International Journal of Pharmacy and Pharmaceutical Research (IJPPR)
Volume 30, Issue 10, October 2024 **ijppr.humanjournals.com** ISSN: 2349-7203

Development and Evaluation of Tablet Using Herbal Additives and Excipient

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Received: 2024-10-11 Revised: 2024-10-17 Accepted: 2024-10-22

ABSTRACT

Herbal pills are expected to become even more important in modern healthcare research on the health benefits of various herbs continues, providing natural and holistic alternatives to traditional treatments. The present study aims to design, development of polyherbal chewable tablets and its standardization. Based on the literature survey, four anti-tubercular plant extracts i.e. Glycyrrhiza glabra and Curcuma longa were selected for the development of polyherbal chewable tablet formulation. 3^2 factorial design was applied for formula optimization. Tablets were prepared by wet granulation method. The pre-compression and post- compression studies showed that the formulation HF3 showed better taste and good results among all the formulations designed. The present study demonstrates that the developed polyherbal chewable tablet has a potential to immunomodulatory activity.

KEYWORDS: Herbal Medicine, Tablet, Excipients, Standardization

INTRODUCTION

Chewable polyherbal tablets are oral dosage forms that include several herbal or botanical extracts. These tablets are designed to be chewed before swallowing in order to release and absorb the active ingredients found in the herbs. The advantages of polyherbal chewable tablets are that they can combine the therapeutic properties of several herbs into a single dosage form. The tablets in combination of many herbs can have a synergistic effect, perhaps improving therapeutic results as compared to utilising individual herbs alone. Depending on the intended use, such as assisting digestion, increasing immunity, alleviating stress, or addressing certain medical disorders, the precise herbal mixture and amount of active ingredients in polyherbal chewable tablets might change. These tablets are frequently used in conventional medical systems, but they are also becoming more widely accepted in contemporary medicine as complementary and alternative treatments (1).

The Vedas are full of spells for curing illnesses and charms for driving out the demons who are believed to be the root of illnesses. The oldest branch of medicine, Ayurveda, has been used for thousands of years in India to treat anomalies and describe many elements of life (2). There are more than 30 dosage forms that have been discovered based on the ancient literature that is still available, and these are regularly recommended by doctors. The ideal type of product for pharmaceuticals that are taken orally is in the form of solid oral dosage forms. This form of administration was chosen due to its practicality, simplicity, and capacity to mask the disagreeable tastes and odours of plant extracts (3, 4, 5).

Formulations made of many herbs fill the gap between conventional wisdom and cutting-edge scientific inquiry (6). Polyherbal mixtures have long been used in traditional medical systems including Ayurveda, Chinese medicine, and Indigenous practices to treat a variety of illnesses. These formulations can be used into contemporary medicine to promote the creation of new treatment choices by fusing conventional knowledge with scientifically supported research (6, 7) Chewable tablets should be secure and simple to administer to a wide range of patients, including children, adults, and elderly patients, who are unable or reluctant to take whole tablets because of their size or swallowing challenges.

In clinical practice, it's critical to have access to safe, simple dose forms. Many over-the-counter (OTC) and prescription medication medicines come in chewable tablet form. The United States Pharmacopeia (USP) recognizes and distinguishes between two categories of chewable tablets (i) those that can be easily administered by chewing; and (ii) those that must be chewed or crushed before swallowing in order to prevent choking and/or to assure the release of the active ingredient. (9) To improve its shelf life, palatability and for the proper fixation of therapeutic dose, it is current essential requirement to develop chewable tablet form along with its quality analysis as per standards.

MATERIALS AND METHODS

Organoleptic Evaluation: It includes the physical evaluation of herbal extracts by various parameters such as colour, odour, taste, appearance of the plant extracts.

