RESEARCH
www.commprac.com
ISSN 1462 2815

POLYHERBAL TABLET: FORMULATION, EVALUATION, AND ANTI-DIABETIC ACTIVITY OF ETHANOLIC EXTRACT OF LEAVES OF T. PORTULACASTRUM AND A. MARMELOS

Dr. Nihar Ranjan Kar [1], Sarath Babu V [2], Brijendra Singh [3], S. Varalaxmi [4], Kirti Kaushal [5], Sharang Bali [6] and Dr. P. Dharani Prasad [7]*

[1] Assistant Professor, Centurion University of Technology and Management, Gopalpur, Balasore, Odisha, India.
[2] Associate Professor, Department of Physiology, Vels Medical College & Hospital, Uthukottai Taluk, Tiruvallur.
[3] Lecturer, Diploma in Pharmacy Course, PHTI, SMS Hospital Campus, Jaipur, Rajasthan.
[4] Associate Professor, MB School of Pharmaceutical Sciences, Mohan Babu University, Sree Sainath Nagar, Rangampet Tirupathi, Andhra Pradesh.
[5] Assistant Professor, Raj Kumar Goel Institute of Technology (Pharmacy), Ghaziabad.
[6] Assistant Professor, Kalinga University, Kotni New Raipur Chhattisgarh.
[7] Professor and HOD, MB School of Pharmaceutical Sciences, MB University, Tirupati. *Corresponding Author

DOI: 10.5281/zenodo.10017531

Abstract

Diabetes, which has been known about since ancient times, is one of the oldest diseases in the world. Given what we know now, it is pretty amazing how early this illness was understood, as may be deduced from the available ancient medical texts. To effectively cure hyperglycaemia and maintain normal blood sugar levels, ancient Indian medicine made considerable use of medicinal herbs. Numerous medicinal plants have been studied recently to discover their effects and determine whether they have any antihyperglycemic potential. An ethanolic extract of the leaves from Circulifer tenellus was used in the current experiment to make and evaluate a polyherbal tablet. The added anti-diabetic efficacy of the enhanced formulation was investigated in an alloxan-induced animal model. Results show that the improved batch demonstrated significant activity compared to standard medicine.

Keywords: Polyherbal tablet, Anti-diabetic activity, Alloxan, Circulifer tenellus

INTRODUCTION

Just a few of the numerous conditions that herbalists treat include asthma, eczema, premenstrual syndrome, rheumatoid arthritis, migraine, menopausal symptoms, chronic fatigue, and irritable bowel syndrome. The ideal method to take herbal treatments is to adhere to the advice of a knowledgeable expert. Be careful to consult your doctor or an herbalist before doing self-medication. [1-2] Here are some common plants' uses explained in depth. Please consult our monographs on each herb for detailed usage explanations as well as details on risks, side effects, and potential interactions. In order to find potential anti-diabetic phototherapeutics, many researchers looked at polyherbal formulations based on Indian medicinal herbs [3-5]. The current study set out to create, evaluate, and test anti-diabetic polyherbal pills.

A polyherbal tablet is a tablet that contains two or more different types of herbs. Polyherbal tablets are often used to treat a variety of conditions, including:

- Colds and coughs
- Flu
- Digestive problems
- Headaches
- Arthritis
- Stress
- Anxiety
- Insomnia

Polyherbal tablets are thought to work by combining the therapeutic effects of the different herbs they contain. For example, a polyherbal tablet for colds and coughs might contain ginger, turmeric, and elderberry. Ginger is thought to help reduce inflammation, turmeric is thought to have antiviral properties, and elderberry is thought to boost the immune system.

Polyherbal tablets are generally considered to be safe and effective, but it is important to talk to your doctor before taking any new herbal supplement, including polyherbal tablets. This is especially important if you have any underlying health conditions or are taking any other medications.

Here are some of the advantages of polyherbal tablets:

- They can be effective for a wide range of conditions.
- They are generally safe and well-tolerated.
- They may have fewer side effects than conventional medications.
- They may be more affordable than conventional medications.

However, there are also some potential disadvantages of polyherbal tablets:

- They may interact with other medications you are taking.
- They may not be effective for everyone.
- They may not be as well-studied as conventional medications.

