



Anti-Diabetic Activity of *Artocarpus heterophyllus* (jackfruit) Seed Extract: An in-vitro Study.

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KEYWORDS

Jackfruit seed, *Artocarpus heterophyllus*, Diabetes mellitus, anti-diabetic activity, extraction, glucose uptake by yeast cell, nutrition.

ABSTRACT:

Introduction: This study was conducted to identify anti-diabetic activity of the jackfruit seed. Many studies have proved that the jackfruit contain anti-diabetic effect towards diabetic patients. So, this study may help many diabetes patients to manage their diabetes through this kind of natural source.

Aim: To determine the anti-diabetic activity of *Artocarpus heterophyllus* seed extract in treatment of diabetic patients.

Materials and methods : Study design: In-vitro study, took place in Tamil Nadu, Chennai. This study was conducted in 2022, at the duration of 6 month. Jack fruit seeds are used in this study, has been collected during jack fruit season (March – June) in Tamil Nadu.

The anti-diabetic effect of ethanolic extract and methanolic extract of jackfruit seeds are proved by the method “glucose uptake by yeast cells”. To get ethanolic extract, steam bath method used and to get methanolic extract, rotary evaporator method was used. Here, the metformin drug was used as standard.

Results: the result shows that the glucose concentration has been decreased in yeast cell, as the jackfruit seed extract concentration was increased. Methanolic extract of jackfruit seed shows more effect through this method, ‘glucose uptake by yeast cell’

Conclusion: this study shows that the extract may prevent the absorption of glucose into the cells.)

Keywords: Jackfruit seed, *Artocarpus heterophyllus*, Diabetes mellitus, anti-diabetic activity, extraction, glucose uptake by yeast cell, nutrition.

1. Introduction

The chronic metabolic disease called DM, which inhibits the body's ability to use glucose either entirely or partially. It is characterised by elevated blood glucose level brought on by changes in the metabolism of fat, protein, carbohydrate. Failure in formation of action or releasing of insulin may be the cause of this.

Diabetes is characterized by insufficient insulin action on target tissue or Inadequate secretion and by the abnormalities in the metabolism of nutrients such as carbohydrates, proteins, and fats^[1]. Hyperglycemia symptoms are polyuria, polydipsia, blurred vision, weight loss and sometimes polyphagia. Diabetes patients majorly faces CVD like atherosclerosis, cerebrovascular disease, peripheral arterial, sexual dysfunction, abnormalities in lipoprotein metabolism. treatment should be given immediately, because ketoacidosis can evolve rapidly. WHO says that, Globally, there are 422 million people with diabetes. Mostly, in people living in low- and middle-income countries. Every year, the illness is directly accountable

for 1.5 million deaths. Over the past several decades, there has been a steady rise in the number of cases and the incidence of diabetes. Scientific name of the jack fruit is *Artocarpus heterophyllus*. It is inexpensively available fruit, mature fruit or immature fruit, it can be used wisely^[2]. The fruit has some vitamin A, flavonoids pigments like β -carotene, xanthin, lutein and cryptoxanthin- β has an important role in antioxidant and for a proper vision^[3]. And it also has more amount of carbohydrate, minerals, lots of fibre, and vitamins like thiamine and ascorbic acid^[4]. Potassium present in this fruit will prevents the calcium loss and increase the bone density and strengthens the bone^[5]. Jackfruit also contains the properties that has an ability to reduce the diseases like high BP, strokes, CVD. It helps in reducing homocysteine levels and helps in improving muscles & nerve function^[6]. Traditionally, *Artocarpus heterophyllus* plant parts were used as medicines for the treatment for asthma, wounds, ulcer and cough^[7]. The protein that was majorly present in the jackfruit seed is JACALIN^[8]. Binding the T-antigen of cancer cells,



Jacalin exhibits anticancer activity. It also stops the cancer's growth. This Jacalin binds the T-antigen (Gal β 1-3GalNAc). Human carcinoma cells were expressed more than 85% and also cancer cells growth was stopped (sowmyashree et al., 2022).

