Research Article | *Cuestiones de Fisioterapia* | *Pharmaceutics*

FORMULATION AND EVALUATION OF JACKFRUIT SYRUP FOR THE TREATMENT OF ASTHMA

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Abstract

Asthma is a chronic respiratory disease marked by airway inflammation, bronchial hyperresponsiveness, and recurring symptoms such as wheezing, coughing, and breathlessness. Although conventional therapies, including corticosteroids and bronchodilators, are widely used, they are often associated with adverse effects and long-term dependency. The present study aims to formulate and evaluate a jackfruit (*Artocarpus heterophyllus*)-based syrup for its potential use in the management of asthma. Jackfruit is a tropical fruit rich in bioactive compounds such as flavonoids, phenols, tannins, and saponins, which are known for their anti-inflammatory, antioxidant, and bronchodilatory activities. In this study, jackfruit pulp and seed extracts were used to develop a herbal syrup formulation. The syrup was evaluated for various physicochemical parameters including pH, viscosity, organoleptic properties, and microbial test. Phytochemical screening confirmed the presence of key constituents with potential therapeutic activity.

Keywords: Jackfruit, Asthma, Anti-inflammatory, Anti-oxidant, Artocarpus.

INTRODUCTION

Asthma:

The most prevalent respiratory condition that affects men is bronchial asthma. Asthma is a chronic condition marked by many types of airway obstruction, airway inflammation, and hyper responsive bronchial tissues. Your airways shrink, swell, and may produce more mucus if you have asthma. This may make breathing difficult and lead to coughing, shortness of breath, and wheezing when you exhale. Some people consider asthma to be a minor annoyance [7]. These symptoms may be brought on by the release of endogenous and intrinsic mediators from mast cells during allergic reactions and inflammation of the airways in the lungs, including histamine, leukotrienes, bradykinin, prostaglandins, nitric oxide, and platelet activating factors, chemokines, and endothelin. Various illnesses, dust, cold or warm air, activity, emotion, scents, chemicals, different foods, tobacco smoke, heredity, and histamine are also known to cause asthma attacks.[1] Approximately 8–10% of people worldwide have bronchial asthma. Asthma's growing frequency, morbidity, and mortality rates over the past 20 years have provided evidence of the condition's increasing severity in the general population. [2]

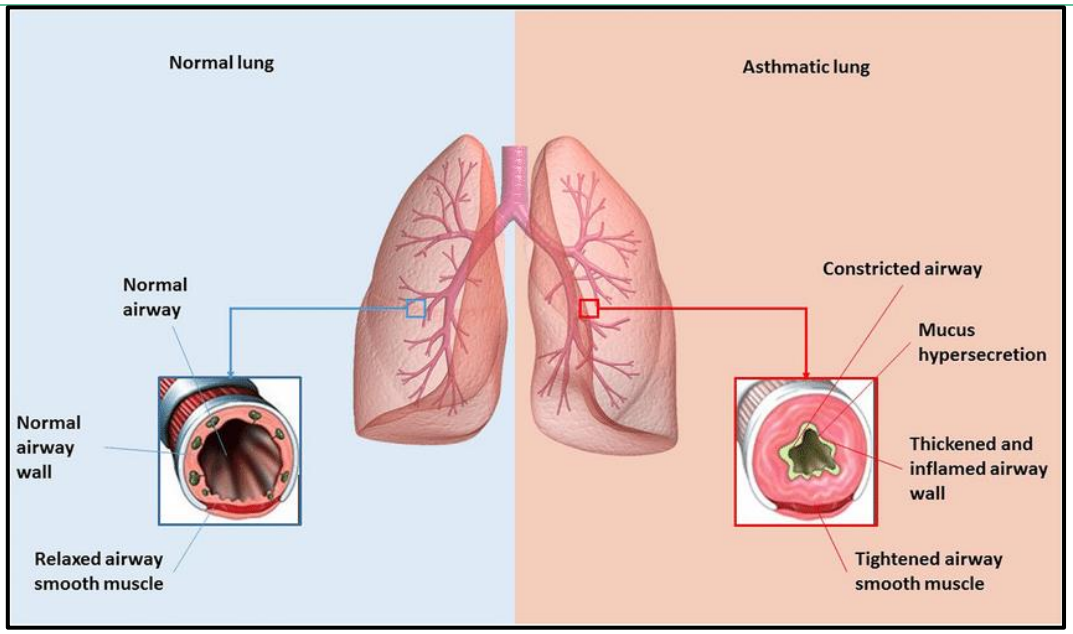


Figure 1: lungs

Asthma symptoms:

Asthma symptoms are typically not too severe. If ignored, though, it can swiftly worsen to the point of becoming fatal. The most typical signs of an asthma attack include:

- Wheezing Tightness or pressure in the chest
- Fast breathing
- Issues with breathing
- Continued coughing
- Talking difficulty
- Blue lips or fingernails
- Pallid and sweaty face. [3]

Types of asthma:

Asthma comes in multitudes of forms. A handful of the more prevalent kinds are mentioned below:

- Asthma Allergic
- Asthma bronchial
- Nighttime Asthma
- Workplace Asthma Exercise-Related Asthma
- Asthma Resistant to Steroids. [4]

Asthma treatment:

Asthma is a chronic illness for which there is currently no known treatment. However, by avoiding triggers for asthma attacks, the illness can be managed. Asthma episodes may be prevented by educating oneself about potential triggers and implementing safety measures. The available treatments are limited and contingent on the intensity of the symptoms. Doctors prescribe a variety of medications for the treatment of children. Treatment options for airway irritation and asthma episodes include long-term care. Additional medications for treating wheezing, coughing, and breathing difficulties include nebulizers, quick-relief

inhalers, corticosteroids, and other tablets. [5]

Drug available in market:

- ❖ Theophylline
- ❖ Aminophylline
- ❖ Dexophylline
- ❖ Choline theophylline. [6]

MATERIAL AND METHOD:

Extraction:

1. Take the dry Jackfruit powder.
2. Now this powdered is placed in a thimble made up of filter paper then it placed inside the Soxhlet apparatus.
3. This apparatus is filled in to a round bottom flask which contain solvent and also with a reflex condenser with the help of adopter.
4. The solvent in the RBF is boiled gently, vapor passes through the side tube, and then it condensed through condenser and fall into thimble containing the material and slowly fills the Soxhlet.
5. When the solvent reaches the top of the attached tube it siphons over into flask (more into RBF).
6. It takes about 3-4 hrs. For complete extraction.
7. After extraction, remove the porous cup which contain residue and repeat process for more, extract obtained in RBF.



Figure 2: Soxhlet Extraction

Phytochemical screening:

Jackfruit extract was subjected to phytochemical evaluation to examine the presence of chemical test.

- **Alkaloids – (Hager's test):** 50 mg of a solvent-free extract was first ingested, thoroughly mixed with a few millilitres of diluted hydrochloric acid, then filtered. Add 2 mL of Hager's reagent (saturated aqueous solution of picric acid) to a few millilitres of filtrate. A noticeable yellow precipitate signifies a positive test result.
- **Alkaloids –** (**Mayer's test):** To the filtrate, a drop of Mayer's reagent was added along the sides of the test tube. A white prescriptate indicate the test as positive.
- **Tannins – (Lead acetate test):** On addition of lead acetate solution to the ethanolic extract white precipitate appeared.
- **carbohydrates** – (**Molish's test**):100 mg of solvent-free extract was dissolved in 5 mL of distilled water, and the resulting liquid was then filtered. Two drops of alcoholic solution should be shaken well into two millilitres of filtrate. Then, slowly pour one millilitre of strong sulphuric acid around the edges of the test tube and leave it there. A violet ring indicates the presence of carbohydrates.
- **Carbohydrates – (Benedicts Test):** Add Benedict's reagent to the sample solution. Heat the mixture in a boiling water bath for a few minutes Observe the color change. A positive result (presence of reducing sugars) shows a color change from blue to green, yellow, orange, or red.
- **Protein –** (**Xanthoprotic test**): A sample of the protein solution is treated with concentrated nitric acid. The mixture is heated gently. If proteins containing aromatic amino acids are present, a yellow color will appear.

