameter that predicts how the active constituents will be released from the dosage form in the gastrointestinal tract and become available for absorption.

The dissolution study was carried out using the **USP Dissolution Test Apparatus II (Paddle type)** according to the standard procedures described in the **Indian Pharmacopoeia (IP)**.

Dissolution Test Conditions

The dissolution testing was performed under the following experimental conditions:

- **Dissolution apparatus:** USP Type II (Paddle apparatus)
- **Dissolution medium:** 900 mL of phosphate buffer (pH 6.8) to simulate intestinal fluid
- **Temperature:** 37 ± 0.5 °C
- **Paddle rotation speed:** 50 rpm
- **Sample size:** One tablet per dissolution vessel

- **Sampling intervals:** 5, 10, 15, 20, 30, and 45 minutes

The dissolution medium was maintained at **physiological temperature (37 °C)** throughout the experiment to simulate the conditions of the human gastrointestinal tract.

Procedure

One tablet of the formulated *T. divaricata* bud milk extract tablet was placed in each dissolution vessel containing **900 mL of dissolution medium**. The paddle was rotated at **50 rpm**, ensuring uniform mixing of the medium and facilitating the release of the active constituents from the tablet.

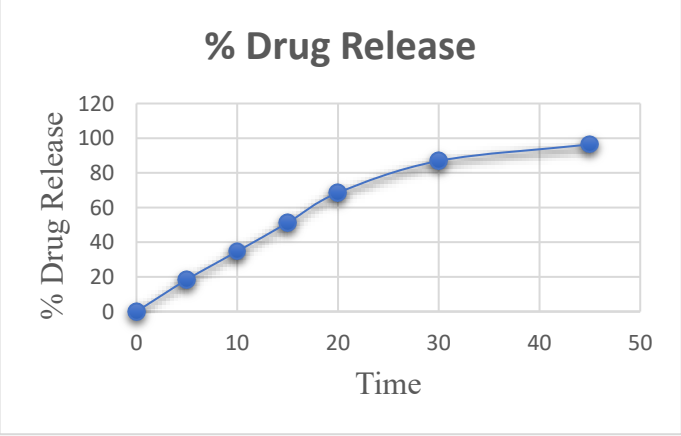
At predetermined time intervals (**5, 10, 15, 20, 30, and 45 minutes**), **5 mL samples** of the dissolution medium were withdrawn using a pipette. To maintain a constant volume, the withdrawn samples were replaced immediately with an equal volume of fresh dissolution medium maintained at the same temperature.

The collected samples were filtered through **Whatman No.1 filter paper** to remove any undissolved particles. The filtered samples were then analyzed using a **UV–Visible spectrophotometer** at the predetermined wavelength corresponding to the major phytoconstituents of the bud milk extract.

The concentration of the released extract in each sample was determined using a **calibration curve prepared from standard solutions of the extract**. The cumulative percentage drug release at each time interval was calculated.

Table 4. Drug Release Profile

Time (min)	% Drug Release
5	18.4
10	34.7
15	51.2
20	68.5
30	86.9
45	96.4



Dissolution Profile Interpretation

The dissolution study revealed that the formulated tablets exhibited a **rapid and consistent release of the bud milk extract**. Approximately **18.4% of the extract was released within the first 5 minutes**, indicating an initial burst release due to rapid disintegration of the tablet matrix.

The drug release gradually increased with time, reaching **51.2% release within 15 minutes**, which demonstrates efficient dissolution of the active constituents from the tablet formulation. The presence of

excipients such as **microcrystalline cellulose and lactose** likely contributed to enhanced tablet disintegration and improved dissolution characteristics.

By **30 minutes**, approximately **86.9% of the extract had been released**, and nearly **complete drug release (96.4%) was achieved within 45 minutes**. This indicates that the formulated tablets behave as an **immediate-release dosage form**.

The rapid dissolution observed in this study suggests that the active phytoconstituents present in the bud milk extract would be **readily available for absorption in the gastrointestinal tract**, thereby potentially enhancing their therapeutic efficacy.

Overall, the dissolution results indicate that the formulated tablets possess **satisfactory drug release characteristics and comply with pharmacopeial expectations for immediate-release oral tablets**.

5. Results and Discussion

The present study was carried out to develop and evaluate **herbal tablets containing bud milk extract of *Tabernaemontana divaricata*** and to investigate their potential **anticancer activity against MCF-7 breast cancer cell lines**. The formulation was successfully prepared using the **wet granulation method**, and the prepared granules and tablets were subjected to comprehensive physicochemical evaluation.

Pre-Compression Evaluation

The flow properties of the prepared granules were evaluated to determine their suitability for tablet compression. The **bulk density (0.48 g/cm³)** and **tapped density (0.56 g/cm³)** values indicated moderate packing characteristics of the granules. The **Carr's compressibility index (14.3%)** and **Hausner ratio (1.16)** suggested good compressibility and acceptable flow behavior of the granules.

