Nutritional, Glycemic and Ecological Assessment of Green Jackfruit for Diabetes in Kerala

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ABSTRACT

Objective: Kerala has a high prevalence of diabetes. Management of diabetes through pharmacological strategy imposes economic burden and adverse effect. Green jackfruit, a traditional food of Kerala, has shown promising effect in the management of diabetes. So the present study was focused to evaluate the nutritional quality and glycemic load of green jackfruit as a meal and also to evaluate the antidiabetic sales in units during the jackfruit season.

Materials and methods: Nutritional analysis of one cup of green jackfruit was done at National Accreditation Board for Testing and Calibration Laboratories (NABL) certified laboratory Glycemic load assessment of green jackfruit as a porridge meal was conducted at the University of Sydney on 10 healthy volunteers and compared with glucose. ‘One meal green jackfruit’ campaign to replace rice was conducted during peak season from April 2018 to July 2018 and the antidiabetic medicine sales in units was recorded.

Results: The nutritional analysis of a cup green jackfruit reveals a low calorie of 115 k/cal, low total carbohydrate of 27.3 g and high fiber content of 1.95 g compared to a cup of white rice. Glycemic study reveals a glycemic load of 17. Official fruit announcement and ‘One meal green jackfruit campaign is associated with a significant decline in the antidiabetic medication sales in units during the period from April 2018 to July 2018.

Conclusion: Green jackfruit offers good dietary fiber content, low calorie, low carbohydrate and low glycemic load, and could be a replacement for high carbohydrate diet. As a low calorie strategy, using green jackfruit as a meal can reduce Kerala’s burden on antidiabetic medications.

Keywords: Diabetes mellitus, Low calorie diet, Green jackfruit, Dietary fiber, Medical nutrition therapy, Glycemic load, Noncommunicable diseases, Low carb diet.

INTRODUCTION

The type 2 diabetes mellitus (T2DM) is highly prevalent in all section of Kerala and thus it substantiates the presence of Asia paradox in Kerala state. Recent reports highlights that the cumulative incidence of T2DM in Kerala is 21.9% and the incidence of prediabetes is 36.7%. Further, the Kerala Diabetes Prevention Program study reveals that cardiometabolic risk factors are in higher range among the general population of Kerala. Mounting studies reveals that there is a significant decrease in the consumption of fruits and vegetables. Low calorie diet or calorie restriction is one of the nonpharmacological strategies to alleviate T2DM. Previous studies indicate that the diets rich in fruits, vegetables are associated with a lower risk for T2DM.

In 2018, Government of Kerala officially declared jackfruit as its state official fruit. However, myths occurs among the diabetic subjects in consumption of jackfruit
due to its sweetness. Meanwhile, green or unripe jackfruit considered as a vegetable is rich in soluble and insoluble fiber with a significant carbohydrate load. Green jackfruit flesh contains a good source of nutrient like carbohydrate (25%), vitamin A and a fair source of protein (1.6%). Further, it has been reported that jackfruit meal (composed of flesh and seeds) has a good glycemic load of 13. In Kerala, the high yield season of jackfruit is from April to July and the nutritional content is also high during this period. In this backdrop, we conducted a communications campaign on different media platform to replace at least ‘one meal a day’ with green jackfruit by replacing the rice diet during its peak season. Further, we evaluated the nutritional content of dry green jackfruit and compared with dry white rice. In addition we also scrutinized the antidiabetic medicine sales in units and evaluated if there was any deviation in the sales during the jackfruit season as result of our campaign.

MATERIALS AND METHODS

Nutritional Analysis of Green Jackfruit

Nutritional analysis of one cup of green jackfruit was analyzed at National Accreditation Board for Testing and Calibration Laboratories (NABL) certified laboratory and the obtained values were compared against available nutritional information for one cup of cooked white rice.

Evaluation of Glycemic Load of Green Jackfruit

The study was conducted on 10 healthy non-smoking, disease free and non-allergic individuals aged between 18 years and 65 years from the staffs and students of University of Sydney approved by the Human Research Ethics Committee of the University. The reference food (Pure Glucose Powder, Glucodin, Boots healthcare company) and green jackfruit were served to the subjects in fixed test portions containing 50 grams of digestible carbohydrates.

Preparation of Green Jackfruit Test Food

The finely chopped freeze dried green jackfruit was added to the sauce pan and water was added and cooked together to get porridge like consistency.

