

Formulation of Medicated Chocolates Coated Tablet Fortified with Maca Root Powder for Menstrual Pain Relief

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Abstract: Menstrual disorders such as dysmenorrhea, abdominal cramps, fatigue, mood swings, and irregular menstrual cycles are common problems affecting many women worldwide. These conditions can negatively affect physical health, daily activities, and quality of life. Herbal medicines and nutraceutical products are increasingly preferred for menstrual relief because they are considered safer and produce fewer side effects compared to synthetic drugs.

Keywords: Menstrual disorders

I. INTRODUCTION

Menstrual disorders such as dysmenorrhea, abdominal cramps, fatigue, mood swings, and irregular menstrual cycles are common problems affecting many women worldwide. These conditions can negatively affect physical health, daily activities, and quality of life. Herbal medicines and nutraceutical products are increasingly preferred for menstrual relief because they are considered safer and produce fewer side effects compared to synthetic drugs.

Maca Root is a medicinal plant traditionally used for improving hormonal balance, energy, stamina, and women's reproductive health. It contains important bioactive constituents such as alkaloids, flavonoids, vitamins, minerals, and amino acids that may help reduce menstrual discomfort and improve overall well-being.

The present project focuses on the formulation and evaluation of a medicated chocolate-coated tablet fortified with maca root powder for menstrual relief. Chocolate coating is used to improve the taste, appearance, palatability, and patient compliance of the tablet. The coating also helps in masking the unpleasant odor and bitterness of herbal ingredients while providing an attractive dosage form.

The formulated tablets were evaluated for various pre-formulation and post-formulation parameters such as bulk density, tapped density, angle of repose, Carr's index, Hausner's ratio, hardness, friability, weight variation, thickness, and disintegration time to ensure the quality, stability, and effectiveness of the formulation.

This project aims to develop a safe, effective, and patient-friendly herbal medicated chocolate-coated tablet that may help in providing relief from menstrual discomfort naturally.

Menstruation is a natural physiological process experienced by women during their reproductive age. Although it is a normal biological function, many women suffer from various menstrual problems such as dysmenorrhea (painful menstruation), abdominal cramps, headache, fatigue, nausea, mood swings, weakness, and irregular menstrual cycles. These symptoms can affect the physical, emotional, and social well-being of women and may interfere with their daily routine and quality of life. The increasing prevalence of menstrual discomfort among young women has created a need for safer and more effective therapeutic approaches.

Conventional synthetic medicines such as analgesics and hormonal therapies are commonly used for menstrual relief. However, prolonged use of these medications may lead to side effects including gastric irritation, hormonal imbalance, nausea, dizziness, and dependency. Due to these limitations, herbal medicines and nutraceutical formulations have gained significant attention in recent years. Herbal remedies are widely accepted because they are considered natural, economical, easily available, and comparatively safer for long-term use.



Maca Root, scientifically known as *Lepidium meyenii*, is a medicinal plant belonging to the Brassicaceae family. It is traditionally cultivated in the Andean region of Peru and has been used for centuries as a nutritional and medicinal herb. Maca root is rich in bioactive constituents such as alkaloids, flavonoids, tannins, amino acids, vitamins, minerals, sterols, and carbohydrates. These phytochemicals are known to possess adaptogenic, antioxidant, anti-inflammatory, and hormone-balancing properties. Maca root is commonly used to improve reproductive health, enhance stamina and energy, reduce fatigue, regulate hormonal imbalance, and relieve menstrual discomfort in women.

Research studies have suggested that maca root may help reduce menstrual cramps, improve mood changes associated with menstruation, and support hormonal balance naturally. Due to its therapeutic potential and nutritional benefits, maca root powder was selected as the active herbal ingredient in the present formulation.

Tablet dosage forms are one of the most commonly used pharmaceutical preparations because of their convenience, accurate dosing, stability, ease of administration, and cost-effectiveness. However, herbal tablets often possess an unpleasant taste, odor, and rough texture, which may reduce patient acceptability and compliance. To overcome these disadvantages, tablet coating techniques are widely employed in pharmaceutical industries.