Physicochemical Evaluation: In the standardization of herbal material, physical and physico-chemical factors play an important role in the establishment of purity and quality. Different physicochemical parameters were studied as listed below.

a) Determination of pH Value: The pH was determined using a calibrated pH meter.

b) Determination of loss on drying (LOD): Percentage loss on drying were calculated by using the formula

$$\% \text{ of Loss on Drying} = \frac{(B - A)}{\text{Wt. of taken}} \times 100$$

c) Determination of Water-Soluble Extractive: Percentage of water soluble extractives were calculated by using the formula

$$\% \text{ of water soluble extractive} = \frac{\text{Wt. of residue}}{\text{Wt. of sample (A)}} \times 100$$

d) Determination of Alcohol soluble extractive: Percentage of alcohol soluble extractives were calculated by using the formula

$$\% \text{ of alcohol soluble extractive} = \frac{\text{Wt. of residue}}{\text{Wt. of sample}} \times 100$$

e) Determination of Total Ash: Total ash content in all the samples were calculated by using the formula

$$\% \text{ of Total Ash} = \frac{\text{Wt. of Ash}}{\text{Wt. of sample}} \times 100$$

f) Determination of Acid Insoluble Ash: Acid insoluble ash content of all samples were calculated in the sample using the formula

$$\% \text{ of Acid Insoluble Ash} = \frac{\text{Wt. of acid insoluble ash}}{\text{Wt. of the total ash}} \times 100$$

5.2.3 HPTLC Fingerprinting for identification of selected herbal extracts:

i) Identification of *G. glabra* dry extract by HPTLC

- **Mobile Phase:** n-butanol: Water: Glacial acetic acid (7:2:1)
- **Stationary Phase:** Silica gel 60F254 (0.2 mm thickness)
- **Scanning:** At 254 nm
- **Standard Solution Preparation:** Five mg of standard was taken and transferred into 5mL of volumetric flask and makeup the volume with methanol. Further 1mL of this solution was taken in 10 mL volumetric flask and dilute it with 10 mL methanol. (100 µg/mL)

- **Test Solution Preparation (Sample 1):** Two gram of dried extract was taken and transferred into 100mL of conical flask and makeup the volume with methanol. Then this sample was sonicated for 10 min and filtered.

- **Test Solution Preparation (Sample 2):** Two gm. of powder was taken and transferred into 50mL of volumetric flask and makeup the volume with methanol. Then this sample was sonicated for 10 min and filtered.

Each sample was applied individually, concerning their powders and standards into the chromate plate and developed the chromate plates in the above mobile phase about 8 cm from point of application. Evaluated at 254 nm after dried the plate. (10)

ii) Identification of *Curcuma longa* dry extract by HPTLC

- **Mobile Phase:** Dichloromethane: Methanol (99:1)

- **Stationary Phase:** Silica gel 60F254 (0.2 mm thickness)

- **Scanning:** At 427 nm

- **Standard Solution Preparation:** Ten mg of standard was taken and transferred into 10 mL of volumetric flask and make up the volume with methanol.

- **Test Solution Preparation (Sample 1):** Fifty mg of dried extract was taken and transferred into 250mL of volumetric flask. 50mL methanol was added and at 50-60ºC refluxed it for 20 minutes. This sample was filtered and make up the volume with methanol up to 10mL.

- **Test Solution Preparation (Sample 2):** One gram of powder was taken and transferred into 250mL of volumetric flask. 20mL of methanol was added and at 50-60°C refluxed it for 20 minutes. This sample was filtered and makes up the volume upto 10mL. (11)

Design And Development Of Herbal Chewable Tablet: Various preliminary trials had taken for selection of excipients of herbal tablets.

Table 1: Composition of Preliminary formulation trials

Ingredients	HF1	HF2	HF3	HF4	HF5	HF6	HF7	HF8	HF9
	Mg/tab								
GG (Dry extract)	90	90	90	90	90	90	90	90	90
CL (Dry extract)	10	10	10	10	10	10	10	10	10
Mannitol	425	400	350	338	329	319	317.5	311.5	324
Lactose	74	56	106	114	130	130	130	138	115.5
CCS	-	30	-	16	-	16	-	-	-
SSG	-	-	30	16	-	-	16	-	-
CP	-	-	-	-	30	16	16	24	24
Starch	-	-	-	-	-	-	-	6	18
Aspartame	3	3	3	3	4	4	3.5	3.5	3.5
Citric acid	10	12	12	14	14	16	16	16	16
Flavor	10	16	16	16	10	16	18	18	16
CSD	5	5	5	5	5	5	5	5	5
MG	8	8	8	8	8	8	8	8	8
Total	630	630	630	630	630	630	630	630	630

GG-Glycyrrhiza glabra; CL-Curcuma longa;m mCCS-Cross carmellose sodium; SSG-Sodium Starch Glycolate; CP-Cross Povidone; CSD Colloidal silicon dioxide; MG-Magnesium stearate

To strengthen tablet hardness different concentration of mannitol and lactose were taken and for maintain sweetness and flavours, different concentration of sweeteners and flavours were taken. To minimize disintegration time various disintegrating agents with different concentration were taken.

