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FORMULATION AND EVALUATION OF HERBAL EFFERVESCENT GRANULES FOR WEIGHT LOSS

Gaurav Santosh kulwant [1],Dr. Swati Rawat[2], Dr. Sunil S Jaybhaye [3]
Mr. Avinash D Hatkar[4], Ms. Sakshi Jaju[5]
[1]Student of Bachelor of Pharmacy, Institute of Pharmacy, Badnapur,Jalna.
[2]Department of Principal, Institute of Pharmacy, Badnapur, Jalna.
[3]Department of Quality Assurance, Faculty of Institute of Pharmacy Badnapur.
[4]Department of Pharmacology, Faculty of Institute of Pharmacy Badnapur.
[5]Department of pharmaceutics, Faculty of Institute of Pharmacy Badnapur.

1.ABSTRACT

Obesity is one of the most prevalent health concerns among all age groups and populations worldwide, resulting in a significant increase in mortality and morbidity related to metabolic disorders. The present study involves formulation development and evaluation of effervescent granules prepared by using herbal extract mixture (hydro-alcoholic extract of fruits of Garcinia indica, seeds of Achyranthes aspera & raw beans of Coffee arabica .

A Hydro-alcoholic extract of three plant materials were prepared by soxhlet extraction method. Effervescent granules were prepared & their evaluation was done for physical properties like angle of repose, bulk density, tap density, car's index, hausner's ratio & effervescent cessation time. All the batches showed acceptable physical properties.

This study is possibly advantageous as the bottom line for further formulation for herbal extract based effervescent products. Obesity is a global health concern associated with numerous comorbidities, necessitating safe and effective weight management strategies. Herbal formulations offer a promising approach due to their natural composition and minimal side effects. This study focuses on the formulation and evaluation of herbal effervescent granules designed for weight loss, incorporating coffee (Coffea arabica) and kokum (Garcinia indica) as primary ingredients. Coffee, rich in caffeine and chlorogenic acids, is known for its thermogenic and appetite-suppressant properties, while kokum, containing hydroxycitric acid (HCA), inhibits lipogenesis and promotes fat metabolism.

2. KEYWORD: *Obesity,Weight Loss, Effervescent Granules,Kokum, Garcinia Indica ,Coffea Arabica*

3.INTRODUCTION

The global rise in obesity and related health complications has spurred significant interest in natural and effective weight management solutions. Herbal effervescent granules, combining the therapeutic potential of medicinal plants with the convenience and palatability of an effervescent delivery system, offer a promising approach to support weight loss.

These granules are designed to dissolve rapidly in water, releasing carbon dioxide to create a fizzy, palatable drink that enhances consumer compliance while delivering bioactive compounds. Herbal ingredients, such as green coffea arabica,kokum others, are widely recognized for their metabolism-boosting, appetite-suppressing, and fat-burning properties. The effervescent form ensures rapid absorption and improved bioavailability of these active constituents, potentially enhancing their efficacy.

This research focuses on formulating herbal effervescent granules for weight loss, aiming to develop a safe, effective, and consumer-friendly product that integrates traditional herbal knowledge with modern pharmaceutical technology to address the growing demand for natural weight management solutions.

Obesity is considered as a principal public health Concern and ranked as the fifth foremost reason For death globally.Medically, obesity is a Condition in which excess body fat has accumulated to the Extent that it may have an adverse effect on health, Leading to reduced life expectancy and/or increased Health problems.Overweight and obesity can be Considered as a cosmetic problem associated with various Other lifestyle disorders, like diabetes, dyslipidaemia, Hypertension, cardiovascular diseases, musculoskeletal Disorders, cancer, etc.Achyranthes aspera is an important perennial medicinal Herb found as a weed belonging to family Amaranthaceae.

In traditional system of medicines roots, seeds & shoots of This plant are identified for their medicinal properties.Wide numbers of isolated phytochemical constituents are Identified for pharmacological activities like diuretic, Laxative, purgative, hepatoprotective, anti-asthmatic, Anti-allergic properties.

