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SHELF LIFE STUDY OF GLUTEN FREE AND SUGAR FREE JACKFRUIT SEED LADDUS

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ABSTRACT: A study was undertaken to standardize an innovative nutritious product and to see its customer acceptability. 'Jackfruit Seed Laddus' was the name of the product designed and its shelf life was studied for a period of 1 month. This multi nutrient food product was gluten-free and sugar-free. The main ingredients were jackfruit seeds, jaggery and coconut. This product was rich in carbohydrates, protein, B-vitamins and fibre. Shelf life study was done using a 5 point hedonic scale. Sensory evaluation was done on sensory attributes like appearance, aroma, taste, sweetness and texture/mouth feel of the product by a scoring method on a 5 point hedonic scale. The other aspects studied were packaging, budgeting, nutritional labelling and marketing. The product was marketed using social media platforms. This product can prove to be beneficial for diabetes patients and can aid in improving gut health. The budget of the product was pocket friendly and can be a profitable venture. As per the conducted sensory evaluation for one month, this product lasted for 4 weeks if (refrigerated) stored in a cool dry place.

Key words: Jackfruit seeds, Product Development, Diabetes, Gut Health, Marketing, Budget, Shelf life, Gluten-free, Sugar free, Sensory Evaluation

INTRODUCTION:

Jackfruit seeds are rich in carbohydrates, proteins and have good amount of fibre and B-complex vitamins. Carbohydrates provide energy, store energy, build macromolecules, and spare protein and fat for other uses. Protein is one of the building blocks that gives tissues and organs their shape and also helps them work. Fiber aids in digestion, helps to feel full, and keeps blood cholesterol levels in check. B-complex vitamins help prevent infections and help support or promote- cell health, growth of red blood cells, energy levels, good eyesight, healthy brain function, good digestion, healthy appetite and proper nerve function. [6]

Keeping the above mentioned health benefits in mind a modified product - 'Jackfruit Seed Laddus', was developed to improve gut health and blood sugar levels. Laddus or laddoo is a sphere-shaped sweet originating from the Indian subcontinent. Diabetes is a disease that occurs when the blood glucose, also called blood sugar, is too high. Blood glucose is the main source of energy and comes from the food which is eaten. Insulin is a hormone made by the pancreas which helps glucose from food to get into the cells to be used for energy. [7]

Gut health describes the function and balance of bacteria in the many parts of the gastrointestinal tract. All food is ultimately broken down in the gut to a simple form that can enter the bloodstream and be delivered as nutrients throughout our bodies. This is only possible with a healthy digestive system. A healthy gut contains healthy bacteria and immune cells that ward off infectious agents like bacteria, viruses and fungi. A healthy gut

also communicates with the brain through nerves and hormones, which helps maintain general health and well-being. [8]

Keeping the above points in mind the following study was undertaken with the objectives:

1. To standardize a healthy, innovative and nutritious product.
2. To design a nutritional label.
3. To study the shelf life of the product using a sensory evaluation for one month.
4. To understand the budgeting aspects.
5. To select a cost effective packaging material.
6. To market the product effectively using social media.

METHODOLOGY:

A unique food product was designed under the undergraduate program of Food Science and Nutrition, which was made of jackfruit seeds which are not commonly seen or used in commercial preparations. Jackfruit seed laddus are neither available anywhere in the market nor online. Jackfruit seeds are rich in antimicrobial compound jackin. Initially many products were thought of while brainstorming, jackfruit seed crackers, jackfruit seed biscuits and jackfruit seed laddus etc. Jackfruit seeds, was the main focus due to its health benefits. Based on the raw ingredients used and the general taste preferences Jackfruit seed Laddus was given more preference.

TABLE-1 – AMOUNT OF INGREDIENTS FOR THE PREPARATION OF JACK-FRUIT SEED LADDUS

| Ingredients | Trial 1 | Trial 2 | STANDARD |
|--------------------|------------------------|------------------------|------------------------|
| Jackfruit seeds | 20-25 seeds 250 gms | 20-25 seeds 250 gms | 20-25 seeds 250 gms |
| Coconut | 250 gms | 250 gms | 250 gms |
| Jaggery | 200 gms | 250gms | 250gms |
| Cashew nuts | 50 gms | 50 gms | 50 gms |
| Cardamom | ½ spoon | ½ spoon | ½ spoon |
| Desiccated coconut | 100 gms | 100 gms | 100 gms |
| Salt | 5 gms | 5 gms | 5 gms |

Description of Ingredients:

- Jackfruit seeds - They are light brown in colour and round in shape. They are 2-3 cm in length and 1-1.5 cm in diameter. They are surrounded by the flesh and enclosed in a white aril surrounding a thin brown spermoderm, which covers the fleshy white cotyledon. It has been found that they are rich in carbohydrates and proteins[1] Jackfruit seeds contain resistant starch which controls blood sugar and keeps the gut healthy.[2] Both the seeds and the flesh of jackfruit are consumed as curries and boiled forms, while the flesh in fully ripened stage can be eaten directly as a fruit. Several countries have developed different food products such as jam, jellies, marmalades, and ice creams using pureed jackfruit. Jackfruit seeds contain around 55% moisture content, thereby lessening the possibility of being kept for a long time.
- Jaggery - It cleanses the whole body, Improves digestion, Prevents anaemia, Improves immune function, aids glucose control and weight loss.
- Coconut - Coconut flesh is highly nutritious and rich in fibre, vitamins C, E, B1, B3, B5 and B6 and minerals including iron, selenium, sodium, calcium, magnesium and phosphorus.
- Cardamom - It pertains to relieving stomach issues and has antioxidant and diuretic properties.
- Cashew nuts - Cashew nuts are rich in essential fatty acids, potassium, and antioxidants that are beneficial for heart health. It contains phyto sterols, phenolic compounds, and oleic acid for heart health and makes blood vessels stronger. Cashew nuts help reduce bad cholesterol (LDL) and improve good cholesterol (HDL) in the body.
- Salt - It helps to balance fluids in the blood and maintain healthy blood pressure, and it is also essential for nerve and muscle function.

Preparation of jackfruit seed laddus (Method)

1. Take 20-25 fresh jackfruit seeds and peel the outer white arils (seed coat)
2. Keep a grated coconut paste ready.
3. Boil the seeds for 10-15 minutes in a pressure cooker.
4. Remove the excess water and grind the seeds finely.
5. Put a saucepan on medium flame and add the finely grinded mixture to it.
6. Add coconut paste and a pinch of cardamom powder to it and mix well.
7. Add jaggery powder along with a pinch of salt to the mixture and keep mixing for 10-15 minutes till the colour of the mix turns golden.
8. Turn off the flame and let it cool for 5-10 mins.
9. Take small portions and give them the shape of laddus.
10. Put a cashew nut on top of each laddu to enhance its appearance.

(Hygiene and proper sanitation needs to be taken care of during the preparation)

SENSORY EVALUATION FOR STANDARDISED RECIPE

The jackfruit seed laddus were confirmed after 2 trials. The sensory evaluation was done for the 1st trial and was done among 10 naive panel members using a score card method. The scorecard consists of a 5 point hedonic scale ranging from - like a lot to dislike a lot. Attributes that were scored were appearance, aroma, taste, sweetness and texture/mouthfeel.