Formulation: Various steps were used in the manufacturing of polyherbal chewable tablet.

Step 1: Raw Material Sifting and Mixing:

Accurately weighed all the active ingredients (G. glabra DE and Curcuma longa DE) and excipients, then sifted through 40# sieve individually. Further transferred all the sifted materials into the sample bag and dry mixed all of them for at least 15-20 minutes for uniform blending.

Step 2: Binding Solution

DM water was used as a binding solution.

Step 3: Granulation

- All the actives and excipients were mixed manually in a sample bag for 10 – 15 min.
- Binding solution was added slowly under continuous granulation.
- All the ingredients were granulated well.
- This wet mass was dried into hot air oven at 75 ±5°C for 45 minutes.
- The tray was removed and turned the material upside down and again keep it for drying at 75 ±5°C for another 20 minutes.
- On an optimum drying, the dried mass was cuttered through comminuting/multi-mill using 8mm sieve and then sifted them through 20# sieve manually.
- Similarly, the same procedure was repeated for oversized granules by gradually decreasing sieve size and continued this process till all the material was passed through 20# sieve.

Step 4: Lubrication Process

After drying all the disintegrates, flavours and lubricants were sifted through 40# sieve. Manually, lubricants and granules were mixed in a sample bag for 15 minutes. Then collected lubricated granules in a clean sterile container and transferred into Tablet compression area and then lubricated granules were evaluated pre compression parameters.

Step 5: Compression Process

The lubricated material was loaded in the compression machine. For tablet compression 12.7 mm biconvex round shaped punches was used. Compressed tablets were collected into clean air tight containers then evaluated post compression parameters. Based on preformulation and post formulation evaluation results, best batch among 9 batches was selected for further optimisation. (12)

Characterization Of Final Herbal Chewable Tablet: Herbal chewable tablet was evaluated on the basis of pre and post compression parameters.

Precompression Parameters

i) Angle of Repose: angle of repose were calculated using the following equation

$$Tan\ \theta = h/\ r$$

θ = tan−1 h/, where ‘h’ is the height of the cone ‘r’ is the radius of the cone

ii) Bulk density: the bulk density was determined using following formula

$$\text{Bulk density} = \frac{\text{Weight of sample blend}}{\text{Bulk volume}}$$

iii) Tapped density: Then the tapped density was determined using following formula

$$\text{Tapped density} = \frac{\text{Weight of sample blend}}{\text{Tapped volume}}$$

iv) Compressibility index: Compressibility index is directly related to flow rate, cohesiveness and particle size and was calculated using following equation

$$\text{Compressibility index} = \frac{\text{Tapped density - Bulk density}}{\text{Tapped density}}$$

v) Loss on Drying: The loss on drying test is designed to measure the amount of water and volatile matters in a sample are dried under specified conditions. The loss on drying of the blend (1g) was determined by using electronic LOD (helium lamp) apparatus at 105ºC. for 5 min.

vi) Hausner's ratio: It indicates the flow properties of the powder and ratio of Tapped density to the Bulk density of the powder or granules. (13)

$$\text{Hausner's Ratio} = \text{Tapped density} / \text{Bulk density}$$

Post-Compression Evaluation Parameters includes

i) Weight Variation The test for uniformity of weight is performed by weighing individually 20 tablets randomly selected from a tablet batch and determining their individual weights. The individual weights are compared with the average weight.

ii) Hardness: The hardness of a tablet is indicative of its tensile strength (Kg/cm^2) and the tablet crushing load, which is the force, required breaking a tablet into pieces by compression. Hardness of the tablet was determined using the Monsanto hardness tester (The lower plunger was placed in contact with the tablet and a zero reading was taken. The plunger was then forced against a spring by tuning a threaded bolt until the tablet fractured. As the spring was compressed a pointer rides along a gauge in the barrel to indicate the force.

iii) Thickness The thickness of an individual tablets is measured with a digital caliper, which gives us information about the variation between tablets. Thickness should be controlled to smooth the progress of packaging. (14)

iv) Friability It is the phenomenon wherein tablet surfaces are damaged or show proof of lamination or breakage whilst subjected to mechanical shock or attrition. The percentage friability was then calculated by

$$F = \frac{\text{Initial wt.} - \text{Final wt.}}{\text{Initial weight}} \times 100$$