Preparation of the Anti- asthmatic Syrup (100 ml):

Table 1: Formulation 1 (F1) for 100 ml

Sr.no	Ingredients	Quantity	Role
1	Jackfruit Powder	5gm	Nutrient Booster
2	Ginger Extract	5 ml	Cough suppressant
3	Turmeric Extract	2 ml	Reduce Inflammation
4	Honey	14 gm	Sweeting agent
5	Orange juice	5 ml	Reduce asthma flare-ups
6	Peppermint Extract	2 ml	Bronchodilator
7	Water	65 ml	Vehicle
8	Methyl parabean	0.1 gm	Preservative
9	Anise oil	1-2 Drops	Flavouring agent

Table 2: Formulation 2 (F2) for 100 ml

Sr.no	Ingredients	Quantity	Role
1	Jackfruit Powder	5gm	Nutrient Booster
2	Ginger Extract	5 ml	Cough suppressant
3	Turmeric Extract	2 ml	Reduce Inflammation
4	Honey	13.8 gm	Sweeting agent
5	Orange juice	5 ml	Reduce asthma flare-ups
6	Peppermint Extract	2 ml	Bronchodilator
7	Water	65 ml	Vehicle

8	Methyl parabean	0.2 gm	Preservative
9	Anise oil	1-2 Drops	Flavouring agent

Table 3: Formulation 3 (F3) for 100 ml

Sr.no	Ingredients	Quantity	Role
1	Jackfruit Powder	5gm	Nutrient Booster
2	Ginger Extract	5 ml	Cough suppressant
3	Turmeric Extract	2 ml	Reduce Inflammation
4	Honey	13.8 gm	Sweeting agent
5	Orange juice	5 ml	Reduce asthma flare-ups
6	Peppermint Extract	2 ml	Bronchodilator
7	Water	65 ml	Vehicle
8	Methyl parabean	0.03 gm	Preservative
9	Anise oil	1-2 Drops	Flavouring agent

Formulation Process:

1. Take 50 mL of warm water in a clean, sanitized beaker.
2. Dissolve jackfruit powder completely by stirring continuously.
3. Add methyl paraben (preservative) and stir until it dissolves completely.
4. Addition of Extracts and Juices, Add ginger extract, turmeric extract, orange juice, and peppermint extract slowly while stirring.
5. Ensure uniform mixing of all extracts for even distribution of flavor and active ingredients.
6. Gradually add honey into the mixture and stir well until it blends smoothly. Honey will act as a natural sweetener and thickening agent.
7. Add the remaining water (15 mL) slowly while mixing to achieve the desired consistency.
8. Addition of Essential Oils - Add 1-2 drops of anise oil as flavoring agents. Mix well to distribute the aroma and taste evenly.
9. If the syrup has undissolved particles, filter it through a fine sieve or muslin cloth. This helps in achieving a smooth and clear texture.
10. Transfer the prepared syrup into a suitable container and keep it into a refrigerator.



Figure 3: Asthmatic Syrup

Evaluation Parameter for syrup formulation:

- **Viscosity:** An Ostwald viscometer can be used to determine the viscosity of herbal syrup. The Ostwald viscometer is cleaned extensively with chromic acid or acetone. The viscometer should be mounted vertically on a suitable platform. Fill the dried viscometer halfway with water. Take note of the time it takes for water to flow from mark A to mark B.to achieve an accurate reading, repeat the operation three times. Wash the viscometer and fill it with herbal syrup, then record the time it takes for the syrup to flow from mark A to mark B.

Formula for viscosity:

$$\text{Viscosity} = \frac{\text{Density of syrup} \times \text{Time required to flow syrup} \times \text{viscosity of water}}{\text{Density of water} \times \text{Time required to flow water}}$$

- **PH:** PH was determined on PH meter.
- **Specific Gravity:** Specific gravity was evaluated by the formulation as given below Specific gravity of liquid under test (syrup) = weight of liquid under test weight of water = W5/ W4
- **Taste:** To ensure quality control and consistency across different batches of a product.
- **Colour:** 5 mL of the resulting syrup was placed in a watch glass and exposed to light, and the color was seen with the naked eye.
- **Odor:** 2 ml of final syrup was smelled individually and then the odor can be detected.