Score Value Assigned –

5 - Like a lot

4 - Like a little

3 - Neither like nor dislike

2 - Dislike a little

1 - Dislike a lot

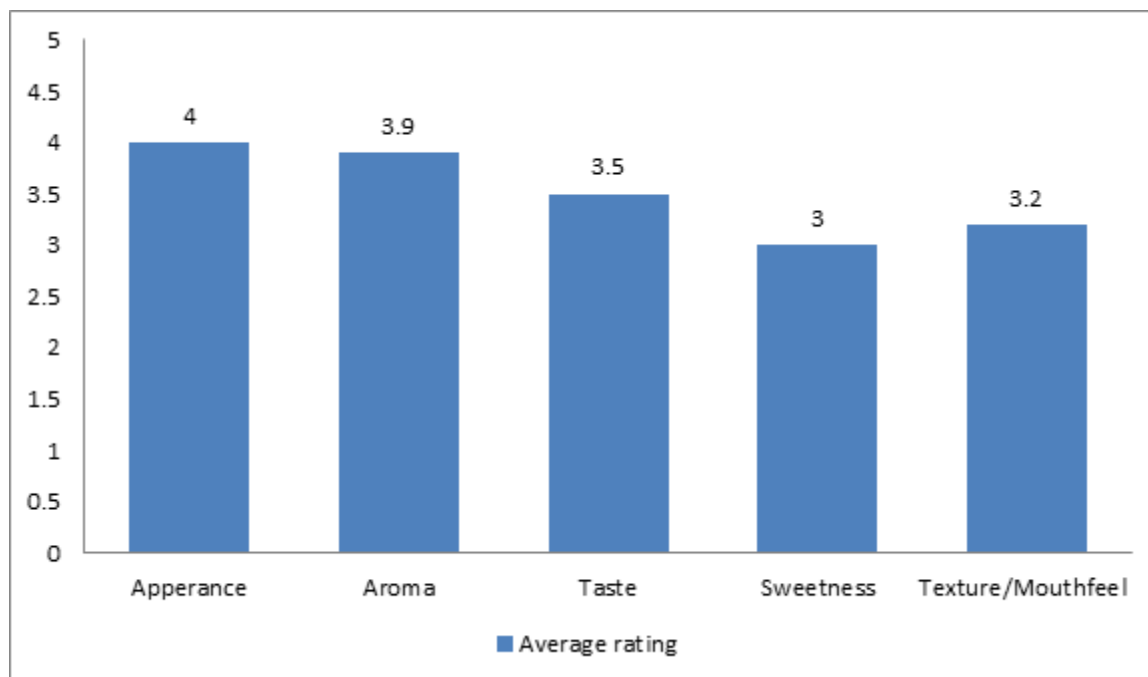


Figure no. 1 - Sensory Evaluation for Trial One

During the first trial, the results of sensory evaluation showed that the jackfruit seed laddus should be a sweeter and one of the feedback also suggested to grate the coconut more before adding to improve texture. (Figure no. 1) The appearance and aroma of the product was very well appreciated by the panel members. As per the feedback given, the taste could be improved.

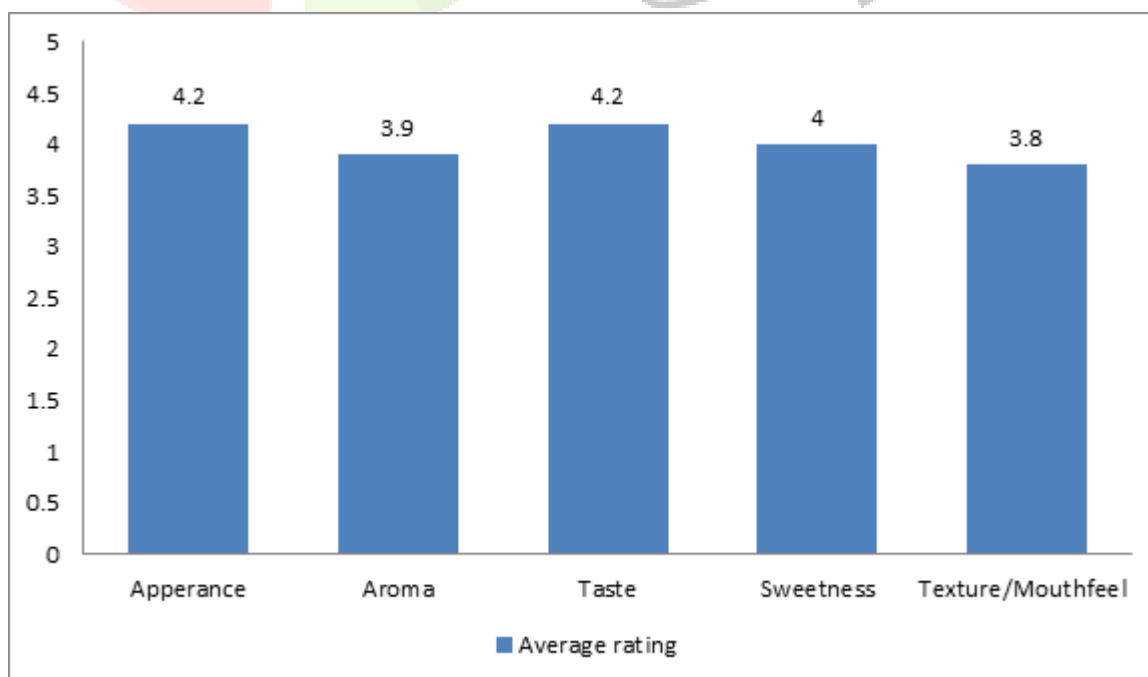


Figure no. 2 - Sensory Evaluation for Trial Two

So to improve its taste, the 2nd trial was done by adding powdered jaggery in a little more amount and finely grating the coconut before adding. This resulted in the improvement of the taste by making it more palatable and the texture aspect also enhanced. (Figure no. 2)

Due to positive feedback from the panel members, this product was finalized. This standardized product was packed in plastic airtight boxes and kept in the refrigerator for further shelf study.