% Friability of tablets less than 1% is considered acceptable.

v) Disintegration Time: For tablets, the primary important step towards drug dissolution is breakdown of the tablets into granules or primary powder particles, a process referred to as disintegration. (15)

vi) Dissolution Test: For allopathic drugs, dissolution testing is a very significant tool in pharmaceutical development and quality control but in case of polyherbal formulations development of dissolution methods is much more complex than for single actives

because herbal medicinal products consist of various active components and the selection of analytical markers is complicated. Its solubility determination and selection of suitable dissolution media are also very necessary parameters. (16)

v) Palatability: Taste has a very important role in chewable tablet. It should be taste has a very important role in chewable tablet. It should be palatable. This test was palatable. This test was done by placing the tablet in a mouth and chew it done by placing the tablet in a mouth and chew it.

Stability testing of optimized herbal tablet formulation: The optimized formulation of the drug was subjected to accelerated stability studies at specified conditions of temperature and relative humidity of 25ºC/60% RH for 3 months. (17-21)

RESULTS AND DISCUSSION

Organoleptic Evaluation: Organoleptic parameters confirmed the identity of the plant extracts. Color represents external color which is varying from white to brownish black. Odor and Taste are the particular type of sensation feel by nose and epithelial layer of tongue. Taste may be sweetish, sour, salt like and bitter or tasteless. These are the essential diagnostic features of plants extract.

pH: pH is a measure of the acidity or alkalinity of a fluid. The pH of any fluid is the measure of its hydrogen ion (H^+) concentration relative to that of a given standard solution. The pH may range from 0 to 14, where 0 is most acid, 14 most basic, and 7 is neutral. Here 1% solution of all the plants extract showed slight acidic in nature.

Determination of loss on drying (LOD): LOD is the loss of weight resulting from water and volatile matter of any kind. It is expressed in percentage w/w. This test may helpful in calculating the active constituent loss during manufacturing procedure of any dosage form like tablet, capsule, syrup, powder etc.

Determination of Extractable matter: Extractive values determine the number of soluble active constituents in a medicinal plant material. These selected plants extract showed more water solubility whereas only Curcuma longa DE showed maximum solubility in alcohol.

Determination of Ash Content: The total ash method is described to measure the total amount of material remaining after ignition. This comprises of both "physiological ash", which is derived from the plant tissue itself, and "non- physiological" ash, which is the residue of the extraneous matter adhering to the plant surface. Acid-insoluble ash measures the amount of silica present, especially as sand and siliceous earth.

Table 2: Results of Organoleptic Evaluation

S. No.	Parameters	G. glabra DE	Curcuma longa DE
1	Colour	Light yellowish green	Yellowish to orange
2	Odour	Characteristic	Characteristic
3	Taste	Pungent bitter	Astringent to Gingery bitter
4	pH value	6.78	5.12
5	LOD %w/w	5.21	1.67
6	Water Soluble Extractive Value (%w/w)	86.11	53.39
7	Alcohol Soluble Extractive Value (%w/w)	40.45	11.86
8	Total Ash (%w/w)	5.38	7.31
9	Acid insoluble ash (%w/w)	2.11	0.83

HPTLC Fingerprinting

i) Identification of G. glabra Dry Extract with Raw herb & active constituent by HPTLC: The method as described in the present study utilized silica gel 60F 254 TLC plat as stationary phase and n-butanol: water: glacial acetic acid (7:2:1) as mobile phase given good separation of berberine at R 0.27 from the other compounds present in dry extract of G. glabra. The TLC plate was visualized under UV light at 254 nm and 366 nm and the HPTLT photographed chrom plats is show in Figure 1 and Figure 2. Rf value of Berberine Standard, G. glabra dry extracts, and T. cordifolia powder were found to be 0.25, 0.27 and 0.26 respectively.

ii) Identification of Curcuma longa Dry Extract with Raw herb & active constituent by HPTLC: The method as described in the present study utilized silica gel 60F 254 TLC plat as stationary phase and Dichloromethane: Methanol (99:1) as mobile phase given good separation of curcumin at R 0.72 from the other compounds present in dry extract of C. longa. The TLC plate was visualized under UV light at 254 nm and 366 nm and the HPTLT photographed chrom plats is show in Figure 1 and Figure 2. Rf value of Berberine Standard, C. longa dry extracts, and T. cordifolia powder were found to be 0.72, 0.73 and 0.73 respectively.