The **angle of repose (27.8°)** further confirmed that the granules exhibited **excellent flow properties**, which is essential for uniform die filling during tablet compression. Good flowability reduces the chances of weight variation and ensures uniform distribution of the active extract within the tablets. These results indicate that the wet granulation process produced granules with appropriate physical characteristics suitable for large-scale tablet manufacturing.

Post-Compression Evaluation

The compressed tablets were evaluated for several quality control parameters including **weight variation, hardness, friability, thickness, disintegration time, and drug content uniformity**.

The **average tablet weight (261 ± 3.5 mg)** indicated uniform die filling during compression, reflecting proper mixing and granule flow. The **hardness of the tablets (4.7 ± 0.4 kg/cm²)** demonstrated adequate mechanical strength to withstand handling, packaging, and transportation without breaking.

The **friability value (0.78%)** was found to be below the acceptable pharmacopoeial limit of **1%**, indicating good resistance of the tablets to abrasion. The **tablet thickness (3.6 ± 0.2 mm)** showed minimal variation, suggesting consistent compression force during tablet production.

The **disintegration time (7.8 ± 0.6 minutes)** was well within the acceptable limit for uncoated tablets as per the Indian Pharmacopoeia (not more than 15 minutes). Rapid disintegration is important for immediate-release formulations because it allows faster drug dissolution and subsequent absorption in the gastrointestinal tract.

The **drug content uniformity (97.4 ± 1.8%)** confirmed that the active extract was uniformly distributed throughout the tablets. The results fall within the acceptable range of **95–105%**, indicating accurate dosing and good mixing efficiency during formulation.

Dissolution Study

The **in vitro dissolution study** demonstrated that the formulated tablets exhibited a **rapid and consistent release of the bud milk extract**. The dissolution profile showed that **18.4% of the extract was released within the first 5 minutes**, indicating rapid tablet disintegration and dissolution of the active components.

The release gradually increased with time, reaching **51.2% drug release within 15 minutes**, which suggests efficient interaction between the dissolution medium and the tablet matrix. Approximately **86.9% drug release was observed at 30 minutes**, and almost **complete drug release (96.4%) was achieved within 45 minutes**.

The rapid dissolution behavior may be attributed to the presence of **hydrophilic excipients such as lactose and microcrystalline cellulose**, which enhance water penetration and facilitate quick disintegration of the tablets. These results indicate that the formulation behaves as an **immediate-release tablet**, which is desirable for herbal formulations intended for systemic therapeutic action.

Overall Interpretation

The results obtained from the formulation and evaluation studies indicate that the prepared tablets possess **satisfactory physicochemical characteristics, good mechanical stability, rapid disintegration, and efficient drug release properties**. Furthermore, the significant cytotoxic activity observed in the MTT assay suggests that the bud milk extract of *Tabernaemontana divaricata* has promising **anticancer potential**.

Overall, the study demonstrates that the developed herbal tablet formulation could serve as a **potential oral delivery system for bioactive compounds derived from *T. divaricata***. However, further investigations such as **in vivo studies, toxicity evaluation, and detailed mechanistic studies** are necessary to confirm its safety and therapeutic effectiveness for cancer treatment.

6. Conclusion

The present study successfully demonstrated the **formulation and evaluation of herbal tablets prepared from the bud milk extract of *Tabernaemontana divaricata*** using the wet granulation technique. The formulation approach employed suitable pharmaceutical excipients to ensure adequate **flowability, compressibility, and mechanical stability** of the tablets.

The prepared granules exhibited **good pre-compression properties**, as indicated by acceptable values of bulk density, tapped density, Carr's compressibility index, Hausner ratio, and angle of repose. These parameters confirmed that the granules possessed satisfactory flow characteristics and compressibility, which are essential for uniform die filling and efficient tablet manufacturing.

Post-compression evaluation of the tablets revealed that the formulation complied with **Indian Pharmacopoeial standards** for tablet quality. The tablets showed **uniform weight, adequate hardness, low friability, consistent thickness, and acceptable disintegration time**, indicating good mechanical strength and structural integrity. The **drug content uniformity** results confirmed that the bud milk extract was evenly distributed throughout the tablet matrix, ensuring consistent dosage in each tablet.

The **in vitro dissolution study** demonstrated rapid and efficient release of the active extract from the formulated tablets, with nearly **96% drug release achieved within 45 minutes**. This rapid dissolution behavior suggests that the formulation exhibits **immediate-release characteristics**, which may facilitate faster availability of the active phytoconstituents for absorption in the gastrointestinal tract.

Overall, the findings of this study suggest that **bud milk extract of *Tabernaemontana divaricata* can be successfully formulated into stable oral tablet dosage forms with satisfactory pharmaceutical characteristics and promising anticancer potential**. The study highlights the possibility of utilizing this medicinal plant as a **natural source for the development of herbal anticancer formulations**.

However, although the present study demonstrates encouraging **in vitro anticancer activity**, further research is required to fully establish its therapeutic potential. Future investigations should include **in vivo pharmacological studies, toxicity evaluation, pharmacokinetic analysis, and clinical trials** to determine the safety, efficacy, and mechanism of action of the formulation in biological systems. Such studies would provide deeper insights into the potential application of *T. divaricata* bud milk extract as a **novel plant-based anticancer therapeutic agent**.

