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Formulation and Evaluation of *Commiphora wightii* Herbal Pills Treatment of Anti-Obesity

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Abstract

An excessive quantity of bodily fat characterizes a complex disorder called obesity. It raises the risk of developing other illnesses and medical conditions like diabetes, high blood pressure, and heart conditions. When our BMI is 30kg/m^2 or greater, obesity is considered to exist. Today, more ailments are treated with traditional herbal medicines than allopathic ones. Compared to herbal medications, allopathic drugs have higher side effects. The current work aims to create and assess the herbal tablet prepared using an ethanolic extract of *Commiphora wightii* leaves. Wet granulation was used to manufacture the formulation. Both the pre-compression parameter and the post-compression parameter of the prepared formulation were assessed. The calculation demonstrated that the permissible pre and postcompression parameters are within bounds.

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INTRODUCTION

Herbal medicine (also called herbalism) is the study of pharmacognosy and the use of medicinal plants, which are the basis of traditional medicine. With worldwide research into pharmacology, some herbal medicines have been translated into modern remedies, such as the anti-malarial group of drugs called artemisinin isolated from Artemisia annua. This herb was known in Chinese medicine to treat fever. There is limited scientific evidence for the safety and efficacy of plants used in 21st-century herbalism, which generally does not provide standards for purity or dosage. The scope of herbal medicine commonly includes fungal and bee products, minerals, shells, and certain animal parts. Herbal medicine is also called phytomedicine or phytotherapy [1]. The World Health Organization (WHO) estimates that 80 percent of the population of some Asian and African countries presently use herbal medicine for some aspect of primary health care. Some prescription drugs have a basis as herbal remedies, including artemisinin, digitalis, quinine, and taxanes. There are many forms in which herbs can

be administered. Herbal teas, or tisanes, are the resultant liquid of extracting herbs into water, though they are made in a few different ways. Infusions are hot water extracts of herbs, such as chamomile or mint, through steeping. Decoctions are the long-term boiled extracts, usually of more complex substances like roots or bark. Maceration is the cold infusion of plants with high mucilage content, such as sage or thyme. To make macerates, plants are chopped and added to cold water. They are left to stand for 7 to 12 hours (depending on the herb used). For most macerates, 10 hours is used [2].

MATERIALS AND METHODS:

MATERIALS:

Plant material Collection and Authentication: The leaves of Commiphora wightii plants were collected from a nearby location, Tirupati, Andhra Pradesh, India. Dr. K. Madhava Chetty, Assistant Professor, Dept. of Botany, Sri Venkateswara University, Tirupati, identified and authenticated plant materials.

Chemicals used for the preparation of Herbal Tablet: The chemicals used in tablet preparation are Microcrystalline cellulose, Starch, Hydroxy propyl methyl cellulose (HPMC), Croscarmellose, Magnesium stearate, and Aerosil. These chemicals are of analytical grade and are purchased from Arabindo Labs, Hyd.

METHODS:

Preparation of Extracts: To make the extracts, dried leaves of Commiphora wightii were gathered, cleaned, and ground into coarse powders. Ethanol 95% vol/vol (75-780 C) was used to extract 1000 g of powdered materials for 72 hours of both leaf powders of Commiphora wightii. The materials were packed evenly in thimbles. Following extraction, the defatted extract was filtered to remove insoluble particles using Whatmann filter paper (No. 10). Vacuum distillation was used to concentrate the extracts. Until all solvent was gone, the concentrated extracts were evaporated using a rotary evaporator [] Rotary evaporator [3].

General Steps for Compressed Tablet Preparation:

Paste-like Hydroxy Propyl Methyl Cellulose was created by adding the necessary amount of HPMC powder to the water while using a mechanical stirrer. The resulting mixture was then utilized to develop a granule-binding solution. Accurately measured amounts of Commiphora wightii, Microcrystalline cellulose, and starch are appropriately combined, added gently to the HPMC slurry, and then added with the powdered guggul extract. After being prepared, the granules are put through sieve number 18 and dried for 30 minutes at 50°C in a hot air oven. To create granules of the same size, the dried granular material was run through a sieve number 12. The various granule batches were then combined with calculated equal amounts of magnesium stearate and Aerosil before being compacted into tablets using a double rotational compression machine [4].