Fig. 1: TLC of G. glabra Std., DE, and Powder at 254nm

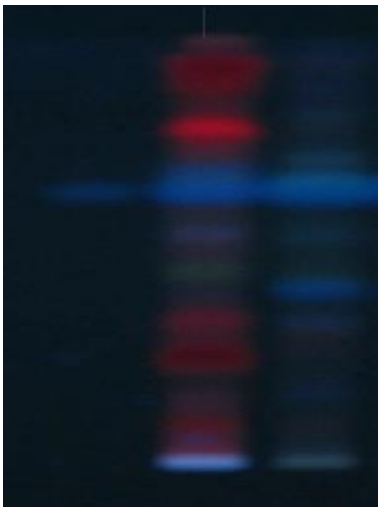

Fig.2: TLC of G. glabra DE Std., DE, and Powder at 366nm

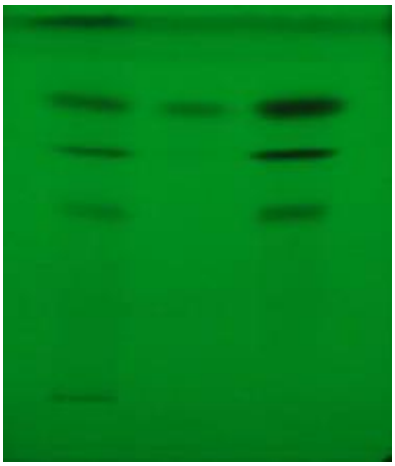

Fig. 3: TLC of C. longa Powder, Std., and DE, at 254nm Std.,

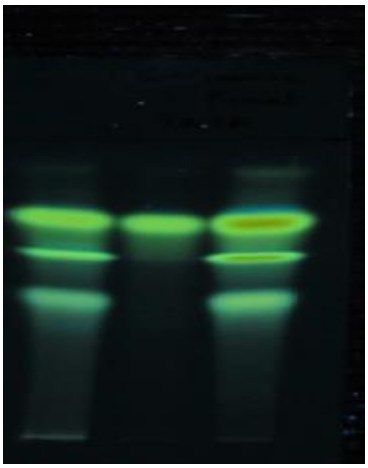

Fig. 4: TLC of C. longa Powder, and DE, at 366nm

Pre-Compression Parameters.

1) Angle of repose (Ɵ): The values obtained for angle of repose for all (HF1-HF9) formulations are tabulated in Table6. The values were found to be in the range from and 23°.87- 35°.86.

2) Hausner's ratio: -The values obtained for hausner's ratio for all (HF1-HF9) formulations are in Table 6. Hausner's ratio value ranges between 1.024 - 1.162 indicating that the granules have the required flow property for compression.

3) Tapped Density: -The values obtained for tapped density for all (HF1-HF9) formulations are in Table6. Tapped Density value ranges between 0.59 - 0.75 indicating that the granules the required flow property for compression.

4) Bulk Density: -The values obtained for Bulk Density for all (HF1-HF9) formulations are in Table6. Bulk Density value ranges between 0.44 - 0.64 indicating that the granules have the required flow property for compression.

5) Compressibility index The values obtained for Compressibility index for all (HF1-HF9) formulations are in Table6. Compressibility index was found to be in the range 15.11% to 23.65%. All formulations showed good to fair properties.

6) Loss On Drying The values obtained for Loss On Drying for all (HF1-HF9) formulations are in Table6. A loss on drying of all batches was found to be 1.49 to 2.64 %.

Table 3: Pre compression parameter of Herbal chewable tablets

Batch	Angle of repose	Hausner ratio	Tapped density	Comp. (%)	Bulk Density	LOD (%)
HF1	25°.12	1.112	0.74	19.40	0.56	2.11
HF2	32°.21	1.106	0.75	21.29	0.61	1.86
HF3	23°.87	1.104	0.67	19.40	0.48	1.96
HF4	29°.34	1.121	0.72	15.11	0.64	2.64
HF5	24°.67	1.024	0.66	23.65	0.53	2.04
HF6	29°.32	1.123	0.59	16.50	0.47	1.76
HF7	33°.11	1.116	0.64	19.11	0.46	1.68
HF8	28°.56	1.105	0.59	22.49	0.51	1.49
HF9	35°.86	1.162	0.72	16.72	0.44	2.01

Evaluation Of Post-Compression Parameter

A. Thickness of tablets: The average thickness for all the formulations (HF1-HF9) was found in the range of 3.12-4.99 mm respectively which is within the allowed limit of deviation i.e. 5% of the standard value.