Dwitiyanti D et al., 2019 and Nair et al., 2013, has done a similar study based on jack fruit plant parts and diabetes. This study has been conducted to identify, whether jack fruit seed contains anti- diabetic activity. So that, it will be helpful for many diabetes patients, who can utilize this kind of natural source to manage their diabetes. The Aim of this study is to prove the antidiabetic effect and the activity of Artocarpus heterophyllus seed, by "glucose uptake in yeast cell"

2. Objectives.

- Anti-diabetic effect and characterization of jackfruit seeds.
- The quantity of glucose that is transporting across yeast cell's cell membrane.

3. Methods

Study design: In-vitro study, took place in Tamil Nadu, Chennai. This study was conducted in 2022, at the duration of 6 month. Jack fruit seeds are used in this study, has been collected during jack fruit season (March – June) in Tamil Nadu.

Methanolic extract :

Requirements:

- jackfruit seeds
- 500ml of methanol
- Shaker
- Centrifuge
- Colorimeter
- Rotary evaporator

procedure:

- Artocarpus heterophyllus seeds are collected during and cleaned thoroughly. Then it was dried for 7 days.
- The dried seeds were cut into small pieces and blended into fine powder.
- 50g of seed powder was mixed in 500ml of methanol.
- Then In the shaker, the mixture has been kept for 24 hours.
- In centrifuge, the mixture was kept at 5000rpm for 30mins for centrifugation(Shown in Image 2).
- The supernatant of the mixture has been collected and concentrated using rotary evaporator.

- The extract was kept in rotary evaporator at 50°C - 55°C, till the solvents get evaporated.
- After the solvents are evaporated the extract will be in paste form.
- The concentrated extract was collected and stored at 4°C - 5°C for later use(Shown in Image 1)^[9].

Image 1: Showing the samples before and after concentration.



Image 1

Ethanollic extract:

Requirements:

- jackfruit seeds
- 100ml of 80% ethanol
- Centrifuge
- Steam bath
- Petri dish

Procedure:

- Artocarpus heterophyllus seeds are collected and cleaned thoroughly. Then it was dried for 7 days.
- The dried seeds are cut into small pieces and blended into fine powder.
- 30g of seed powder was mixed into 100ml of 80% ethanol.
- Mixture was kept in normal-room temperature for 5 days.



- Then the mixture was centrifuged at 5000rpm for 30mins. The supernatant was collected.
- In a petri dish, the supernatant was poured and kept in steam bath for concentrating the extract.
- The supernatant was kept in steam bath at 50°C - 55°C for solvents to get evaporated completely.
- Once when the solvents are evaporated the extract will be in brownish paste form (Shown in Image 2).
- The concentrated extract was collected and stored 4°C - 5°C for further use (Shown in Image 2)^[10].

Image 2: shows the samples before and after the collection of extract



Image 2

Glucose uptake in yeast cell:

The facilitation is dose-dependent. It depends on preincubation of the yeast cells along with glucose ^[11]. Further evidence “that the glucose uptake by yeast cells is enhanced by glucose tolerance factor”

Requirements:

- Yeast
- Distilled water

- Centrifuge
- Plant extract – (methanolic and ethanolic extracts)
- Glucose
- Metformin

Procedure:

- The commercially available yeast was mixed in distilled water and soaked at overnight^[12].
- Then it was subjected to centrifugation at 4000rpm for 10 mins.
- The supernatant was collected and 10% of the suspension was prepared using distilled water.
- Methanolic extract and ethanolic jack fruit seed extract was taken in different concentration (200μl, 400μl, 600μ) separately, and added to the 1ml of glucose solution with 10% concentration.
- Incubated at room temperature 10 – 15 mins.
- To start the reaction, 100μl yeast suspension has been added. Further, incubated at room temperature for one hour.
- Metformin 500mg drug was used for standard.
- The percentage increase in glucose concentration was noted down ^[10](Shown in Image 3 and 4).