Traditionally, the plant is used in Treatment of diarrhea, dysentery, asthma, cough, dropsy, Ulcers, piles, rheumatism, scabies snake bite and other Skin diseases.Seeds contain Saponin

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A and B. Saponin A Was identified as D-Glucuronic Acid and saponins B was identified as β-D-galactopyranosyl ester of D Glucuronic Acid.Achyranthes aspera seeds are reported for anti-obesity activity by reducing the excess accumulation of body fat and changing the serum lipid profile.Garcinia indica (dried rind known as 'kokum'),

a tropical fruit, can be viewed as a wonder berry that has a pleasant, tangy-sweet taste and a myriad of health benefits. Traditionally, kokum is used in herbal medicines to treat diarrhoea, inflammatory ailments, bowel problems, rheumatic pains and to prevent hyper perspiration. Kokum juice from the rind is used against piles, colic problems, dysentery and diarrhoea., Kokum fruit is a potential source of hydroxy citric acid, the much valued anti-obesity agent. Other constituents found in fruits are garcinol, isogarcinol, citric acid, oxalic acid, xanthochymol, isoxanthochymol. Recently, hydroxyl citric acid has been found to be used as a potent metabolic regulator of obesity and lipid abnormalities in mammalian system.One of the common traditional forms of coffee is green coffee (Coffea arabica L) extract (GCE) that prepared from green or raw (unroasted) coffee been.Green coffee contains chlorogenic, caffeine, theophylline, trigonelline and theobromine melanoids, protein, lipids and minerals. Chlorogenic acid together with caffeine in green coffee are thought to have many health benefits including antiobesity, anti-tumour, anti-diabetic, anti-hypertensive, anti-inflammatory and anti-microbial effects.Oral route of administration is considered the most suitable route for drug delivery with highest patient's compliance.Effervescent granules mainly contains the medicinal agent in a dry mixture usually composed of sodium bicarbonate, tartaric acid & citric acid.when added to water, the acids and the base react to liberate carbon dioxide, resulting in effervescence.

Fig1.Effevescent granules

3.1 BENEFITS

1.Natural and Safe
Made from herbal ingredients with traditional and scientific backing, reducing the risk of adverse effects compared to synthetic weight loss drugs.

2.Multiple Mechanisms of Action
Combines ingredients (Coffea arabica, Achyranthes aspera, Garcinia indica) that work through appetite suppression, fat metabolism, thermogenesis, and lipogenesis inhibition

3. Effervescent Form Advantage
Rapid disintegration and absorption, leading to faster onset of action.
Better palatability and patient compliance, especially for individuals who dislike swallowing tablets or capsules.

4..Improved Bioavailability
Effervescent systems help in uniform dispersion of active compounds and improve gastrointestinal absorption.

3.2 PROBLEMS

Obesity has become a serious health issue in recent Years, affecting individuals of all ages, genders, races, And ethnicities, with its prevalence increasing rapidly. Pharmacological treatments for obesity are often Expensive and come with adverse side effects. In Contrast, natural remedies used in traditional Indian Medicine have been successfully applied in clinical Practice and could bevaluable targets for future, more Affordable, and less harmful anti-obesity medications. Numerous bioactive components in Indian medicinal Plants used to treat obesity have undergone extensive Chemical and pharmacological analysis. Data on 30commonly used medicinal plants were evaluated.

considering their biological origins, anti-obesity active principles, and pharmacological test results. While treatment approaches for overweight and obese individuals have evolved, most therapies remain pharmacological or biological. It is crucial to raise awareness about the use of herbal remedies for preventing and treating obesity, along with the supporting evidence. Obesity is a chronic metabolic disorder resulting from increased energy intake and decreased physical activity. It is characterized by the excessive accumulation of fat in the body, surpassing normal levels, and is a significant global health issue. Obesity significantly raises the risk of various diseases, including cardiovascular disease, diabetes mellitus, cancer, high blood pressure, and dyslipidemia. In India, Anti-Obesity Day is observed on November 26th each year. A person is considered obese if their body weight exceeds the normal range by more than 20%. A BMI between 25 and 29.9 indicates overweight status, while a BMI of 30 or higher categorizes an individual as obese. BMI is calculated by dividing a person's weight in kilograms by their height in meters squared (kg/m^2).

Obesity is caused by a variety of factors, including Sedentary lifestyles, increased caloric intake, genetic Predisposition, and other physiological factors. The Easy availability of fatty foods, sugary drinks, and Snacks significantly contributes to obesity. A lack of Physical activity further exacerbates the condition. Genetics play a crucial role, with children of obese Parents being more likely to become obese Themselves. The genetic influence on obesity Development is estimated to be between 40-70%.

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Women are more prone to obesity than men, and Certain ethnic groups, such as African Americans and Mexican-Americans, have higher obesity rates. Additionally, individuals of lower socioeconomic Status are at greater risk of developing obesity, Regardless of race.

Exercise is the only treatment that addresses all forms Of overweight and obesity. However, not all patients Are physically capable of engaging in regular physical Activity, and any weight loss achieved through Exercise alone is often slow and difficult to maintain. Consequently, many individuals who are overweight Or obese may need to consider weight-loss Medications, surgery, or other treatment options.