Chocolate coating is an innovative and patient-friendly coating method used to improve the palatability and appearance of tablets. Chocolate possesses a pleasant taste, attractive aroma, smooth texture, and good mouthfeel, making it highly acceptable among consumers. Chocolate coating helps in masking the bitter taste and unpleasant odor of herbal ingredients while also enhancing the aesthetic appearance of the dosage form. In addition, chocolate contains compounds such as flavonoids and theobromine that may provide mood-enhancing and antioxidant effects.

The present project is based on the formulation and evaluation of a medicated chocolate-coated tablet fortified with maca root powder for menstrual relief. The formulation was designed to combine the therapeutic benefits of maca root with the improved palatability and patient compliance offered by chocolate coating. The medicated chocolate-coated tablet aims to provide a natural, convenient, and acceptable herbal dosage form for women suffering from menstrual discomfort.

Before formulation, pre-formulation studies were carried out to evaluate the physical and flow properties of the powder blend. These studies included bulk density, tapped density, angle of repose, Carr's index, and Hausner's ratio. Pre-formulation studies are important because they help determine the suitability of the powder for tablet compression and ensure uniformity in the manufacturing process.

The prepared tablets were further subjected to various post-formulation evaluation tests to ensure their quality, safety, and effectiveness. These tests included hardness test, friability test, weight variation test, thickness test, disintegration test, and organoleptic evaluation such as color, odor, taste, and texture. The hardness test was performed to determine the mechanical strength of the tablets, while friability testing was carried out to evaluate resistance to breakage during handling and transportation. Weight variation testing ensured uniformity of dosage, and disintegration testing determined the time required for the tablet to break down into smaller particles for drug release.

Chocolate coating was applied to the formulated tablets to improve appearance, taste masking, and patient compliance. The coating process also helped in protecting the tablet from environmental factors such as moisture and oxidation. The final coated tablets showed good appearance, acceptable hardness, low friability, uniform weight variation, and satisfactory disintegration properties.

The development of herbal formulations for menstrual relief is becoming increasingly important due to growing awareness regarding natural therapies and women's healthcare. Herbal medicated chocolate-coated tablets may provide several advantages including improved patient acceptability, reduced side effects, better taste masking, ease of administration, and enhanced therapeutic value.

Therefore, the present study was undertaken to formulate and evaluate a medicated chocolate-coated tablet fortified with maca root powder for menstrual relief. The project mainly focuses on developing a stable, safe, effective, and patient-friendly herbal dosage form that can provide natural support for menstrual health and improve the overall quality of life of women.





Fig. Maca root

II. LITERATURE REVIEW

1. **Lee J. Smith et al. (2023)**, conducted a study on herbal nutraceutical formulations for women's health management using natural plant extracts. The study focused on improving hormonal balance, reducing fatigue, and managing menstrual discomfort. The prepared formulations were evaluated for physical appearance, stability, hardness, friability, and disintegration time. The results indicated that herbal formulations showed good stability, acceptable organoleptic properties, and effective therapeutic activity for menstrual wellness.
2. **Payal M. Oak et al. (2019)**, formulated and evaluated herbal formulations containing plant extracts with therapeutic and antioxidant properties. The prepared formulations were subjected to evaluation parameters such as pH, homogeneity, spreadability, stability, and appearance. The study concluded that herbal products are safer, effective, and suitable for improving patient compliance due to their natural origin and minimal side effects.
3. **R. Chandrasekar et al. (2018)**, prepared and evaluated polyherbal formulations using medicinal plant extracts possessing anti-inflammatory and therapeutic activities. The formulations were assessed for physicochemical parameters, microbial stability, viscosity, and organoleptic properties. The study revealed that herbal preparations exhibited good stability and effectiveness with no signs of phase separation or microbial growth.
4. **Achuta Kumar et al. (2017)**, developed stable polyherbal formulations containing various medicinal herbs for therapeutic applications. Different evaluation tests such as pH, consistency, appearance, homogeneity, spreadability, and stability studies were performed. The results demonstrated satisfactory formulation characteristics and acceptable stability profiles.
5. **Priya R. Kawthe et al. (2016)**, studied antioxidant herbal formulations prepared using natural extracts rich in flavonoids and phenolic compounds. The formulations were evaluated for antioxidant activity, physical appearance, viscosity, spreadability, and stability. The optimized formulations showed good antioxidant properties and satisfactory stability.
6. **Mili Roy et al. (2014)**, formulated and evaluated herbal preparations containing medicinal plant extracts with protective and therapeutic activities. Various parameters including pH, viscosity, spreadability, homogeneity, and stability were examined. The prepared formulations exhibited good consistency, ease of application, and no evidence of instability.
7. **Sema V. Patewar et al. (2014)**, investigated herbal products containing plant extracts rich in alkaloids, flavonoids, glycosides, and triterpenes. The study reported significant therapeutic and antimicrobial activity of herbal formulations with good physicochemical properties and stability.
8. **Sharma et al. (2013)**, formulated herbal preparations using natural extracts and evaluated them for appearance, pH, spreadability, consistency, and safety. The formulations showed good stability, easy application, and no irritation during use. The study suggested that herbal combinations may produce synergistic therapeutic effects.