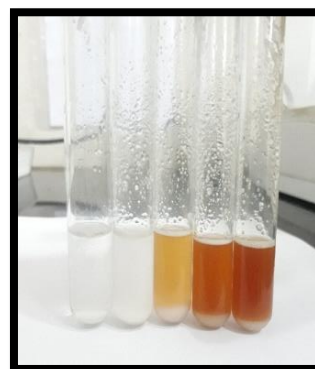


Image 3: Showing the Blank, Standard and Methanolic extracts

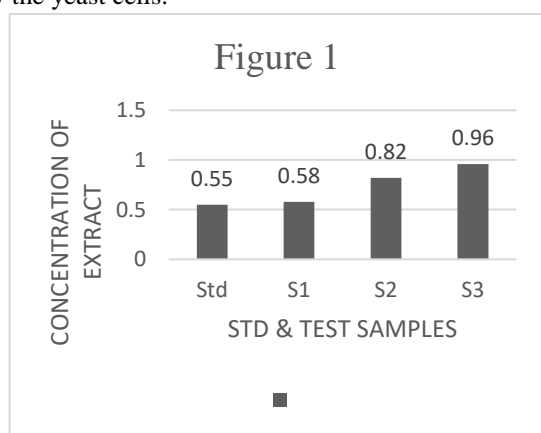




Image 4 : Showing the Ethanolic extract

4. Results

Figure 1: bar diagram shows the relationship between the concentration of the extract and the glucose uptake by the yeast cells.



When the concentration of the extract is more, the glucose uptake by yeast cell is less.

The OD of test sample 1 0.58 with 100 μ l volume of extract with glucose and yeast was found to be the value: 528.

The OD of test sample 2 0.82 with 300 μ l volume of extract with glucose and yeast was found to be the value: 745

The OD of test sample 3 0.96 with 500 μ l volume of extract with glucose and yeast was found to be the value: 782

The OD value of the standard with 500mg concentration with glucose and yeast was found to be: 0.55

Result shows that the *Artocarpus heterophyllus* seeds may have the effect on increasing the glucose by the method, glucose uptake by yeast cells ^[9]

5. Discussion

This study is based on jackfruit seed, as people consume jackfruit seed without knowing the health benefits of it. jackfruit seeds contain lot of nutrients and some anti-diabetic, anti-bacterial and antioxidants. There are many products developed using jackfruit seeds like flour, jackfruit seed butter, oil, snacks etc. It has anti-cancer activity also, as it helps the cancer patents ^[13].

My study result shows that the jackfruit seed may have the anti-diabetic effect by decreasing the intestinal absorption of glucose into blood.

Studies done with the 'glucose uptake by yeast cells' says that " α – glucosidase and α – amylase are enzymes that breaks down carbohydrates. Intestinal and Pancreatic glucosidase are the primary enzymes that involves in the digestion of dietary carbohydrate; inhibitors of these enzymes have the potential to effectively delay the absorption of glucose. This is due to the fact, that only monosaccharides are easily absorbed carbohydrates must first undergo enzymatic breakdown in order to be absorbed" (Santhiya et al., 2016)^[14]

In vivo study of jackfruit seed in Reducing the Blood Sugar Levels in Gestational Diabetes, study says that, "gestational diabetic rat's blood glucose level was lowered by three doses over the course of 14 days" and also says "beta-carotene epoxide present in jackfruit seeds has the ability to decrease the blood sugar levels by inducing insulin secretion"^[15].

(Nair et al., 2013) has mentioned, after they did the experiment using *Artocarpus heterophyllus* in this method - "Results also indicated that *Artocarpus heterophyllus* and *Artocarpus altilis* had greater effect in the glucose uptake by yeast cells when compared to standard" . "The methanolic extracts of *Artocarpus heterophyllus* shows higher activity than other plant extracts"^[9].

There are some drugs and medicines, which helps in the treatment of diabetes such as, metformin, glucagon-like peptide receptor 1 agonists, insulin ^[16].

With those drugs some natural foods like jackfruit seeds may help to reduce and maintain the blood glucose level and it might also be good choice to keep the blood sugar level under control.

6. Conclusion:

This study shows that the extract might help in reducing the absorption of glucose. So, this *Artocarpus heterophyllus* (jack fruit) seed, may helpful for the diabetic patients by inhibiting the glucose absorption.

Further, this study can be carried out through animal study for the proper identification of its mechanism, so that in future, it will be helpful to do intervention study in human and the jackfruit seed's components could be used making drugs or any kind of supplements, which will be helpful for diabetes patients.

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