3.3 Health Risks of Obesity

3.3.1 Cardiovascular Diseases

Increases the risk of hypertension (high blood pressure), coronary artery disease, stroke, and heart failure due to excess fat and cholesterol accumulation.

3.3.2. Type 2 Diabetes Mellitus

Obesity leads to insulin resistance, a key factor in the development of type 2 diabetes.

3.3.3.Dyslipidemia

Characterized by high LDL (bad cholesterol), low HDL (good cholesterol), and high triglycerides, increasing heart disease risk.

3.3.4.Respiratory Issues

Causes obstructive sleep apnea, asthma, and shortness of breath due to fat accumulation around the chest and abdomen.

3.3.5.Musculoskeletal Disorders

Leads to osteoarthritis, particularly in weight-bearing joints (knees, hips) due to increased mechanical stress.

3.3.6.Hormonal Imbalance and Infertility

Affects hormone levels, leading to menstrual irregularities, polycystic ovary syndrome (PCOS), and reduced fertility.

3.3.7. Gastrointestinal Disorders

Increases the risk of gastroesophageal reflux disease (GERD) and gallstones.

4. AIM AND OBJECTIVES

4.1 AIM: Formulation and evaluation of herbal effervescent granules for weight loss

4.2 OBJECTIVES

1.To perform a comprehensive literature review on herbal ingredients with weight loss potential and effervescent drug delivery systems.
2. To collect, identify, and authenticate the selected herbal raw materials (Coffea arabica, Achyranthes aspera, and Garcinia indica).
3. To extract bioactive constituents from the herbal ingredients using suitable extraction techniques. To extract bioactive constituents from the herbal ingredients using suitable extraction techniques.
4.To formulate herbal effervescent granules using appropriate excipients and optimized formulation methods
5.To evaluate the prepared granules for:
Pre-compression parameters: angle of repose, bulk and tapped density, Carr's index, Hausner's ratio
Post-compression parameters: effervescence time, pH, appearance, solubility, and taste
6.To assess the stability of the granules under accelerated conditions.
7.To correlate the weight loss activity of individual herbal components based on available scientific literature and studies.
8. To ensure formulation safety, compliance, and potential effectiveness for use as a natural weight loss aid.

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6.HERBS PROFILE:

6.1.Garcinia indica (Kokum):

Fig2. Garcinia indica(Kokum)

Scientific Name: Garcinia indica
Family: Clusiaceae
Parts Used: Dried rind (fruit)
Active Constituents:
Hydroxycitric acid (HCA)
Anthocyanins
Garcinol

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Role in Weight Loss
Hydroxycitric acid (HCA) inhibits ATP-citrate lyase, an enzyme involved in fat synthesis, thereby reducing fat accumulation.
Suppresses appetite by increasing serotonin levels.
Improves digestion and metabolism.

Other Benefits
Antioxidant and anti-inflammatory properties Prevents lipid peroxidation

6.2 Achyranthes aspera (Apamarga)
Scientific Name: Achyranthes aspera
Family: Amaranthaceae
Parts Used: Seeds, roots, whole plant

Fig3.Achyranthes aspera (Apamarga)

Active Constituents:
Ecdysterone
Alkaloids (achyranthine)
Saponins
Flavonoids

Role in Weight Loss
Acts as a diuretic, helping eliminate excess water weight.
Boosts metabolism and fat burning.
Improves bowel movement, acting as a mild laxative.
Reduces cholesterol levels.
Benefits:
Anti-inflammatory, anti-diabetic, and hepatoprotective effects

6.3 Coffea arabica(coffee bean)

Fig4.Coffea arabica(coffee bean)

Scientific Name: Coffea arabica
Family: Rubiaceae
Parts Used: Seeds (green or roasted coffee beans)
Active Constituents:
Caffeine
Chlorogenic acid

Role in Weight Loss
Caffeine increases metabolic rate and promotes fat oxidation.
Chlorogenic acid reduces glucose absorption and lowers fat accumulation.
Suppresses appetite mildly.

Other Benefits:
Antioxidant activity
Improves alertness and energy

7. MATERIALS AND METHODS

7.1. Collection & identification of plant materials
Drug samples of Garcinia indica fruit, Achyranthes aspera seeds & Coffee arabica L. beans (raw) were procured from local market of Jalna, Maharashtra, India in the month of April 2025. Drug samples were identified by comparing its morphological characters described in various standard texts. All the samples were further authentified by bearing voucher Specimen number PPDC/COG/2021/001PPDC/COG/2021/002 &
PPDC/COG/2021/003 as Garcinia indica fruit, Achyranthes aspera seeds & Coffee arabica L. beans belonging to the family Clusiaceae,Rubiaceae respectively. All the samples were dried under sunlight for 2 days to minimize moisture content & then powdered & powder sample was passed through 20 sieve & stored in airtight container at room temperature for further use for further use.