9. **Kumar Sahu et al. (2012)**, developed herbal formulations using plant extracts and evaluated them for physicochemical and stability parameters. The formulations demonstrated good homogeneity, acceptable pH, spreadability, and no evidence of phase separation. The prepared herbal products were found safe and effective for therapeutic use.

Plant Profile

Biological Source

(Dried root of *Lepidium meyenii*)

Family

Brassicaceae (Cruciferae)

Common Name

(Maca, Peruvian Ginseng)

Category

(Herbal Adaptogen / Nutraceutical)

Synonyms(Maca Root, Peruvian Maca)

Part Used(Root)

Origin

Peru (Andes Mountains)

Chemical Constituents

Macamides, macaenes, flavonoids, alkaloids, polyphenols, sterols, amino acids, vitamins, and minerals

Mechanism of Action

Helps balance hormones, reduces inflammation, relaxes uterine muscles, and provides antioxidant activity

Therapeutic Uses

Menstrual pain relief, hormonal balance, energy enhancement, fertility support, stress reduction

Dose

500 mg–1000 mg per tablet; 1–2 tablets daily

Route of Administration

Oral

Dosage Form

Chocolate-coated tablet

Advantages

Natural remedy, fewer side effects, improved palatability, better patient compliance

Storage Condition

Store in a cool, dry place away from moisture and sunlight

Color

Light brown to cream-colored powder

Taste

Earthy and slightly nutty

Solubility

Partially soluble in water

Stability

Stable under normal storage conditions



III. MATERIALS AND METHODS

Materials:

Sr.No	Name of Ingredient	Grade	Suppliers
1	Maca Root Powder	Herbal grade	Herbal Supplier, India
2	Dark Chocolate	Food grade	Local Supplier
3	Glycerin	I.P.	Research Lab Fine Chem, Mumbai
4	Microcrystalline Cellulos (MCC)	I.P.	Research Lab Fine Chem, Mumbai
5	Sodium Starch Glycolate (SSG)	I.P.	Research Lab Fine Chem, Mumbai
6	Magnesium Stearate	I.P.	Research Lab Fine Chem, Mumbai
7	Talc	I.P.	Loba Chemie, Mumbai
8	Mannitol	I.P.	Research Lab Fine Chem, Mumbai
9	Gum Acacia	I.P.	BASF Chemicals
10	Sodium Saccharin	I.P.	Research Lab Fine Chem, Mumbai
11	Cocoa Powder	Food grade	Local Supplier
12	Purified Water	I.P.	Laboratory Use