B. Hardness: Hardness test was performed by "Monsanto hardness tester". All the formulations (HF1-HF9) have an average hardness in between 4.3 to 5.3, kg/cm^2 respectively. This ensures good handling characteristics of all formulation batches.

C. Friability: The average percentage friability for all the formulations was found in between 0.121% to 0.198%, which is found within the pharmacopoeial limit (i.e. less than 1%). So, the maximum friability was 0.121% observed for HF5 and the minimum friability 0.198% observed for HF3.

D. Weight Variation Test: The weight variation for all formulations (HF1-HF9) were found in the range of 627 to 633 results were dissipated in **table 6**.6 All the formulated tablets passed weight variation test as the % weight variation was within the pharmacopoeial limits (<5%). The weights of all the tablets were found to be uniform with low standard deviation values.

E. Palatability: The Palatability for formulation HFA-HF9 was observed slight bitter. The results were shown in **table 6.16**.

Table 4: Post-compression parameters results

Formulation	Thickness (mm) ± SD	Weight variation (mg)	Palatability	Hardness (kg/cm^2)	Friability (%)
HF1	3.34 ±0.12	628 ± 5	Slight Bitter	4.3 ± 0.11	0.127± 0.02
HF2	3.12 ±0.11	631 ± 5	Slight Bitter	4.4 ± 0.11	0.143± 0.01
HF3	4.56 ±0.12	631 ± 5	Slight Bitter	5.1 ± 0.12	0.121± 0.1
HF4	4.99 ±0.14	630 ± 5	Slight Bitter	5.3 ± 0.12	0.123± 0.1
HF5	3.22 ±0.12	629 ± 5	Slight Bitter	4.7 ± 0.14	0.156± 0.2
HF6	3.45 ±0.12	627 ± 5	Slight Bitter	4.2 ± 0.12	0.198± 0.2
HF7	3.89 ±0.11	632 ± 5	Slight Bitter	4.7 ± 0.14	0.145± 0.1
HF8	4.21 ±0.12	638 ± 5	Slight Bitter	5.3 ± 0.12	0.165± 0.1
HF9	4.75 ±0.14	632 ± 5	Slight Bitter	5.2 ± 0.13	0.167± 0.1

International Journal of Pharmacy and Pharmaceutical Research (IJPPR)
Volume 30, Issue 10, October 2024 ijppr.humanjournals.com ISSN: 2349-7203

Disintegration Test: For the purposes of this test, disintegration does not imply complete solution of the unit or even of its active constituent. Complete disintegration is defined as that state in which any residue of the unit, except fragments of insoluble coating or capsule shell, remaining on the screen of the test apparatus or adhering to the lower surface of the disk, if used, is a soft mass having no palpably firm core. The disintegration time for Batch HF1-HF9 ranged from 15-30 Minutes.

Table 5: Disintegration time of batch (HF1-HF9)

S. N0.	Formulation code	Disintegration time (min)
1	HF1	19.03 ± 2.12
2	HF2	23.45± 1.11
3	HF3	26.18± 1.23
4	HF4	24.17± 1.87
5	HF5	20.86± 1.15
6	HF6	24.54± 2.16
7	HF7	19.17± 2.11
8	HF8	28.87± 1.23
9	HF9	29.11± 1.54

VI) *In-vitro* Dissolution Study. The *in-vitro* drug release of the tablets were carried in phosphate buffer pH 7.4 from 0 to 30 min by USP XXIV type-II apparatus and the values are shown in Table no. 10 to 18. The plot of % Cumulative drug release v/s time (hrs) was plotted and depicted as shown in Figure 18 and 22.