It is important to note that polyherbal tablets are not regulated by the FDA in the same way as prescription medications. This means that there is less assurance of their safety and efficacy. It is also important to note that polyherbal tablets can contain a variety of different herbs, and it can be difficult to know how they will interact with each other or with other medications you are taking.

If you are considering taking polyherbal tablets, be sure to talk to your doctor first. They can help you assess the risks and benefits and make sure that polyherbal tablets are right for you [11-26].

MATERIAL AND METHODS

Collection and Identification of Herbal Plants

T. portulacastrum and *A. marmelos* leaves samples were collected from a range of local locations in the Malwa region of Madhya Pradesh from July through September 2023. The head of the botany department at Janata PG College in A.P. and a former professor, will be given out voucher specimens J/Bot./TPL-38, J/Bot./LNL-39.

The Process of Extracting

Using ethanol as the solvent, 250 gm of dried leaves from *T. portulacastrum* and *A. marmelos* were Soxhlet-processed to create the extract. When the extraction process was complete, the extract was concentrated and kept in a desiccator for later use [6].

Making a Preparation for Polyherbal Tablets

The wet granulation method and the appropriate excipients microcrystalline cellulose, starch, crospovig done, Aerosil, and magnesium stearate were used to create the polyherbal tablet (PHT), which contained the ethanolic leaf extract of the *T. portulacastrum* and *A. marmelos*. [7] Table 1 listed the PFT's composition.

Table 1: Tablets made with Polyherbal herbs

Ingredients	Formulation Code				
	PHT-1	PHT-2	PHT-3	PHT-4	PHT-5
EETPL	10	20	30	40	50
EELNL	10	20	30	40	50
EEDPL	10	20	30	40	50
MicrocrystallineCellulose	325	275	225	175	125
Starch	50	50	50	50	50
Crospovidone	20	20	20	20	20
Granulation					
Water	q.s.	q.s.	q.s.	q.s.	q.s.
Prelubrication					
Starch	30	30	30	30	30
Aerosil	10	10	10	10	10
Talc	20	20	20	20	20
Lubrication					
Magnesium Sterate	5	5	5	5	5
Total weight (mg)	500	500	500	500	500

Evaluation of Polyherbal preparation (Tablet) [7-9]

Appearance

The manufactured herbal tablets' appearance and colour were evaluated. In this study, colour, odor, and taste were noted.

Hardness

Five tablets were chosen at random from each batch to test the crushing strength using Monsanto's tablet hardness tester.

Angle of repose

The angle of repose was calculated using the fixed height method in order to forecast the flow characteristics of the physical mixtures in each formulation. A funnel with a 10mm inner diameter stem was suspended from the platform at a height of 2 cm. 10g of material were transferred gradually and contacted the steam in the funnel. A

preliminary estimation of the radius of the powder cone was obtained by rough circling the base of the pile. The average radius and the following formula were used to get the angle of repose.

ɵ = tan-1 (h/r)

Where,

ɵ = Angle of repose

h = Height of the pile

r = Average radius of the powder cone

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Friability

25 randomly chosen tablets were weighed out, placed in an Electro lab friabilator, and rotated at 25 rpm for 4 minutes to assess the friability. The percentage of friability was

$$\%F = (1-WI/WF) * 100$$

Where, WI=Initial weight of the 25 tablets; WF=Final weight of 25 tablets

Weight Variation

In compliance with IP 2018, the weight fluctuation of 20 randomly selected pills was assessed.

Disintegration Time

Six tablets were chosen at random from each batch and put in a USP disintegration equipment with 0.1 N HCl at 370C. The moment the tablet finished dissolving was recorded.

Disintegration test:

The determination of tablet disintegration time was conducted utilising the digital microprocessor-based disintegration test equipment, namely the basket rack assembly from Lab India. A single pill was placed into each tube and thereafter a disc was inserted. The assembly was placed in a 1000 mL beaker that was filled with water. The water volume was sufficient for the wires to intersect at their maximum point, which was positioned at least 25 mm below the water's surface. Similarly, at its minimum point, the wires were positioned at least 25 mm above the bottom of the beaker. The equipment was operated and maintained at a temperature of 37±2 degrees Celsius. The duration necessary for all pills to undergo disintegration and traverse a wire mesh was recorded.