Pre-compression parameter for evaluation:

The angle of repose:

The funnel method was used to calculate the powder's angle of repose. A 2.5 cm-high funnel attached to a burette stand was used to funnel the powder. On the table, graph paper was set down next to the funnel. The pile's height and radius were measured. Using the following formula, the powder's angle of repose was determined [5]:

$$\text{Angle of repose } (\theta) = \text{Tan}^{-1} h / r$$

Table 1 Composition of Herbal Formulation

Ingredients	F1	F2	F3	F4	F5	F6
Commiphora wightii (mg)	20	20	40	40	60	60
Microcrystalline cellulose (mg)	120	120	150	150	170	170
Starch (mg)	5	5	10	10	20	20
Croscarmellose (mg)	10	10	15	15	20	20
Hydroxypropyl methyl cellulose (mg)	10	10	15	15	20	20
Magnesium Stearate (mg)	4	4	8	8	10	10
Areosil (mg)	5	5	5	5	5	5

Bulk density is the ratio of the powder's total mass to its bulk volume. Once weighed, a measuring cylinder was filled with the powder, and the original weight was recorded [6]. Using this information, the bulk density was determined using the following formula.

$$\text{Bulk density (Db)} = \text{Mass (M)} / \text{Bulk volume (Vb)}$$

Tapped density:

It is the proportion of the powder's overall mass to its tapped volume. The powder was tapped 100 times to measure volume, and the tapped volume was recorded [7]. It is provided by and stated in gm/ml.

$$\text{Tapped density (Dt)} = \text{Mass (M)} / \text{Tapped volume (Vt)}$$

Compressibility index:

The following formula was used to get the percentage compressibility index of the bulk medication based on the apparent bulk density and the tapped density.

$$\%\ \text{compressibility index} = \frac{\text{Tapped density} - \text{Bulk density}}{\text{Tapped density}} \times 100$$

Hausner's ratio:

Hausner's ratio is the proportion between tapped density and bulk density. It is a proximate indicator of how easily powder flows [8]. The formula used to calculate it is as follows.

$$\text{Hausner ratio} = \text{Tapped density (Dt)} / \text{Bulk density (Db)}$$

Post-compression parameter for evaluation:

Weight variation:

Twenty tablets were individually weighed before the average weight was determined. Additionally, a percentage variation was generated using both average and individual weight. The formula used to determine it was as follows [9]:

$$\%\ deviation = \frac{Average\ weight - Individual\ weight}{Average\ weight}$$

Friability:

The toughness of a tablet is measured by its friability. The friability of the pill was assessed using the Roche Fraibilator. Ten pills were precisely weighed and put into the friability chamber, which rotates at 25 rpm for 4 minutes, dropping the tablets over a 6-inch distance with each rotation [10]. After which the tablets were reweighed, one hundred rotations took 4 minutes to complete. The formula used to compute the friability is

$$\text{Friability (\%)} = \frac{\text{Initial Weight (W1)} - \text{Final Weight (W2)}}{\text{Initial Weight (W1)}} \times 100$$

Hardness:

The amount of force needed to crush tablets during a compression test. The procedure for assessing a tablet's hardness involves crushing the tablet between two jaws. The Pfizer tester was used to determine the tablet's hardness. Kg/cm^2 is the unit of hardness [11].

***In vitro* dissolution studies**

Using a paddle, the tablets were dissolved on USP XXIII dissolution type II apparatus. A hydration mechanism fixed the tablet to the paddle. 900 ml of pH 1.2 buffer (0.1N HCl) as dissolution medium was filled in a dissolution vessel, and the temperature of the medium was set at 37 ± 0.5ºC. The rotational speed of the paddle was set at 100 rpm. 1 ml of sample was withdrawn at the predetermined time interval of 1 hr up to 12 hr, and the same volume of fresh medium was replaced. The withdrawn samples were diluted to 10 ml with pH 1.2 buffer, filtered, and analyzed on a U.V. spectrophotometer at 238 nm using pH 1.2 buffer as a blank. Percentage cumulative drug release was calculated [12].

Data analysis

The data obtained were fitted into Zero order, First order, Higuchi matrix, and Peppa's model to analyze the mechanism of release and release rate kinetics of the dosage form. Based on the r-value, the best-fit model was selected [13].