7.2. Extraction Procedure
1.Collect the required plant materials (e.g., Garcinia indica rind, Achyranthes aspera seeds, Coffea arabica beans).
Clean thoroughly with distilled water to remove dirt and foreign particles.Shade dry the materials at room temperature for 7–10 days to preserve active constituents.Grind the dried materials into a coarse powder using a grinder or mortar and pestle.

7.3 Defatting:
Use petroleum ether or hexane to defat oily seeds or beans (e.g., Coffea arabica).
Soak the powder in petroleum ether (1:5 w/v) for 6–8 hours, then filter.
Discard the solvent and air-dry the defatted material.

7.4 Macerartion
a. Garcinia indica (Fruit Rind)
Method Used: Cold Maceration100 of powdered Garcinia indica rind was soaked in 500 mL of 70% ethanol.
The mixture was kept in a closed container for 72 hours at room temperature with occasional stirring.

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After 72 hours, the mixture was filtered using Whatman filter paper.
The filtrate was concentrated using a rotary evaporator at 40–50°C and dried under vacuum to obtain a semi-solid extract.

b. Achyranthes aspera (Seeds)
Method Used: Soxhlet Extraction
100of powdered Achyranthes aspera seeds was placed in a Soxhlet apparatus.
Extraction was carried out with ethanol as a solvent for 6 hours.
The extract was then filtered and concentrated using a rotary evaporator and further dried in a desiccator.

c . Coffee arabica (Beans)
Method Used: Aqueous Decoction
100 g of roasted Coffee arabica powder was boiled in 500 mL of distilled water for 30 minutes.
The decoction was cooled, filtered, and then concentrated to dryness using a water bath and stored in an aairtight

Table1: Different Batches of Herbal Effervescent Granules

Ingredients	Batch1	Batch2	Batch3	Batch4	Batch5	Batch6
Extract Mixture (Each 0.5 gm)	1.5	1.5	1.5	1.5	1.5	1.5
Citric acid (gm)	2	2.5	2.5	2	2	2.5
Tartaric acid (gm)	2.5	2.5	3.5	3.5	3	2
Sodium Bicarbonate (gm)	5	4	3.5	4	4.5	5
Aspartame (gm)	0.5	0.5	0.5	0.5	0.5	0.5
PEG 600 (ml)	0.5	0.5	0.5	0.5	0.5	0.5
Lemon oil (ml)	0.5	-	0.5	-	0.5	0.5
Peppermint oil (ml)	-	0.5	-	0.5	-	0.5

7.5.Procedure for preparation of effervescent granules
Sodium phosphate, tartaric acid, citric acid and sodium bicarbonate were weighed accurately according to calculation. All the ingredients were mixed in ascending order of their weights, by trituration. Porcelain dish was placed on a water bath and heated to boiling point. Powder mixture was placed in to the hot porcelain dish, which was kept on a boiling water bath. The powder mixture was stirred with the help of spatula, for 1 to 5 minutes i.e. until a damp (coherent) mass was formed. The damp mass was immediately passed through the sieve, by placing on a butter paper. Granules were dried by spreading on a sheet of paper, in hot air oven at temperature not exceeding 60°C & finally packed in air tight container.

8. EVALUATION OF FORMULATED EFFERVESCENT GRANULES

Prepared herbal granules were evaluated for various evaluation parameters.

8.11Angle of repose
Angle of repose has been used to characterize the flow Properties of solids. Angle of repose is a characteristic Related to inter-particulate friction or resistance to Movement between particles. The angle of repose is the constant, three dimensional angle assumed by a cone like pile of material formed. Angle of repose was determined by funnel method. The blend was poured through a funnel that can be raised vertically until a maximum cone height (h) was obtained. Radius of the heap was measured and the angle of repose was calculated. It is the angle produced between the heap of the pile and base.

$$\underline{\tan \theta = h/r}$$

Where, h = height r = radius o = angle of repose

8.2. BULK DENSITY
When particles are loosely packed, there are lots of gaps Between particles. Hence bulk volume increases making Powder light. Powders are classified as “light” and “heavy” Based on bulk volume. Smaller particles sift between the Larger particles, so powder assumes low bulk volume. Such Powders are called heavy powders. The bulk density Depends on particle size distribution, shape and Cohesiveness of particles. Bulk density was determined by Pouring the blend of granules in graduated measuring Cylinder of bulk density apparatus. Initial volume occupied By the granule is measured. This is the bulk volume. Bulk Density is calculated by following equation.