In vitro Dissolution test:

The investigation was conducted with a basket type tablet dissolving test device manufactured by Lab India. A dissolving media with a volume of 900 mL was prepared by adding 0.1 M hydrochloric acid to the apparatus vessel. The medium was then

heated to a temperature of 37±1°C and stirred at a speed of 50 rpm for a duration of 2 hours. Samples of 10 mL were extracted from a region located at the midpoint between the surface of the dissolving medium and the top of the revolving blade at specified time intervals. Subsequently, an equivalent volume of new dissolution medium, maintained at the same temperature, was introduced to the system. The samples were subjected to analysis by using a UV-visible spectrophotometer (Shimadzu UV-1700) to measure the absorbance at a wavelength of 365 nm. The calculation of the cumulative percentage of drug release was performed using an equation derived from a standard curve.

Experimental animals

Male albino Wister strain rats weighing between 100 and 150g were used for this experiment from the Government Veterinary Hospital in Mhow, Madhya Pradesh. The rats were housed in larger, roomier cages, fed commercial pelleted rat food produced by Hindustan Lever Ltd. in Bangalore, India, under the trade name Gold Mohur Rat Feed, and given unrestricted access to water and the lab. The animals were successfully acclimated to the trial's regular ambient conditions, including temperature and 12 hours of light and darkness, over the course of the experiment. The use of animals in the current experiment received approval from the institutional animal ethical committee.

Preparation of Alloxan Monohydrates

1 g of alloxan was weighed out and dissolved in 20 ml of water for injection. At this calculated dose, alloxan is considered to have a concentration of 50 mg/ml.

Anti-diabetic Activity [10-11]

Six rats were separated into various groups for the current investigation. The basal blood glucose levels of each animal were recorded, and then six animals were divided to serve as a typical control. The remaining animals each received a single intra-peritoneal injection of Alloxan monohydrate in water for injection at a dose of 150 mg/kg. Blood glucose levels were calculated after four days of Alloxan administration, and animals with readings between 280 mg/dl and 380 mg/dl were selected and divided into groups. The control group in Group 1 is untreated saline water; the diabetic group in Group 2 is given Alloxan 150 mg/kg; the diabetic group in Group 3 is given glibenclamide 10 mg/kg; and the diabetic groups in Groups 4 through 8 are given PHF.

Statistical Analysis

Data were assessed by comparing outcomes for various treatment groups with figures for individual controls. Analysis of variance (one-way ANOVA) was utilized in the most recent piece of software to look at significant variations in values. The information is displayed as X (Mean) SEM, with n=6 for all the gathered results. (One-way ANOVA followed by a Bonferroni multiple comparison test).

Inhibition of -amylase, In-Vitro Anti-Diabetic Activity, 6.9.1 Assay

Amylase was dissolved in phosphate buffered saline (0.02 mol/L, pH 6.8) at a concentration of 0.1 mg/ml. Different concentrations of sample solutions (0.25 mL) were mixed with the -amylase solution (0.010 mL), and the combination was then incubated at 37 °C for 5 min. The reaction was then initiated by adding 0.1ml of a 1.0% (w/v) starch substrate solution to the incubation medium. After being incubated at 37 °C for three minutes, the reaction was halted by adding 1 mL of DNS reagent (1%

Dinitro salicylic acid, 0.05% Na2SO3, and 1% NaOH solution) and boiling it at 100 °C for five minutes. After cooling to room temperature, the absorbance (Abs) at 532 nm was measured using a spectrophotometer. The formula below was employed.

Inhibition (%) = [(Abs1 − Abs2)/Abs1] × 100

where,

Abs1=sample

Abs2 = control.

Accelerated Stability Studies

The stability properties of a medication dosage form may be affected by several environmental factors during storage, including temperature, light, air, humidity, and the components of the packaging. The various formulations underwent accelerated stability testing for a duration of three months under certain temperature circumstances. These parameters included room temperature (25±2^{o}C) with a relative humidity of 60%, as well as temperatures of 5^{o}C under ambient conditions and 40^{o}C with a relative humidity of 75%. The study examined many factors, including colour, odour, and texture of the tablets, as well as average weight, hardness, friability, and disintegration time. These parameters were investigated at accelerated temperature circumstances.