Kinetic study

Pharmacokinetics of Drug Release Mechanism

The results of the *in-vitro* release profile obtained for all formulations were plotted in modes of data treatment as follows:

Cumulative percent drug release V/s. Time (Zeroorder).

Table 2 I.R. interpretation data of *Commiphora wightii* and Polymer Mixtures

Interpretation	*Commiphora wightii*	Microcrystalline cellulose	HPMC	Croscarmellose	Mixture
C –Br stretch	563.35	558.36	561.93	559.40	598.58
C- H bend	619.87	665.87	627.78	611.29	1379.26
=NOH (N-O)	953.77	1506.49	944.22	1318.31	2077.18
Ar. CH= CHR	1621.19	1450.33	2890.43	2920.06	2077.18
C=C Stretch	1677.30	3421.42	3135.86	3270.84	1647.85

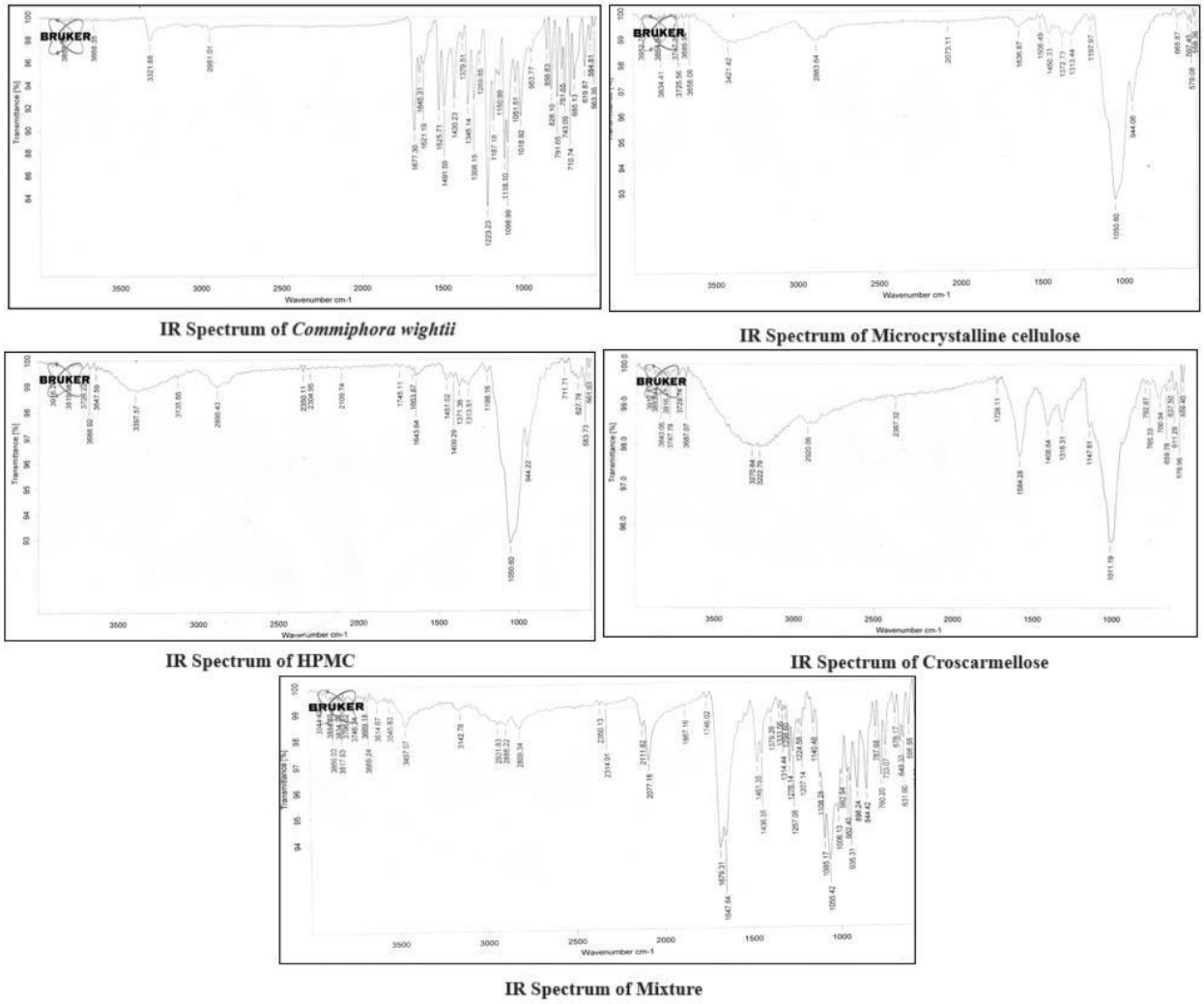

Figure 1 I.R. Spectrums of Commiphora wightii and Polymer Mixtures

Cumulative percent drug release V/s. The square root of Time (Higuchi Matrix Model).