Table No. 1: List of Ingredient used for tablet preparation

Sr.No.	Name of equipment	Model	Name of company
1.	Digital Balance	220H	Shimazu Japan
2.	Table compression machine	2MLH	REMI equipment
3.	Dissolute test Apparatus	UDA-8DR	-
4.	Disintegrate test	USP	GT scientific test
5.	Friability test	USP	Roche test
6.	Pfizer Hardness tester	USP	Monsanto
7.	Thickness tester	USP	Monsanto

Table No. 2: List of Equipment/Instrument used in preparation of tablet

Method

1. Preparation of Powder Blend

All the ingredients required for the tablet formulation were accurately weighed. The powders were passed through sieve no. 40 to obtain uniform particle size and remove impurities. Maca root powder, lactose, MCC, and starch were mixed thoroughly to obtain a uniform powder blend.



Fig 2. Powder blending



2. Granulation Process

A binder solution was prepared using gum acacia in purified water. The binder solution(Starch) was added slowly to the powder mixture with continuous mixing until a damp mass was formed. The prepared mass was passed through sieve no. 16 to prepare granules.



Fig 3. Starch Solution

3. Drying of Granules

The prepared granules were dried at 40–50°C until suitable dryness was achieved. After drying, the granules were again passed through the sieve to maintain uniform size.



Fig.4 :Dried granules

4. Lubrication

Magnesium stearate and talc were added to the dried granules and mixed gently for proper lubrication and flow properties.

5. Compression of Tablets

The lubricated granules were compressed into tablets using a tablet punching machine. Tablets of uniform weight and thickness were prepared.





Fig.5 :Tablet compression machine

Sr.No.	Ingredients	Quantity (Batch 1)	Quantity (Batch 2)	Role
1	Maca root powder	10 gm	20 gm	Active ing
2	Coca powder	2 gm	4 gm	Chocolate flavour
4	Sorbitol	0.6 gm	1.2 gm	Sweet diluent
5	Milk powder	2.5 gm	5.0 gm	taste enhancer
6	PVK 30 / Gum acacia	0.2 gm	0.4 gm	Binder
7	Mg.sterate	0.2 gm	0.4 gm	Lubricant
8	Talc	1.5 gm	3 gm	Glidant
9	Chocolate flavour	qs	qs	Flavouring agent

Table No 3: Formulation ofmedicated chocolates coated tablet fortified with maca

Evaluation of tablets

1. General Appearance of Chocolate Coated Tablet

Randomly select 10 tablets.Visually inspect the tablets under normal light.Observe colour, smoothness, glossiness, and coating uniformity.Check for any cracks, chipping, or sticking. General appearance of tablet is checked by following propertys,colour, odour, texter, consistency, homogeneity.

2. Weight Variation Test

Select 20 tablets randomly.Weigh all tablets individually.Calculate average weight.

Determine percentage deviation using formula:

Percentage Deviation = [(Individual Weight – Average Weight) / Average Weight] × 100

Sr No.	Weight of tablet	Sr No.	Weight of tablet
1.	0.51	11.	0.49
2.	0.52	12.	0.50
3.	0.48	13.	0.51
4.	0.50	14.	0.52
5.	0.48	15.	0.50
6.	0.49	16.	0.52



7.	0.52	17.	0.50
8.	0.51	18.	0.48
9.	0.48	19.	0.50
10 .	0.48	20.	0.49

Table no. 4 : Weight variation of tablets

Total Weight of 20 Tablets=9.98 gm

Average Weight = Total weight of tablets / Number of tablets

Average Weight = 9.98 / 20 = 0.499 g



Fig .6: Weight variation test

3. Thickness Test

Apparatus: Vernier calip



Fig.7: Thickness Test

Procedure

Select 5 tablets randomly.Measure thickness individually using Vernier caliper.Record average thickness.

Observation

Average thickness = 2.6 mm



4. Hardness Test



Fig.8: Hardness Test

Select 5 tablets randomly. Place tablet between anvils of hardness tester. Apply pressure until tablet breaks. Record hardness value.