Anti-Inflammatory:



Figure 4: Concentration

Inhibition of albumin denaturation:

In vitro anti-inflammatory activity was determined by inhibition of protein (egg albumin) denaturation method.

Control Solution (50 ml): Phosphate buffer saline (28ml) of pH 6.4 was transferred to freshly prepared egg albumin (2ml) and distilled water (20ml) was added to this, to prepared control solution.

Standard Solution (50 ml): Phosphate buffer saline (28ml) of pH 6.4 was transferred to freshly prepared egg albumin (2ml) and (20ml) solution of diclofenac sodium of different concentration ranges from 10 - 2000 µg/ml was added to this, to prepared standard solution.

Test Solution (50 ml): Phosphate buffer saline (28ml) of pH 6.4 was transferred to freshly prepared egg

albumin (2ml) and (20ml) solution of diclofenac sodium of different concentration ranges from 10 - 2000 µg/ml was added to this, to prepared standard solution. All the solutions were incubated at 37 ± 2 °C for 15 minutes and it was then heated at 70 °C on a water bath for 5 minutes. The solutions were allowed to cool at room temperature. The absorbance was then measured using UV-Visible spectrophotometer at 660 nm using vehicle as blank. The percentage inhibition of protein denaturation was calculated from the control using below under formula:
Percentage inhibition = (Abs Control –Abs Sample) X 100/ Abs control.

Anti-microbial:

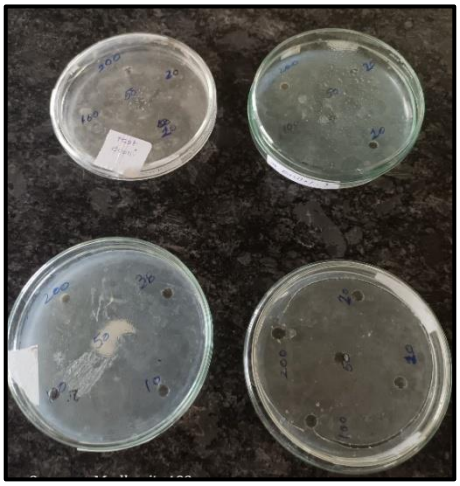


Figure 5: Agar diffusion method

The antibacterial susceptibility was tested by agar well diffusion method. Inoculums were prepared and adjusted to 0.5 McFarland turbidity standard guidelines. The inoculum suspension (E.coli gram negative and Bacillus subtilis gram positive) from the nutrient broth was streaked uniformly on nutrient agar medium. Wells were cut into the lawn cultures with a sterile borer of well of 6 mm diameter in the pathogen inoculated media. A10 µl, 20 µl, 50 µl, 100 µl, 200 µl of each extract were aseptically filled into the well. The plates were placed at room temperature to allow diffusion of extract into the agar for a period of one hour. It was then incubated for 24 hours at 37°C. The results were recorded by measuring the diameter of zone of inhibition at the end of 24-48 hours. An Antibiotic amikacin was used as a positive control at concentration 10 µl, 20 µl, 50 µl, 100 µl, 200 µl, while Ethanol medium at concentration 10 µl, 20 µl, 50 µl, 100 µl, 200 µl without the herbal extracts was taken as a negative control. After incubation the clear zone around the wells was measured in mm and was recorded as the zone of inhibition. The test was done in different concentrations values were recorded.