Log Cumulative percent drug retained V/s. Time (First-order).

Log Cumulative percent drug release in V/s. log Time (Krosmeyer-Peppas Model).

Zero-order kinetics

The following equation can represent drug dissolution from pharmaceutical dosage forms that do not disaggregate and release the drug slowly, assuming that the area does not change and no equilibrium conditions are obtained.

$Q_t = Q_o + K_o t$

Table 3 Data obtained for the evaluation of powder blend of Herbal Pills

F.Code	Derived Properties		Flow Properties		
	Bulk density (mean ± SD)	Tapped density (mean ± SD)	Angle of repose (mean ± SD)	Carr's index (mean ± SD)	Hausner's ratio (mean ± SD)
F1	0.31±0.02	0.33±0.05	37.16±0.06	20.19±0.02	1.12±0.04
F2	0.48±0.05	0.42±0.04	33.30±0.04	16.32±0.04	1.31±0.02
F3	0.29±0.07	0.27±0.02	38.29±0.04	11.38±0.06	1.19±0.02
F4	0.35±0.06	0.27±0.04	28.82±0.05	14.70±0.04	1.32±0.06
F5	0.47±0.03	0.29±0.06	40.67±0.02	12.50±0.03	1.29±0.02
F6	0.31±0.05	0.40±0.07	41.06±0.03	12.61±0.04	1.17±0.02

Each value represents the mean ± standard deviation (n=3)

Table 4 Evaluation parameters of Herbal Pills

Formulation code	Evaluation parameters				
	Thickness ± S.D.(mm) (n= 5)	Hardness ± S.D. (Kg/cm^2) (n =5)	Friability (%)	Average weight variation (n=10)	Drug content (%)
F_1	3.60 ± 0.043	6.5 ± 0.4	0.291	0.525 ± 0.011	97.72
F_2	3.54 ± 0.055	6.2 ± 0.2	0.308	0.520 ± 0.010	98.7
F_3	3.72 ± 0.085	6.1 ± 0.2	0.415	0.521 ± 0.010	98.16
F_4	3.70 ± 0.067	6.6 ± 0.1	0.152	0.518 ± 0.135	101.1
F_5	3.64 ± 0.054	6.4 ± 0.6	0.419	0.501 ± 0.009	97.17
F_6	3.78 ± 0.028	6.2 ± 0.2	0.298	0.526 ± 0.008	97.92

Each value represents the mean ± standard deviation (n=3)

First order kinetics

The release rate data were fitted to the following equation to study the first-order release kinetics.

$\text{Log } Q_t = \log Q_o + K\,t / 2.303$

Higuchi model

Higuchi developed several theoretical models to study the release of water-soluble and low-soluble drugs incorporated in semisolids and solid matrices. Mathematical expressions were obtained for drug particles dispersed in a uniform matrix behaving as the diffusion media; the equation is

$Q\,t = K.H.\ t1/2$

Korsemeyer and Peppas Release model

The release rate data are fitted to the following equation to study this model.

$F = M_t / M = K.t_n$

RESULTS AND DISCUSSION:

Preliminary Research: Pre-formulation investigations are the initial step in logically creating a pharmacological substance's dosage form. Pre-formulation studies aim to assemble a database of knowledge about medication material that can be used to develop various dosage forms. Investigation of the physical and chemical characteristics of the drug material alone and when mixed with excipients is known as preformulation.

Compatibility study

The physical mixture of the drug and polymer was characterized by FTIR spectral analysis for any physical and chemical alteration of the drug characteristics. The results concluded no interference in the functional group as the principle peaks were unaltered in the drugpolymer physical mixtures, indicating they were compatible Chemically. I.R. spectra are shown in Figure 1 and interpreted values are shown in Table 2.

