



Formulation Development and Evaluation of Directly Compressed Polyherbal Tablets Containing Plant Extracts

Ranu Gupta¹, CH KVLSN Anjana Male^{2*}, Subodh Dubey³

¹ Research Scholar, School of Pharmacy, ITM University, Gwalior, Madhya Pradesh, India

² Professor, School of Pharmacy, ITM University, Gwalior, Madhya Pradesh, India

³ Dean, School of Pharmacy, Vikrant University, Gwalior, Madhya Pradesh, India

*Corresponding Author: CH KVLSN Anjana Male, Professor, School of Pharmacy, ITM University, Gwalior, Madhya Pradesh, India, Email: anjana.male@gmail.com

Abstract

Polyherbal formulations combine multiple medicinal plants to achieve synergistic therapeutic effects and improved efficacy. The present study aimed to formulate and evaluate polyherbal tablets containing extracts of *Gymnema sylvestre*, *Vinca rosea*, *Cinnamomum zeylanicum*, and *Eugenia jambolana* using the direct compression technique. Five formulations (PHF-1 to PHF-5) were prepared by varying the proportions of ethanolic and aqueous extracts of the selected medicinal plants. Microcrystalline cellulose, lactose, starch, polyvinylpyrrolidone (PVP K-30), talc, and magnesium stearate were used as excipients. The powder blends were evaluated for bulk density, tapped density, angle of repose, Carr's index, and Hausner's ratio. Compressed tablets were evaluated for weight variation, hardness, friability, and disintegration time according to pharmacopeial procedures. All powder blends exhibited satisfactory flow properties with angle of repose values below 30°, Carr's index ranging from 11.8–16.0%, and Hausner's ratio below 1.25. The compressed tablets complied with pharmacopeial specifications for weight variation. Tablet hardness ranged from 4.5–6.2 kg/cm², friability was below 1%, and disintegration time ranged from 9.8–13.5 minutes. Among all formulations, PHF-3 and PHF-4 demonstrated superior pre-compression and post-compression characteristics. The direct compression method successfully produced polyherbal tablets with acceptable pharmaceutical properties. Formulations PHF-3 and PHF-4 showed optimum flowability, compressibility, mechanical strength, and disintegration behavior, making them suitable candidates for further pharmacological investigations.

Keywords: Polyherbal tablets, Direct compression, *Gymnema sylvestre*, *Vinca rosea*, *Cinnamomum zeylanicum*, *Eugenia jambolana*, Tablet evaluation.

Introduction

Medicinal plants have been extensively used in traditional systems of medicine for the prevention and treatment of various diseases. Polyherbal formulations are based on the concept that the therapeutic efficacy of herbal medicines can be enhanced by combining multiple herbs with complementary pharmacological actions. Such combinations may provide synergistic effects, reduce toxicity, and improve patient compliance compared with single-herb formulations [1].

Gymnema sylvestre is traditionally recognized for its antidiabetic activity and its ability to regulate glucose metabolism [2]. *Vinca rosea* (*Catharanthus roseus*) contains biologically active alkaloids and has been reported to possess antidiabetic and antioxidant properties [3]. *Cinnamomum zeylanicum* has demonstrated hypoglycemic, anti-inflammatory, and antioxidant effects owing to its rich phytochemical composition [4]. *Eugenia jambolana* (*Syzygium cumini*) seeds are widely used in traditional medicine for glycemic control and metabolic disorders [5].

Tablet dosage forms remain one of the most preferred pharmaceutical preparations because of their convenience, stability, accurate dosing, and patient acceptability. Direct compression is a simple and economical tablet manufacturing method requiring fewer processing steps and reduced production costs [6]. Therefore, the present investigation was undertaken to formulate polyherbal tablets using extracts of *Gymnema sylvestre*, *Vinca rosea*, *Cinnamomum zeylanicum*, and *Eugenia jambolana* and to evaluate their pharmaceutical properties.

Materials and Methods

Materials

Ethanolic and aqueous extracts of *Gymnema sylvestre* leaves, *Vinca rosea* whole plant, *Cinnamomum zeylanicum* bark, and *Eugenia jambolana* seeds were used. Microcrystalline cellulose, lactose, starch, polyvinylpyrrolidone (PVP K-30), talc, and magnesium stearate served as pharmaceutical excipients.

Preparation of Polyherbal Tablets

The polyherbal tablets were prepared by the direct compression method. All dried extracts were pulverized and passed through sieve number 60. The required quantities of extracts were weighed accurately and blended geometrically. Excipients were similarly sieved and mixed thoroughly with the herbal extracts. Talc and magnesium stearate were added at the final stage and blended gently. The final powder blends were compressed using a rotary tablet compression machine to obtain tablets of 500 mg weight.