RESULTS AND DISCUSSION

A polyherbal tablet containing ethanolic leaf extract of Circulifer tenellus was evaluated for appearance, hardness, friability, weight variation, and disintegration speed. The external symptoms of PHT were included in Table 2. The results show that polyherbal pills are perfect. The metrics for PHT evaluation were shown in Table 3. The result demonstrates that the data for each formulation code for which it was acquired are under the IP limit. Animal models produced by alloxan were used to examine the anti-diabetic effects of PHF, and the results revealed that PHF-5 outperformed conventional medicine**.**

Table 2: Physical Parameters (Appearance) of Polyherbal tablet

Formulation Code	Physical Parameters (Appearance)			
	Color	Odor	Taste	Shape
PHT-1	Light green	Characteristic	Characteristic	Circular biconvex
PHT-2	Light green	Characteristic	Characteristic	Circular biconvex
PHT-3	Light green	Characteristic	Characteristic	Circular biconvex
PHT-4	Light green	Characteristic	Characteristic	Circular biconvex
PHT-5	Light green	Characteristic	Characteristic	Circular biconvex

Table 3: Evaluation Parameters of Polyherbal Tablet

Formulation Code	Parameters			
	Weight variations(%)	Hardness (kg/cm^2)	Friability (%)	Disintegrationtime (mts)
PHT-1	±3.42	3.74±0.18	0.29±0.24	18.66±0.01
PHT-2	±3.34	3.39±0.29	0.22±0.42	15.22±0.11
PHT-3	±4.19	3.29±0.22	0.63±0.11	13.01±0.12
PHT-4	±4.02	4.06±0.05	0.81±0.05	21.73±0.22
PHT-5	±4.22	4.29±0.16	0.84±0.03	25.79±0.21

Note: With n=3, each value is expressed as Mean SD

Table 4: Effect of Administration of Feeding the PHT Serum Glucose Estimation in Normaland Diabetic Rats

Group	Serum glucose (mg/dL)			
	0 day	7th day	14th day	21th day
Control	83.16±0.04	84.12±0.11	85.11±0.04	86.23±0.09
Diabetic control	295.11±0.11	366.89±0.07##	418.29±0.18###	407.09±0.11###
Standard (10mg/kg)	283.17±0.21	202.21±1.23**	160.39±1.21***	110.21±1.03***
PHT-1	269.12±0.02	249.25±1.10**	16X9.29±1.23***	128.31±1.02***
PHT-2	270.11±0.01	238.31±0.11**	198.24±1.21***	129.22±1.23***
PHT-3	278.22±0.02	209.23±0.02**	172.29±1.02***	119.42±1.09***
PHT-4	258.39±0.11	259.34±0.21**	183.87±1.05***	123.50±1.01***
PHT-5	262.29±0.20	263.43±0.32**	189.60±1.06***	126.98±1.10***

With ***P0.001 compared to the diabetic control group (normal saline), **P0.01 compared to the diabetic control group (normal saline), and ###P0.001 compared to the control, all values are expressed as the mean standard error of the mean (n=6).