Treatment Protocol

Using standard methodology, a portion of food containing 25 or 50 grams of available carbohydrate was fed to 10 healthy subjects in the morning, who were under fasting overnight. Then the fasting blood sample was collected and the subjects were allowed to consume test food (green jackfruit porridge). After 15 minutes, the postprandial blood sample was withdrawn at regular intervals up to 2 hours. The procedure is repeated on the same subjects on next day with reference food (Glucodin, Boots healthcare company). The glycemic index (GI) value of the test food was calculated by expressing the 2 hours blood glucose response to the test food as a percentage of the response produced by the reference food (GI value of glucose is 100). Glycemic Load value is then calculated by multiplying the amount of available carbohydrate in the portion of the food or drink by its GI value and then dividing by 100.

‘One Meal Green Jackfruit Campaign’— Ecological Evaluation of Antidiabetic Medication Sales

From the beginning of the jackfruit season in April 2018, we organized a communications campaign across the state using mass media, social media, and traditional advertisement methods like billboards across the major roadways. Through the campaign, we encouraged citizens to replace at least ‘one meal a day’ with green jackfruit. As a result, the Vegetable and Fruit Promotion Council of Government of Kerala for the first time recorded jackfruit as a general vegetable market commodity of trade between April and June 2018. In December 2018, we obtained monthly sales data of anti-diabetic medications such as oral hypoglycemic agents and insulin, using the Right to Information Act of India.

RESULTS

Nutritional Analysis of Green Jackfruit

Nutritional analysis showed that the dry weight of one cup of green jackfruit as 30 g vs 50 g for dry weight of one cup of boiled white rice, total carbohydrate value of 27.3, which is 38% lower, energy value of 115 calories, which is 38% lower and total dietary fiber of 1.95, which is 95% more, than a cup of rice. The results are shown in Table 1.
In the present study, the mean GI value of freeze dried green jackfruit prepared as porridge was found to be 65 ± 5 and it was significantly (p = 0.001) lower than reference food glucose sugar which had a GI of 100. Thus in the present study the test food displayed a medium GI. Further, the glycemic load was found to be 17 compared to a higher GL of 28 for parboiled long grain white rice already recorded in the International Table of Glycemic Index and Glycemic Load Values.9

Effect of ‘One Meal Green Jackfruit’ Campaign and Evaluation of Antidiabetic Medical Sales

Increased awareness from the ‘official fruit’ announcement, and the ‘one meal a day’ campaign brought back jackfruit as a commodity of trade in vegetable shops from April until July, which was the end of season in 2018. The antidiabetic medication sales data showed a decline from April, reaching a 25% drop in May and June compared to sales data from a reference month of March (Fig. 1). After the jackfruit season, medication sales started steadily increasing every month and by October it returned back to March 2018 level. The seasonality index assessment of the data showed statistical significance (p = 0.01).

DISCUSSION

Kerala is considered as the diabetic capital of India with a prevalence rate of 20% and leads country in epidemiologic transition. Pharmacological management of T2DM leads to severe adverse effect and also imposes severe economic burden among the patients. Recent clinical studies reveal that attenuation of diabetes is possible with diet restriction and calorie reduction without using any drug therapy. The counterpoint study reveals that effective diabetes reversal was observed by advising very low-calorie diet (400–600 kcal/day) to the diabetic patients in the form of liquid meal formula with nonstarchy vegetables and salads for 8 weeks.10 In another study by Sarathi et al. conducted on 32 newly diagnosed diabetic patients, intensive life style therapy encompassing daily calorie intake of 1,500 kcal (60% as carbohydrates, 15% as proteins, and 25% as fat) and brisk walking for 1 h every day revealed that 75% of the patients achieved partial/complete reversal of diabetes at 3 months.11 WHO technical report substantiates that, consumption of fruits and vegetables is important in reducing the risk of non-communicable diseases.12 Dietary fiber has direct effect on insulin sensitivity by delaying the absorption of carbohydrate and also aids the secretion of optimum level of insulin to minify the insulin resistance and thus maintaining the normal