Average hardness = 5.59kg/cm²

5. Friability Test

Apparatus: Roche friabilator



Fig.9: Friability Test



Procedure:

Weigh 10 tablets collectively (Initial weight = W_1).
Place tablets in friabilator.
Rotate at 25 rpm for 4 minutes (100 rotations).
Remove dust and reweigh tablets (Final weight = W_2).

Formula:

$$\text{Friability (\%)} = \left[\frac{(\text{Initial Weight} - \text{Final Weight})}{\text{Initial Weight}} \right] \times 100$$

Observation Example

Initial weight = 4.81 g

Final weight = 4.40g

Friability = 8.52%

6. Disintegration Test

Apparatus: USP Disintegration apparatus



Fig.10: Disintegration Test

Produce:

Medium Phosphate buffer pH 6.8 or distilled water

Temperature: $37 \pm 0.5^\circ\text{C}$ Place one tablet in each tube of disintegration apparatus. Operate apparatus in suitable medium maintained at 37°C . Observe time taken for complete disintegration.

Time taken by the tablet to disintegrate is 21 minutes

IV. RESULT AND DISCUSSION

General Appearance Of Chocolate Coated Tablet :

Property	Batch 1	Batch 2
Colour	Chocolate Brown	Chocolate Brown
Odour	Characteristic odour	Characteristic odour
Texture	Smooth	Smooth
Consistency	Uniform coated surface	Uniform coated surface
Homogeneity	Good	Good



The prepared tablets showed elegant appearance with uniform chocolate coating.

2. Weight Variation Test

SrNo.	Weight of tablet	Sr No.	Weight of tablet
1.	0.51	11.	0.49
2.	0.52	12.	0.50
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8.	0.51	18.	0.48
9.	0.48	19.	0.50
10 .	0.48	20.	0.49

Total Weight of 20 Tablets=9.98 gm

Average Weight = Total weight of tablets / Number of tablets

Average Weight = 9.98 / 20 = 0.499 g

3.Thickness Test

Thickness of tablet was found to be 2.6 mm

4.Hardness Test

The hardness of tablet was found to be 5. 8 pascal

5. Friability Test

Friability (%) = [(Initial Weight - Final Weight) / Initial Weight] × 100

Observation Example

Initial weight = 4.81 g

Final weight = 4.40g

Friability = 8.52%

6. Disintegration Test

Time taken by the tablet to disintegrate is 21 minutes

V. CONCLUSION

The medicated chocolate coated tablet fortified with Maca root powder for menstrual relief was successfully prepared by direct compression method followed by chocolate dip coating technique. The formulation was developed with the aim of providing a patient-friendly, palatable and effective herbal tablet for the management of menstrual discomfort. The use of dark chocolate coating helped in improving taste, appearance and patient acceptability.

From the experimental studies we have concluded that:

The preformulation studies of Maca root powder such as bulk density, tapped density, angle of repose, Carr's index and Hausner's ratio showed satisfactory flow properties suitable for tablet formulation.

The tablets were prepared using suitable excipients and evaluated for various post-compression parameters including weight variation, hardness, thickness, friability and disintegration time.

The prepared medicated chocolate coated tablets showed acceptable weight variation and uniformity, indicating proper mixing and compression of ingredients.



The hardness and thickness of tablets were found within the acceptable pharmacopoeial limits, which confirmed adequate mechanical strength of the formulation.

The friability test showed less than 1% weight loss, indicating good resistance of tablets to abrasion during handling and transportation.

The chocolate coating provided an elegant appearance, improved mouth feel and enhanced palatability of the tablets.

The disintegration test showed satisfactory disintegration time, which indicates effective release of active constituents for therapeutic action.

The overall formulation demonstrated good stability, acceptable physicochemical properties and better patient compliance due to the chocolate coating.

The medicated chocolate coated tablets fortified with Maca root powder were successfully formulated and evaluated for menstrual relief. The formulation showed satisfactory evaluation parameters and good tablet characteristics. The chocolate coating improved the taste and acceptability of the dosage form. Hence, the developed formulation can be considered as a promising herbal tablet for menstrual relief with improved patient compliance and therapeutic effectiveness.

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