Table 1. Composition of Polyherbal Tablet Formulations (mg/tablet)

Ingredients	PHF-1	PHF-2	PHF-3	PHF-4	PHF-5
GS Ethanolic Extract	40	50	60	70	80
GS Aqueous Extract	40	30	20	10	10
VR Ethanolic Extract	40	50	60	70	80
VR Aqueous Extract	40	30	20	10	10
CZ Ethanolic Extract	30	40	50	60	70
CZ Aqueous Extract	30	20	10	10	10
EJ Ethanolic Extract	30	40	50	60	70
EJ Aqueous Extract	30	20	10	10	10
Microcrystalline Cellulose	90	90	90	80	70
Lactose	60	60	50	40	30
Starch	25	25	25	25	25
PVP K-30	10	10	10	10	10
Talc	3	3	3	3	3
Magnesium Stearate	2	2	2	2	2
Total Weight (mg)	500	500	500	500	500

Evaluation of Powder Blends

The powder blends were evaluated for bulk density, tapped density, angle of repose, Carr's compressibility index, and Hausner's ratio according to standard procedures [7].

Evaluation of Tablets

Prepared tablets were evaluated for weight variation, hardness, friability, and disintegration time according to pharmacopeial guidelines [8].

Results and Discussion

Pre-compression Evaluation

All formulations exhibited satisfactory micromeritic properties suitable for direct compression. Bulk density ranged from 0.42–0.46 g/cm³, while tapped density varied between 0.50 and 0.53 g/cm³. Angle of repose values below 30° indicated good flow behavior. Carr's index values between 11.8 and 16.0% suggested fair to good compressibility, and Hausner's ratio values below 1.25 confirmed acceptable flowability. PHF-3 and PHF-4 showed comparatively superior flow and packing characteristics [9].

Table 2. Pre-compression Parameters

Formulation	Bulk Density (g/cm ³)	Tapped Density (g/cm ³)	Angle of Repose (°)	Carr's Index (%)	Hausner's Ratio
PHF-1	0.42 ± 0.02	0.50 ± 0.02	29.5 ± 0.8	16.0 ± 0.6	1.19 ± 0.03
PHF-2	0.44 ± 0.01	0.52 ± 0.02	28.8 ± 0.7	15.3 ± 0.5	1.18 ± 0.02
PHF-3	0.46 ± 0.02	0.53 ± 0.01	27.6 ± 0.6	13.2 ± 0.4	1.15 ± 0.02
PHF-4	0.45 ± 0.01	0.51 ± 0.02	26.9 ± 0.5	11.8 ± 0.3	1.13 ± 0.01
PHF-5	0.43 ± 0.02	0.50 ± 0.02	29.2 ± 0.7	14.0 ± 0.5	1.16 ± 0.02

Post-compression Evaluation

The tablets complied with pharmacopeial standards for weight variation. Hardness values indicated adequate mechanical strength, while friability values below 1% confirmed resistance to abrasion [10]. Disintegration times were within acceptable limits for conventional tablets. PHF-3 and PHF-4 showed the most balanced characteristics with optimum hardness and rapid disintegration.

Table 3. Post-compression Parameters

Formulation	Weight Variation (mg)	Hardness (kg/cm ²)	Friability (%)	Disintegration Time (min)
PHF-1	498 ± 5	4.5 ± 0.2	0.82 ± 0.03	13.5 ± 0.5
PHF-2	502 ± 4	5.0 ± 0.3	0.75 ± 0.02	12.2 ± 0.4
PHF-3	500 ± 3	5.8 ± 0.2	0.60 ± 0.02	10.5 ± 0.3
PHF-4	499 ± 4	6.2 ± 0.3	0.55 ± 0.01	9.8 ± 0.2
PHF-5	501 ± 5	5.2 ± 0.2	0.68 ± 0.02	11.6 ± 0.4

The improved performance of PHF-3 and PHF-4 may be attributed to the balanced ratio of herbal extracts and excipients, resulting in better powder flow, compression characteristics, and tablet integrity. These findings indicate the suitability of direct compression for the development of stable polyherbal tablet formulations.