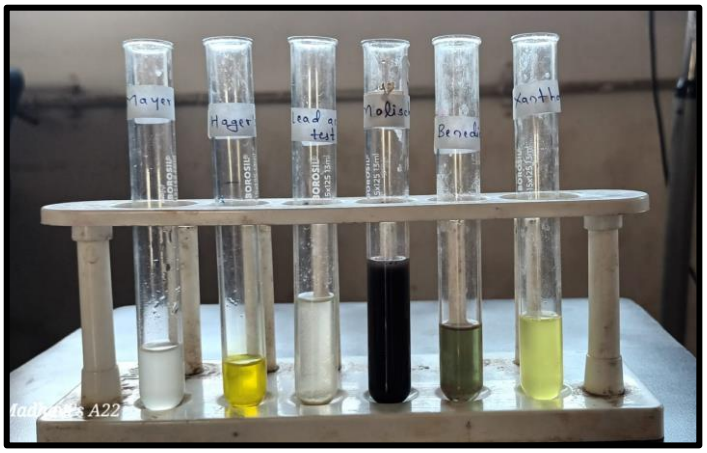
RESULT AND DISCUSSION:

The final formulation (F1) was obtained is stable than formulations F2, F3 The formulation (F1) was obtained by minimizing the error in formulation F2, F3 The formulation (F1) having antioxidant property hence it will be very helpful for researchers as well as F1 formulation is effective for the management of hepatotoxicity and industries to make the similar formulations on large.

Phytochemical constitute of the Jackfruit extract:

Table 4: Phytochemical Test

S.No.	Chemical constituent	Observation	Inference
1.	Mayer's Test	Present	White color
2.	Hager's Test	Present	Yellow color
3.	Lead acetate	Present	White color
4.	Molish Test	Present	Voilet color
5.	Benedict's Test	Present	Green color
6.	Xanthoprotic Test	Present	Yellow color



Evaluation parameter of syrup formulation:

Table No.5: Evaluation parameter

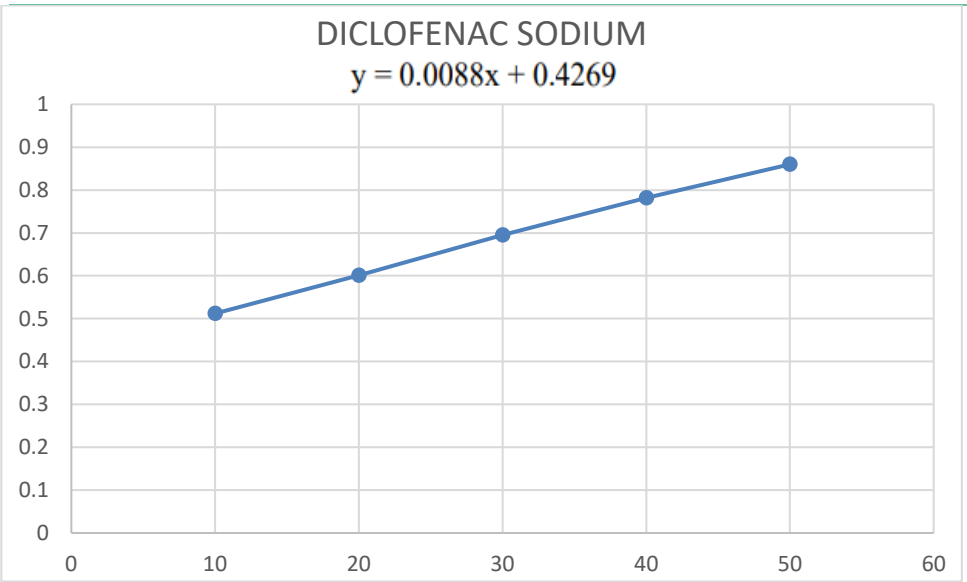
Formulation	Colour	Odor	Taste	PH	Viscosity	Specific gravity
F1	Pale Yellowish	Sweet	Sweet	5.4	2.15	2.04
F2	Pale Yellowish	Sweet	Sweet	5.1	2.18	2.06
F3	Pale Yellowish	Sweet	Sweet	5.2	2.17	2.07

Anti-inflammatory:

Calibration Curve of Standard Sample in U.V:

Table 6: Absorbance

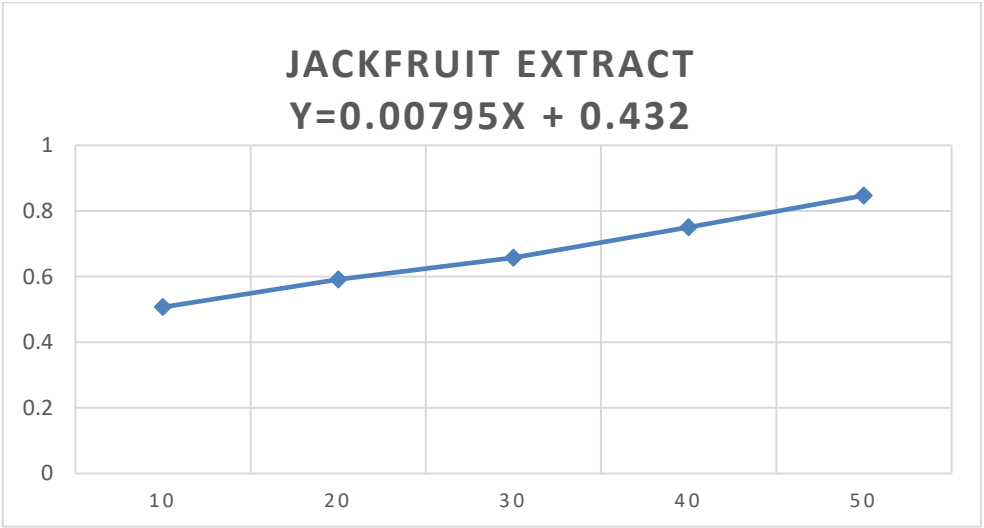
Concentration	Absorbance
10	0.512
20	0.601
30	0.695
40	0.782
50	0.86



Calibration Curve of Test Sample in U.V:

Table 7: Absorbance

Concentration	Absorbance
10	0.507
20	0.591
30	0.658
40	0.750
50	0.847



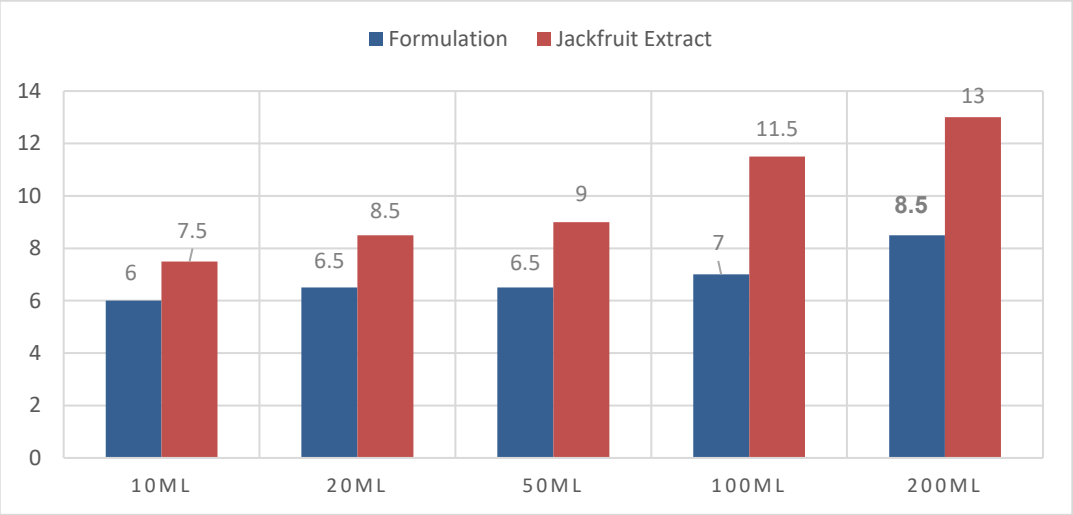
According to the procedure of the anti-inflammatory activity, there are the absorbance of the all samples like Standard Solution, Test Solution, l Control Solution using the UV Spectrophotometer are measured from that absorbance the above calibration curve of the standard drug (Diclofenac sodium) and Test Sample (Jackfruit Extract) & the all-plotting absorbance are linear.