Pre-Compression Parameters:

The evaluation studies on herbal granules of all the formulations proved to be within limits and showed good derived and flow properties.

Table 5 In vitro release data of Herbal Pill Tablets

TIME (hrs)	F1	F2	F3	F4	F5	F6
0.5	9.21	4.21	19.42	9.61	14.61	9.62
1	17.33	10.33	26.51	15.54	25.54	14.52
2	26.18	26.18	37.89	22.38	34.82	37.51
3	32.18	42.18	40.51	36.48	47.74	49.54
4	44.88	54.88	52.86	45.83	56.33	54.62
5	59.38	65.32	65.66	52.70	67.84	63.43
6	60.71	79.65	74.58	66.87	76.32	75.44
7	72.18	87.23	85.22	73.33	80.42	89.30
8	84.22	90.32	86.40	87.91	92.61	92.25
9	90.42	92.12	90.21	92.45	95.14	97.38

Table 6 Drug Release Kinetics of Herbal Pills

Batch Code	Zero Order r^2	First Order r^2	Higuchi r^2	Peppas r^2	Peppas n
F1	0.966	0.822	0.948	0.623	1.032
F2	0.978	0.816	0.949	0.632	1.022
F3	0.976	0.822	0.966	0.612	1.023
F4	0.962	0.843	0.964	0.633	1.032
F5	0.951	0.811	0.987	0.621	1.018
F6	0.962	0.843	0.945	0.624	1.013
F7	0.964	0.832	0.963	0.618	1.017
F8	0.977	0.811	0.977	0.617	1.018
F9	0.967	0.388	0.888	0.776	1.012
F10	0.979	0.812	0.945	0.637	1.021
F11	0.973	0.824	0.963	0.615	1.022
F12	0.957	0.356	0.372	0.913	1.024

Post-Compression Parameters:

Results of post-formulation parameters such as tablet dimensions (thickness, Hardness, Friability, Weight variation, and Drug content were represented in Table 3. There should be a certain amount of strength or hardness and resistance to friability for the tablet so that the tablet should not break during handling. However, it also affects drug dissolution. The average hardness of herbal pills is 6.1 to 6.5 kg/cm^2. Friability studies of herbal pill tablets range from 0.29 % to 0.41%. This indicates that tablets show acceptable resistance to withstand handling [Table 4].

***In vitro* dissolution studies**

The results of the in vitro dissolution studies showed controlled release predictably. Compared to MCC and HPMC, Croscarmellose retarded drug release more effectively; herbal pill tablets had an optimum release at the end of the 12th hour. The in vitro release profiles of all the the formulations (F1 to F6) are shown in Table 5, 6 and Figure 2.

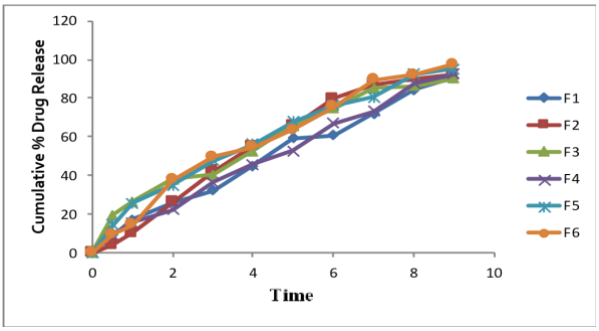

Figure 2 In vitro release data of Herbal Pill Tablets

CONCLUSION:

Commiphora wightii is a medication used to treat obesity in tandem. This tablet was created utilizing various excipients. Before being punched into tablets, the powder and mixes were tested for bulk density, tapped density, compressibility index, and Hausner's ratio. Results of postformulation parameters such as tablet dimensions (thickness, Hardness, Friability, Weight variation, and Drug contentThere should be a certain amount of strength or hardness and resistance to friability for the tablet so that the tablet should not break during handling. However, it also affects drug dissolution. The average hardness of herbal pills is 6.1 to 6.5 kg/cm^2. Friability studies of Herbal pill tablets range from 0.29 % to 0.41%. This indicates that tablets show acceptable resistance to withstand handling. The *in vitro* dissolution data for best formulation F6 were fitted in different kinetic models, i.e., zero order, first order, and Higuchi and Korsemeyer-Peppas equations. Its value is nearer to the '1', so it conforms to the zero-order release.

Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

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