Table 1
Nutritional composition of green jackfruit as compared to White rice

<table>
<thead>
<tr>
<th>Nutrition</th>
<th>Green Jackfruit (Dry Weight) 30 gm</th>
<th>White Rice (Dry Weight) 50 gm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal)</td>
<td>115.41</td>
<td>185</td>
</tr>
<tr>
<td>Total Carb (g)</td>
<td>27.3</td>
<td>40</td>
</tr>
<tr>
<td>Diet Fiber (g)</td>
<td>1.95</td>
<td>1</td>
</tr>
<tr>
<td>Glycemic Load</td>
<td>17</td>
<td>28</td>
</tr>
</tbody>
</table>

Figure 1: Antidiabetic medication sales trend in 2018
homeostasis of postprandial glucose and insulin levels. Further, increased intake of dietary fiber can promote stomach fullness and decreases the intake of energy dense foods and thus reduces the risk of obesity, a cardinal risk factor involved in the progression of diabetes.

Jackfruit (*Artocarpus heterophyllus* Lam) is a tropical plant, abundantly found in all the parts of Kerala. In traditional Ayurvedic medicine, hot water extract of jackfruit leaves is used for the treatment of diabetes. A clinical study conducted in Kerala on 30 diabetic subjects shows that decoction of jackfruit leaves was effective in lowering the fasting and postprandial blood sugar level, as well as total cholesterol. Mounting preclinical reports displayed the antidiabetic efficacy of ripe jackfruit and seeds; however, studies related to unripe or green jackfruit is limited. So, the present study was undertaken to study the effectiveness of green jackfruit as a meal replacement of rice diet among the Kerala people during its peak season through mass communication program. Further, we also assessed the antidiabetic medicine sales in units during this period and also evaluated the nutritional quality of green jackfruit as a meal.

In our study, the nutritional analysis of green jackfruit as a meal reveals the low calorie, low carbohydrate and low glycemic load as that of white rice. Meanwhile, the dietary fiber content of green jackfruit is higher as that of the white rice. A study done by Hettiarachchi et al. elicited that jackfruit meal contains high amount of soluble and insoluble dietary fiber content and low glycemic load as compared to standard carbohydrate diet. In this study we have conducted ‘One meal green jackfruit campaign’ during the jackfruit season from April to July and advised citizens to replace one rice meal with green jackfruit. In 2013, a 9,000 patient primary care practice in UK, conducted a low-carbohydrate diet campaign encouraging diabetic patients to switch from high GI starchy foods like rice to low GI foods like less sugary fruits and in 3 years found significantly better quality of diabetes control and spending reduction of £40,000 per year for antidiabetic medication.

Interestingly, we observed that the sales of antidiabetic medicine were significantly decreased during the jackfruit season (April to July 2018) as that of March 2018. Meanwhile, there was a steady increase in the sales of antidiabetic medicines after the jackfruit season was over. Sales returned to the level of pre-season by October 2018.

Thus, in conclusion the green jackfruit as an alternate to rice meal is rich in dietary fiber, low in calorie, low in carbohydrate and low in glycemic load. Further, ‘One meal green jackfruit campaign’ was associated with a decrease in antidiabetic medication sales during the jackfruit season. In addition green jackfruit as an alternate to rice is an easy and affordable way to increase vegetable and fruit content in the average diet of Kerala in line with WHO recommendation to reduce global burden on noncommunicable diseases. Government of Kerala has a huge opportunity to utilize its mostly wasted official fruit, green jackfruit, to reduce its burden on lifestyle diseases like diabetes. However, further multicenter clinical cohort studies are highly warranted to analyze the efficacy of green jackfruit as a meal replacement in nonpharmacological management of T2DM.

ACKNOWLEDGMENTS

The author is grateful to the following organization and individual who helped during the study period.

- Kerala State Industrial Development Corporation for supporting Glycemc Study through Seed Fund.
- Dr Fiona Atkinson, Research Manager, Sydney University’s Glycemic Index Research Service (SUGiRS) for spearheading the glycemic study of green jackfruit and for the intellectual support in interpreting glycemic load values.
- Kerala State Medical Services Corporation Pvt Ltd, for their support in compiling Anti-diabetic Medication Sales data from government pharmacies in Kerala for the year 2018.

DECLARATION OF INTEREST

Subsequent to the glycemic study author has developed a patent pending flour from green jackfruit to part replace rice or wheat flour in commonly used meals to reduce its glycemic load and is the founder of Jackfruit365.com an initiative to create an organized market for the mostly wasted jackfruits in India.
REFERENCES