Anti -microbial assay:

Effect of extract on E.coli micro-organism, zone of inhibition obtained are shown in the table

Table 8 (A):

Particulars	Concentration µl	Diameter of zone of inhibition mm
Formulation	10	6mm
	20	6.5mm
	50	6.5mm
	100	7mm
	200	8.5mm
Extract (Test) Jackfruit extract	10	7.5mm
	20	8.5mm
	50	9mm
	100	11.5mm
	200	13mm

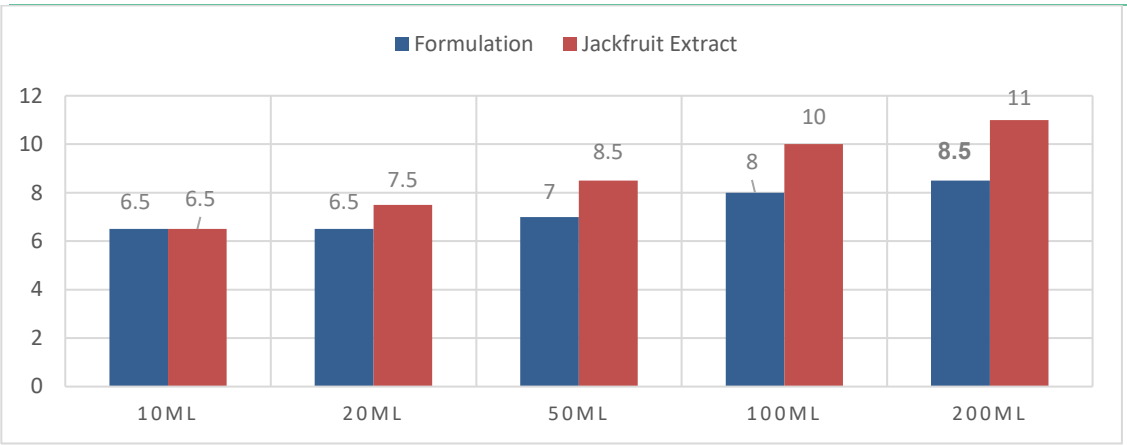


Graph 1: Anti-microbial test (Zone of inhibition)

Effect of extract on bacillus subtilis micro-organism, zone of inhibition obtained are shown in the table

Table 9 (B):

Particulars	Concentration µl	Diameter of zone of inhibition mm
Formulation	10	6.5mm
	20	6.5mm
	50	7mm
	100	8mm
	200	8.5mm
Extract (Test) Jackfruit extract	10	6.5mm
	20	7.5mm
	50	8.5mm
	100	10mm
	200	11mm



Graph 2: Anti-microbial test (Zone of inhibition)

1.Extract (Test)

E. coli (100.68) Bacillus Subtilis (98.35)

2. Formulation

E. coli (101.25 Bacillus Subtilis (96.64)

Expected outcome:

- ❖ Anti-inflammatory effect: The formulated jackfruit syrup is expected to exhibit significant anti-inflammatory activity, which plays a crucial role in the management of asthma.
- ❖ Potential as Herbal Alternative: Syrup shows promise as a natural or complementary treatment for asthma, encouraging further research or clinical trials
- ❖ Stability Over Time: Maintains effectiveness, appearance, and safety throughout the intended shelf life.
- ❖ Therapeutic Effectiveness: Demonstrated anti-asthmatic activity in preclinical studies, such as reduced airway inflammation or bronchodilation.
- ❖ Safety Profile: Syrup is safe and non-toxic at therapeutic doses as determined by toxicity testing.

CONCLUSION:

The formulation and evaluation of jackfruit syrup for the treatment of asthma were successfully completed. The syrup was found to have good physical and chemical properties, including proper color, taste, thickness, and pH. It was also stable over time and easy to consume. Jackfruit contains natural compounds like flavonoids and antioxidants, which are known to help reduce inflammation and relax the airway muscles. These effects may help ease breathing difficulties in people with asthma.

The syrup showed potential as a natural remedy for managing asthma symptoms. It could be especially useful for patients who prefer herbal or plant-based treatments. Since it is in syrup form, it is also easier to take, especially for children and elderly patients. All evaluation tests suggest that the syrup is safe and could be a supportive option along with regular asthma medicines.

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