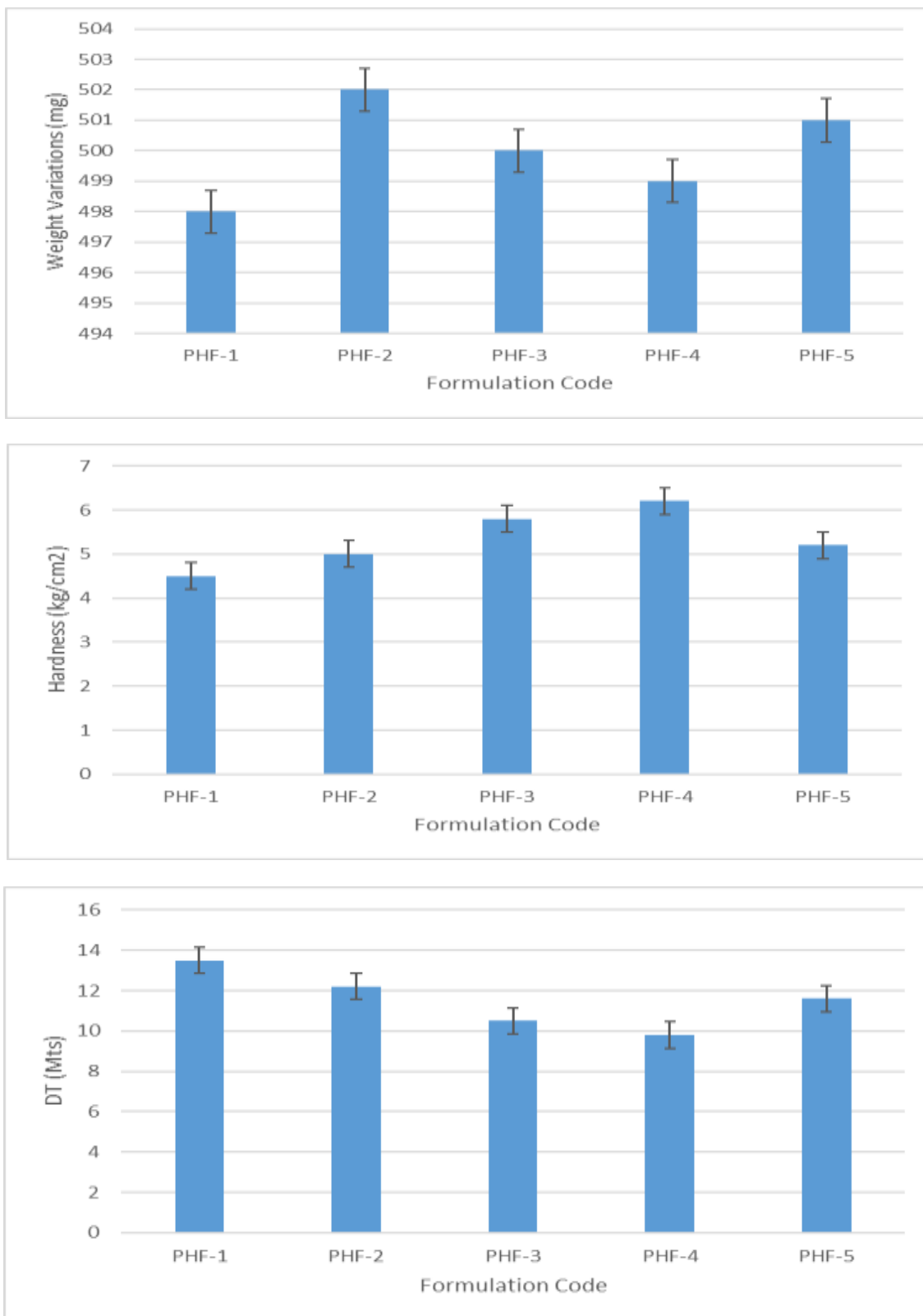


Figure 1: Evaluation Parameters of Polyherbal Formulation Tablets

Conclusion

Polyherbal tablets containing extracts of *Gymnema sylvestre*, *Vinca rosea*, *Cinnamomum zeylanicum*, and *Eugenia jambolana* were successfully prepared by direct compression. All formulations demonstrated acceptable pre-compression and post-compression properties. PHF-3 and PHF-4 exhibited superior pharmaceutical performance and may be considered optimized formulations for future pharmacological and stability studies.

References

1. Mukherjee PK. Quality Control and Evaluation of Herbal Drugs. New Delhi: Elsevier; 2019.
2. Tiwari P, Mishra BN, Sangwan NS. Phytochemical and pharmacological properties of *Gymnema sylvestre*. Biomed Res Int. 2014;2014:830285.
3. Patil PJ, Ghosh JS. Antidiabetic activity of *Catharanthus roseus*. J Clin Diagn Res. 2010;4:2450-5.

4. Ranasinghe P, Piger S, Premakumara GS, Galappaththy P, Constantine GR, Katulanda P. Medicinal properties of true cinnamon. *BMC Complement Altern Med.* 2013;13:275.
5. Baliga MS, Bhat HP, Baliga BR, Wilson R, Palatty PL. Phytochemistry and medicinal uses of *Syzygium cumini*. *Food Res Int.* 2011;44(7):1776-89.
6. Aulton ME, Taylor K. *Aulton's Pharmaceutics: The Design and Manufacture of Medicines.* 6th ed. London: Elsevier; 2022.
7. *United States Pharmacopeia 47–National Formulary 42.* Rockville, MD: USP Convention; 2024.
8. *Indian Pharmacopoeia Commission. Indian Pharmacopoeia.* Ghaziabad: IPC; 2022.
9. Shrivastava, R. (2025). Impact of Climate Change on Photosynthesis and Plant Productivity, *SARPS: Journal of Advanced Research in Plant Science*, 1(1), 5-7. <https://doi.org/10.29121/SARPS.v1.i1.2025.2>
10. Naram, S., Mahajan, D., & Parekh, H. (2024). A Randomized, Open Labelled, Controlled Equivalence Pilot Drug Trial to Evaluate Effect of Polyherbal Formulations, Efficacy and Safety of Modified Panchakarma Treatment Plan Obetox in Patients with Obesity (MEDOROG). *Journal of Ayurvedic Herbal and Integrative Medicine*, 4(2), 1–8. <https://doi.org/10.29121/jahim.v4.i2.2024.60>