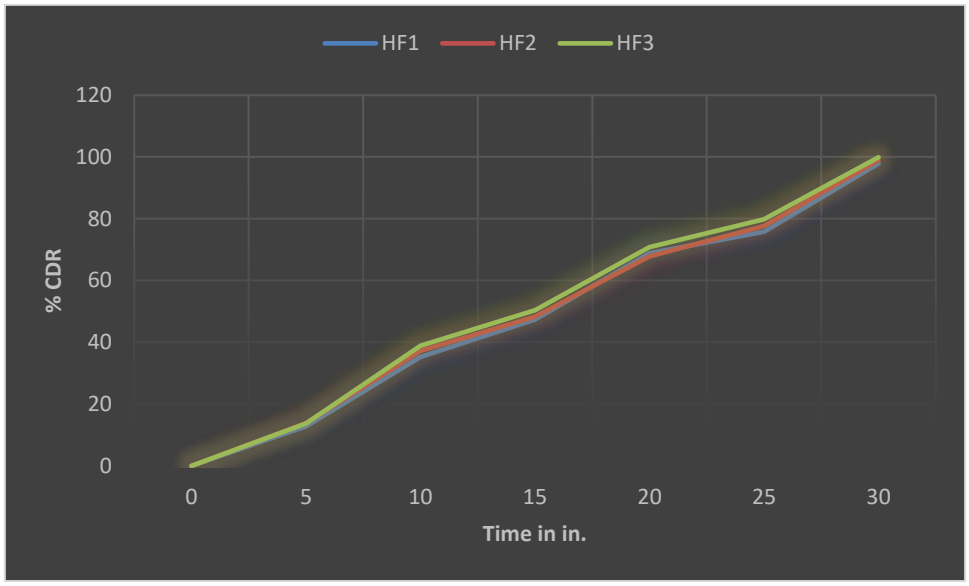

Figure 5: In-vitro drug release (HF1-HF3)

International Journal of Pharmacy and Pharmaceutical Research (IJPPR)
Volume 30, Issue 10, October 2024 ijppr.humanjournals.com ISSN: 2349-7203

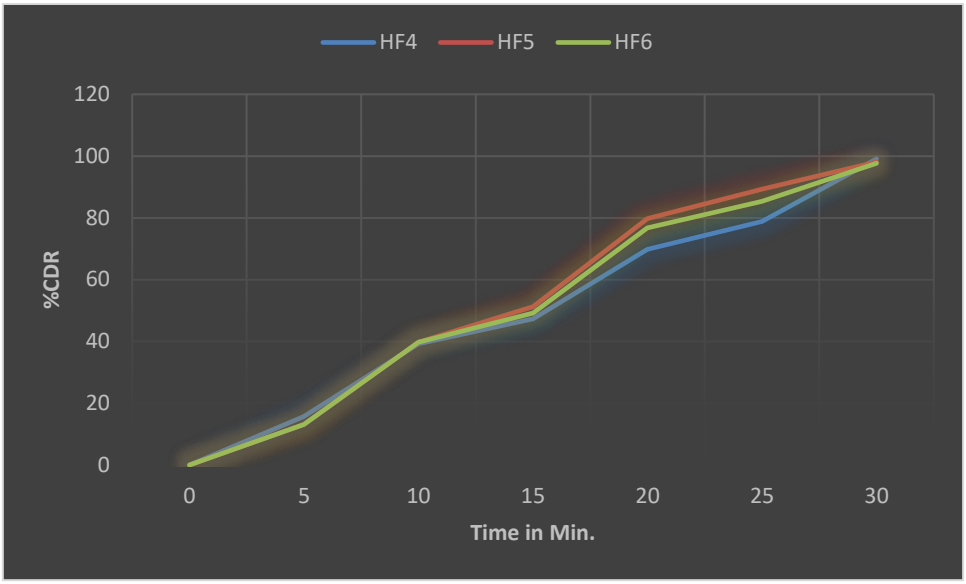

Figure 6: In-vitro drug release (HF4-HF6)