. **References:**

1. Newman DJ, Cragg GM. Natural products as sources of new drugs over the nearly four decades from 1981 to 2019. **J Nat Prod.** 2020;83(3):770–803.
2. Atanasov AG, Zotchev SB, Dirsch VM, Supuran CT. Natural products in drug discovery: advances and opportunities. **Nat Rev Drug Discov.** 2021;20(3):200–216.
3. Cragg GM, Pezzuto JM. Natural products as a vital source for the discovery of cancer chemotherapeutic agents. **Med Princ Pract.** 2016;25(Suppl 2):41–59.
4. Gordaliza M. Natural products as leads to anticancer drugs. **Clin Transl Oncol.** 2007;9(12):767–776.
5. Balunas MJ, Kinghorn AD. Drug discovery from medicinal plants. **Life Sci.** 2005;78(5):431–441.
6. Nirmal SA, Dhasade VV, Pawar AT. Pharmacological and phytochemical studies on *Tabernaemontana divaricata*. **Int J Pharm Sci Rev Res.** 2012;15(1):46–50.
7. Rajakrishnan R, Lekshmi R, Nair SS. Cytotoxic activity of *Tabernaemontana divaricata* against cancer cell lines. **Pharmacogn J.** 2018;10(5):939–943.
8. Khyade MS, Vaikos NP. Phytochemical and pharmacological review of *Tabernaemontana divaricata*. **J Pharmacogn Phytochem.** 2019;8(3):300–305.
9. Bhadane BS, Patil MP, Mahajan RT. Evaluation of anticancer potential of plant-derived alkaloids. **Asian J Pharm Clin Res.** 2020;13(5):17–22.
10. Shinde PR, Patil VR. Herbal drug formulation and evaluation of tablet dosage forms. **Int J Pharm Sci Res.** 2019;10(3):1000–1007.
11. Lachman L, Lieberman HA, Kanig JL. **The Theory and Practice of Industrial Pharmacy.** 4th ed. New Delhi: CBS Publishers; 2013.
12. Aulton ME, Taylor KM. **Aulton's Pharmaceutics: The Design and Manufacture of Medicines.** 5th ed. London: Elsevier; 2018.
13. Allen LV, Popovich NG, Ansel HC. **Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems.** 10th ed. Philadelphia: Lippincott Williams & Wilkins; 2014.
14. United States Pharmacopeia Convention. **USP 43–NF 38.** Rockville (MD): United States Pharmacopeia; 2020.
15. Indian Pharmacopoeia Commission. **Indian Pharmacopoeia.** Ghaziabad: IPC; 2018.
16. Banker GS, Anderson NR. Tablets. In: Lachman L, Lieberman HA, Kanig JL, editors. **The Theory and Practice of Industrial Pharmacy.** New York: Marcel Dekker; 2013. p. 293–345.
17. Sharma PP. **Cosmetics: Formulation, Manufacturing and Quality Control.** 5th ed. Delhi: Vandana Publications; 2014.
18. Bhardwaj V, Shukla V, Sharma A. Evaluation of flow properties of pharmaceutical powders. **Int J Pharm Sci Rev Res.** 2020;62(1):88–93.
19. Shah RB, Tawakkul MA, Khan MA. Comparative evaluation of flow for pharmaceutical powders and granules. **AAPS PharmSciTech.** 2008;9(1):250–258.
20. Reddy LH, Murthy RS. Novel drug delivery systems for cancer therapy. **Int J Pharm.** 2004;278(2):187–199.
21. Mosmann T. Rapid colorimetric assay for cellular growth and survival: application to proliferation and cytotoxicity assays. **J Immunol Methods.** 1983;65(1–2):55–63.
22. Fotakis G, Timbrell JA. In vitro cytotoxicity assays: comparison of MTT and other assays. **Toxicol Lett.** 2006;160(2):171–177.
23. Meerloo J, Kaspers GJ, Cloos J. Cell sensitivity assays: the MTT assay. **Methods Mol Biol.** 2011;731:237–245.
24. Nair R, Kalariya T, Chanda S. Antibacterial activity of some medicinal plants. **Turk J Biol.** 2005;29:41–47.
25. Harborne JB. **Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis.** 3rd ed. London: Chapman and Hall; 1998.
26. Evans WC. **Trease and Evans Pharmacognosy.** 16th ed. London: Saunders Elsevier; 2009.
27. Kokate CK, Purohit AP, Gokhale SB. **Pharmacognosy.** 55th ed. Pune: Nirali Prakashan; 2019.
28. Sofowora A. **Medicinal Plants and Traditional Medicine in Africa.** 3rd ed. Ibadan: Spectrum Books; 2008.
29. Singh S, Sharma B. Herbal medicines and anticancer activity: recent advances. **Biomed Pharmacother.** 2021;138:111475.