PACKAGING

Product packaging serves to protect the product inside. Packaging must keep the product safe during shipment between the manufacturing facility and the retailer and must prevent damage while the product sits on the shelf. Therefore, product packaging must be sturdy and reliable. Choosing a style and colors that will appeal to consumers and encourage them to pick up your product is very important, as is choosing high-quality packaging materials. The product packaging is a reflection of the product inside and the brand as a whole. [9]

A total number of 10 Jackfruit seed laddus were packed in one box. It was a black colour good quality polystyrene plastic airtight box and was rectangular in shape. It prevented the product from getting in contact with microorganisms, dust and dirt. Polystyrene is a versatile plastic that can be rigid or foamed. General purpose polystyrene is clear, hard, and brittle. It has a relatively low melting point. Typical applications include protective packaging, food service packaging, bottles, and food containers. This box was selected to pack the product as it is one of the most reliable types of boxes to pack solid food items. The lid was airtight that can provide a good way to ensure that the product was free from damage and microorganisms. The product was kept in this box for 4 weeks during the sensory evaluation and it was observed that the product inside was completely free from any environmental or physical damages. Each box of laddus weighed approximately 300gms. [10]



Figure no. 3 Packaging Material

NUTRITION LABELLING

Nutrition labelling is the section of information on a food label that specifically declares nutrient content. According to the *Codex Alimentarius*, 'Nutrition labelling is effective when it provides the consumer with information about a food to help him or her to make healthy food choices'. Food labels inform consumers about the composition and nature of products to avoid confusion and protect the consumer against misuse, risk and abuse. Marketing information, including the selling price, brand name and commercial offers, is provided as well as information on the safe storage, preparation and handling of the food product. Information on ingredients, nutrition and the declaration of potential allergens and nutrition and/or health claims, helps consumers to make an informed decision. There has been an emphasis in recent years on food safety and the

protection of the health of the consumer as one of the main objectives of food legislation. [5] A nutrition label was designed for the product, 'Jackfruit seed laddus' using a digital designing application - Canva. It had all major nutrient amounts and other information like net wt., packaging date, veg logo, and ingredients. This helps to enhance the product's sale by innovation for good marketing and to attract customers. The facts such as the laddus are gluten-free, sugar-free, high in energy and protein were emphasized on the front label. On the nutrition label backside, health benefits of the laddus were mentioned along with the nutrition facts. Important information such as the product is 100% organic with no added preservatives/colors and it should be stored in an airtight container in a cold place was mentioned.