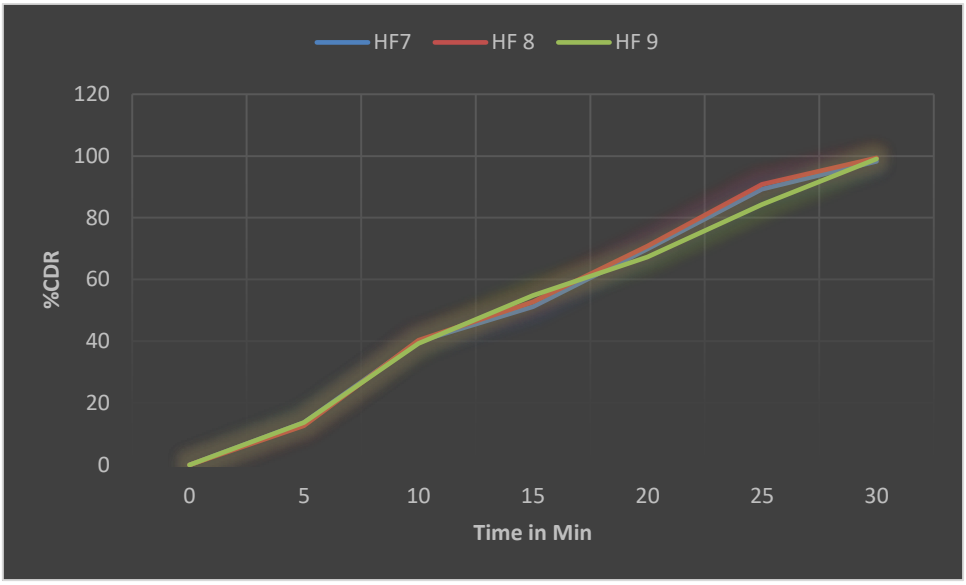

Figure 7: In-vitro drug release (HF7-HF9)

Release kinetic studies: The *in-vitro* drug release data of all formulations were analysed for determining kinetics of drug release. The obtained data were fitted to zero order kinetics, first order kinetics Higuchi model and Peppas. The highest correlation coefficient (r^2) obtained from these method gives an idea about model best fitted to the release data. From the results of kinetic studies, the examination of correlation coefficient "r^2" indicated that the drug release followed first order release kinetics. It was found that the value of "r^2" for first order ranged from 0.981-0.992, which is near to 1 when compared to Higuchi square root ranged from 0.892-0.958 and zero order ranged from 0.895-0.969. So, it was understood to be following first order release pattern followed by all formulations. Further, to understand the drug release mechanism, the data were fitted into Korsmeyer Peppas exponential model Mt / Ma = Ktn.

Where Mt / Ma is the fraction of drug released after time 't' and 'k' is kinetic constant and 'n' release exponent which characterizes the drug transport mechanism. The release exponent (n) ranges in between 0.483-0.7911. For all the formulations HF5 the values for 'n' ranged above 0.89 which indicates that all the formulations followed non-fickian release mechanism. The relative complexity of the prepared formulations may indicate that the drug release mechanism was possibly controlled by the combination of diffusion and erosion.

STABILITY STUDIES

Based on the results of *in-vitro* drug release two best HF3 were selected for three-month stability studies at 25ºC/60% RH. The stability studies were conducted according to the method described in section four. The selected formulations were evaluated for physical appearance, hardness, friability, and drug content.

Table 6: Stability Study of HF3

Formulation	Initial	1 month	2 months	3 months
Hardness kg/cm^2	5.1 ± 0.12	5.1 ± 0.12	5.0 ± 0.12	5.0 ± 0.12
Friability %	0.122	0.121	0.120	0.119
Drug release %	96.34 ± 0.15	96.19 ± 0.15	96.05 ± 0.15	95.98 ± 0.15

CONCLUSION

From this study, it has been demonstrated that the standardization and its in-vitro activity have confirmed the quality and efficacy of the selected plant extracts. The proposed design can help to develop and optimize the polyherbal formulation and this leads to the development of valuable and cost-effective products and their manufacturing process in a minimum period of time. This herbal chewable tablet may inhibit or kill the bacteria in mouth through chewing. As a primary symptom of pulmonary tuberculosis are like coughing, sore throat, bloody phlegm etc. and through chewing method standardized plant extracts are completely mixed with the saliva and activate lysozymes which will prevent the mycobacterial growth in saliva and create a less chances of infection. Thus, from the available study data, it has been concluded that developed herbal chewable tablet can be the alternative dosage form for the symptomatic treatment and also it could be used as an adjuvant therapy with existing anti-immunomodulatory drugs.

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How to cite this article:
Kirti Kushwah et al. Ijppr.Human, 2024; Vol. 30 (10): 370-381.
Conflict of Interest Statement: All authors have nothing else to disclose.