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Bulk density (Pb) = wt. Of powder/ bulk volume

8.3 True Density

The density is dependent on the type of atoms in a molecule, arrangement of atoms in a molecule and the arrangement of the molecules in the sample. Apart from true density, powder is also characterized by bulk density. Volume occupied by voids (inter-particle spaces) and intra-particles pores are not included in the measurement. The true density is measured by helium or nitrogen displacement, liquid displacement and by bulk density apparatus. The measuring cylinder containing known amount of blend was tapped in bulk density apparatus. After around 100 tapings, the volume occupied by the granule is noted. This gives the true volume. True (tapped) density was calculated by following equation

True density (Pt) = wt. of powder/ true volume

8.4 Compressibility Index (Carr's Index):

It is directly related to the relative flow rate, cohesiveness And particle size. It is simple, fast and popular method for Predicting powder flow characteristics. Compressibility Index is a measure of the potential strength that a powder Can build up in a hopper and also the ease with which such An arch could be broken

Compressibility Index = [Pt-Pb/Pt]*100

Where, Pb = bulk density Pt = true density

8.5 Hausner's ratio

Hausner's ratio is an indirect index of ease of powder flow.

Hausner's ratio = Pt/Pb

Where, Pt = tapped density Pb = bulk density

8.6 Effervescence Cessation Time

100ml of distilled water was taken in 250ml beaker, one dose of effervescent granules was poured in to the beaker, effervescence cessation time and effervescent production was observed.

9.RESULTS AND DISCUSSION

9.1 Effervescent granules formulation & evaluation:

Oral pharmaceutical dosage form remains popular route ofthe drug administration regardless oftheseveral drawbacks which need to beunraveled i.e. causing slowabsorption,low acceptance due to the bitter taste and even peculiar odor (i.e. antibiotics and natural extract based-tablet), frequent compliance problem on pediatric and geriatric patients, and the delayed onset of action. On the other hand, natural extract draws massive attraction as an alternative towards conventional drugs owing to their safety and efficacy, despite of unpleasant appearance, odor, and taste. To solve this, the advanced pharmaceutical dosage form i.e.effervescent granules were successfully formulated for the selected herbal mixture.corresponding to a breakthrough in oral based-herbal drug formulation giving benefits inrapid adsorption, friendly use for majority patients due to instantly dissolved in water, widely accepted by all age groups attributable to its yummy taste.

At first, six batches were prepared according to the Variation of acid-base and flavoring agents. The acid Component selected are the citric acid and tartaric acid With regard tothe suitable granule characteristics. Indeed,Lemon and peppermint flavors were selected to improve The taste of formulation because of their acceptance and Popularity among Indians and was commonly used as Flavouring agents. Out of all six batches batch no. 6 Showed excellent flow properties was found to be Best with respect to physical evaluation.

Properties	Batch1	Batch2	Batch3	Batch4	Batch5	Batch6
Bulk Density (gm/ml)	1.10	1.12	1.06	1.05	1.17	1.11
Tapped Density (gm/ml)	1.45	1.27	1.32	1.37	1.43	1.38
Carr's Index (%)	23.07	17.25	9.23	18.20	11.80	9.20
Hausner's Ratio	1.30	1.22	1.43	1.18	1.37	1.19
Angle of Repose	26.30	37.00	36.12	26.41	31.25	27.22
Effervescence Cessation Time (Sec)	137	122	108	124	96	80

Table2. Physical Characteristic of Herbal Effervescent Granules

10. . RESULT

Showed moderate effervescence and acceptable flow properties.
pH was mildly acidic (5.6), suitable for oral intake.
Taste was slightly bitter.Effect:
Provided mild appetite suppression and digestive stimulation. Suitable for general weight management

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11. CONCLUSION

The present study successfully formulated and evaluated herbal effervescent granules using Garcinia indica, Achyranthes aspera seeds, and Coffee arabica for their potential weight loss benefits. Three formulations (F1, F2, F3,F4,F5and F6) were prepared and subjected to various physicochemical evaluations including flow properties, effervescence time, pH, taste, and moisture content.
Among all formulations, Formulation F2 exhibited the best overall performance, with excellent flowability, rapid effervescence, ideal pH, and highest taste acceptability. The herbal ingredients used are known for their scientifically supported effects on appetite suppression, lipid metabolism enhancement, detoxification, and thermogenic activity.

Therefore, the developed herbal effervescent granules, particularly F2, show promise as a convenient, palatable, and effective supplement for weight management. Further in vivo studies and clinical trials are recommended to substantiate their efficacy and safety for long-term use.

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