After one-way ANOVA, the Bonferroni multiple comparison test is applied

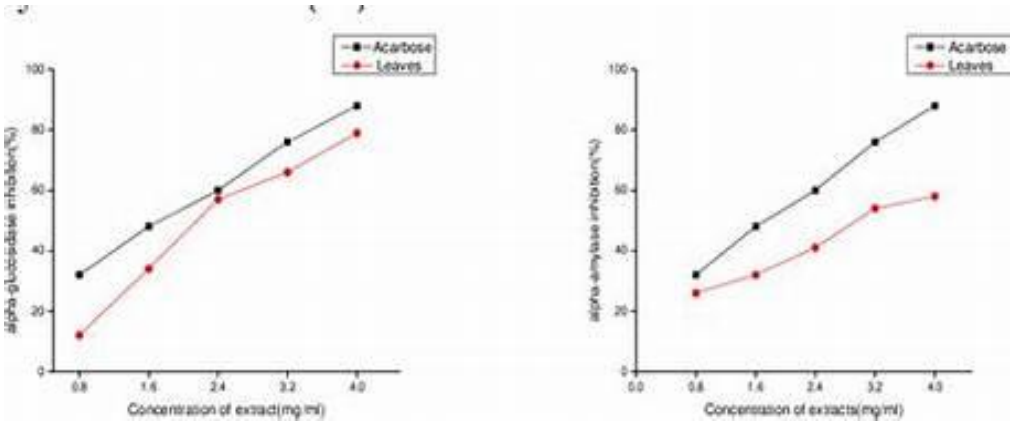

Figure 1: Inhibition of -amylase, In-Vitro Anti-Diabetic Activity

Table 5: Accelerated stability studies of tablets

Parameters	Observations								
	Initial	30 days			60 days			90 days		
		RT/ 60%RH	5°C/ Ambient	40°C/ 75%RH	RT/ 60%RH	5°C/ Ambient	40°C/ 75%RH	RT/ 60%RH	5°C/ Ambient	40°C/ 75%RH
Color	Blackish green	NC	NC	NC	NC	NC	NC	NC	NC	Faint green
Odor	Characteristic	NC	NC	NC	NC	NC	NC	NC	NC	NC
Texture	Smooth	NC	NC	NC	NC	NC	NC	NC	NC	NC
Average Weight (%)	1.60	1.60	1.60	1.60	1.60	1.60	1.59	1.59	1.58	1.59
Hardness (kg/cm^2)	6.96	6.96	6.96	6.96	6.96	6.96	6.94	6.96	6.96	6.94
Friability (%)	0.45	0.45	0.45	0.46	0.45	0.45	0.45	0.45	0.45	0.46
Disintegration time (minute)	12.2	12.5	12.3	12.3	12.2	12.4	12.1	12.2	12.2	12.0

NC= No Change, RT= Room temperature (25±2°C)

An in vitro dissolving research was conducted to investigate the behaviour of the isolated marker chemicals MD1 found in herbal actives. The purpose of this non-specific dissolution was to serve as a diagnostic tool for assessing batch-to-batch

variability. The underlying premise of this approach was that if the separated markers are shown to have dissolved within a certain time period and under given circumstances, it may be concluded that the tablets do not experience any issues linked to their composition. The data indicates that the cumulative percentage of medication release for all formulations exceeded 90% after a duration of 2 hours.

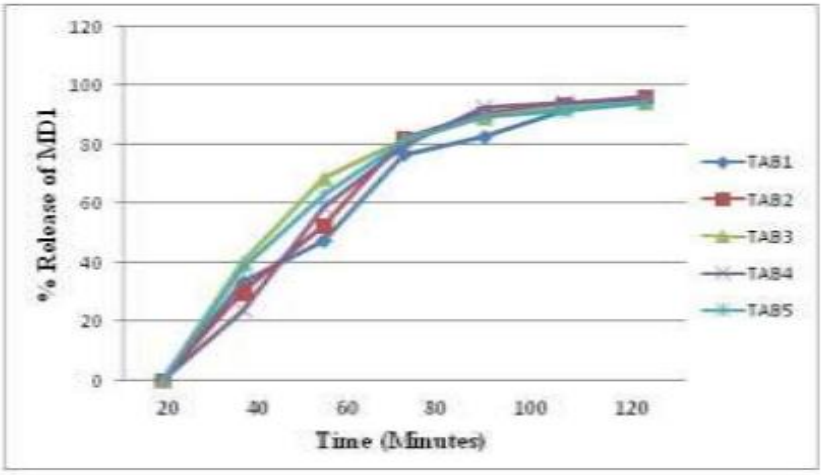

Figure 2: Release profile of compound MD1

CONCLUSION

This laboratory scale preparation of polyherbal tablet may be used as a stable, solid dosage form and the work done in stability testing may help in the progress of shelf-life determination. The present study revealed that the composition ratio of ingredients of polyherbal tablets, not affect the stability parameters. From this study it is concluded that using traditional knowledge and the recent technologies, the medicinal plants can be prepared in the form of cost-effective tablet formulations to improve their stability, consumer compliance and acceptability. The results show that PHF-3 has the best anti-diabetic impact when compared to traditional medications.

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