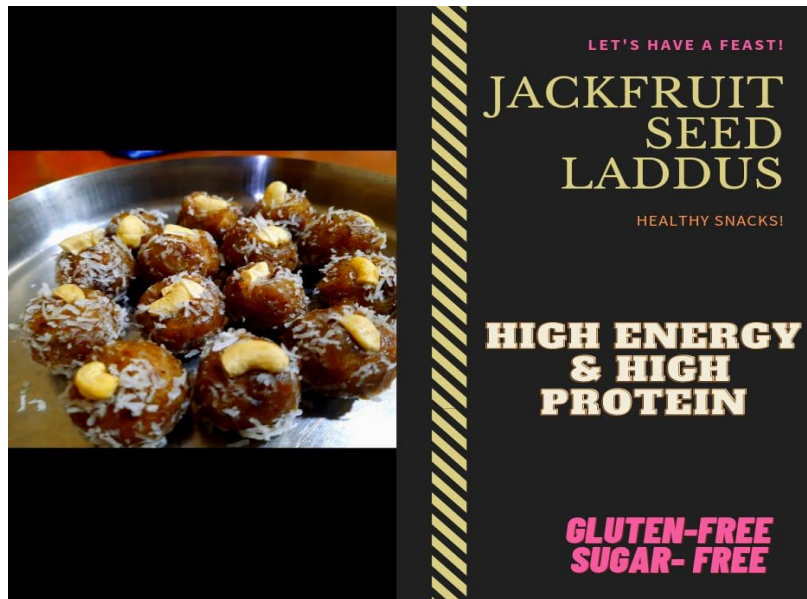


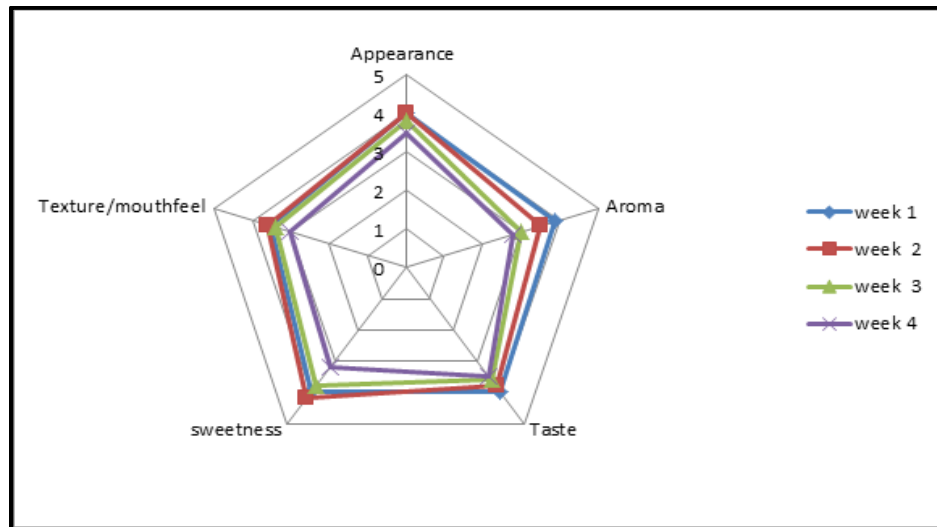
Figure no. 4 Nutrition Label Front

| HEALTH BENEFITS OF JACKFRUIT SEED LADDUS | NUTRITION FACTS | | | | | | | | | | |
|---|--|--------|----------|---------------|--------|---------|---------|-----|---------|---------------|---------|
| <ul style="list-style-type: none"> ✓ Rich in energy and protein. ✓ Gluten - free ✓ Sugar - free ✓ Good source of fibre and B-Complex vitamins ✓ Good for Diabetes and Gut Health | <p>1 Serving Size - 30 g</p> <table border="1"> <tr> <td>Energy</td> <td>790 Kcal</td> </tr> <tr> <td>Carbohydrates</td> <td>84.6 g</td> </tr> <tr> <td>Protein</td> <td>14.14 g</td> </tr> <tr> <td>Fat</td> <td>45.46 g</td> </tr> <tr> <td>Dietary Fibre</td> <td>16.99 g</td> </tr> </table> | Energy | 790 Kcal | Carbohydrates | 84.6 g | Protein | 14.14 g | Fat | 45.46 g | Dietary Fibre | 16.99 g |
| Energy | 790 Kcal | | | | | | | | | | |
| Carbohydrates | 84.6 g | | | | | | | | | | |
| Protein | 14.14 g | | | | | | | | | | |
| Fat | 45.46 g | | | | | | | | | | |
| Dietary Fibre | 16.99 g | | | | | | | | | | |
| <p>STORE IN A COLD PLACE AND IN AIR TIGHT CONTAINER ONLY</p> <p>HEALTHY SNACK!</p> <ul style="list-style-type: none"> > 100 % ORGANIC > NO PRESERVATIVE > NO ADDED COLOURS | <p>INGREDIENTS :</p> <ul style="list-style-type: none"> Jackfruit seeds Coconut Jaggery Cashew nuts Cardamom Desiccated coconut Salt <p>Net weight : 300 g Packed on : 08 - 07 -21</p> <p>Best Before 4 weeks from the date of packaging. MRP - Rs. 250</p> | | | | | | | | | | |
| <p>Manufactured by - Sakshi Mhatre mhatre.sakshi3641@gmail.com</p> | | | | | | | | | | | |

Figure no. 5 Nutrition Label Back

SENSORY EVALUATION FOR SHELF LIFE STUDY

To study the shelf life of 'Jackfruit Seed Laddus', sensory evaluation of the product was conducted every week for 1 month periodically with 10 naive panel members. Scoring test was done which included appearance, aroma, taste, sweetness and texture/mouthfeel on a 5 point hedonic scale.



(Figure no. 6 - Sensory Evaluation after 4 weeks)

- After conducting the sensory evaluation for 4 weeks there were changes observed in the characteristics of the product. As observed in fig. 3 the product had great appearance during the first 2 weeks but by the end of 4 weeks it started reducing.
- The best part about the product was its aroma due to usage of cardamom which also eventually declined by the end of week 4. Little change in taste was observed every week.
- As the flavours mixed well, the sweetness of the product along with texture and mouthfeel was at its best in week 2 which reduced in the last week. Therefore, the product was finally labelled as - Best Before 4 weeks from the date of packaging.



Figure no. 7 and 8 - Final Product

MARKETING

Marketing is important because it helps to sell products or services. The bottom line of any business is to make money and marketing is an essential channel to reach that end goal. Modern marketing is a less expensive game than ever before. Social media platforms and email campaigns have made reaching out to consumers a much more finance-friendly possibility. [11]

The product was marketed as a healthy snack for all age groups giving special focus on people who suffer from diabetes and gut health problems. The picture of the product along with the nutritional label was posted on social media platforms like Instagram, Facebook, Whatsapp and Pinterest. Though no specific age group was targeted, there was more focus on diabetic patients. Then peoples' reaction and comments were recorded. Lot of people were curious and interested in the product because of its nutritional value. The positive feedback proved that this product can be a viable option for starting an entrepreneurial venture.

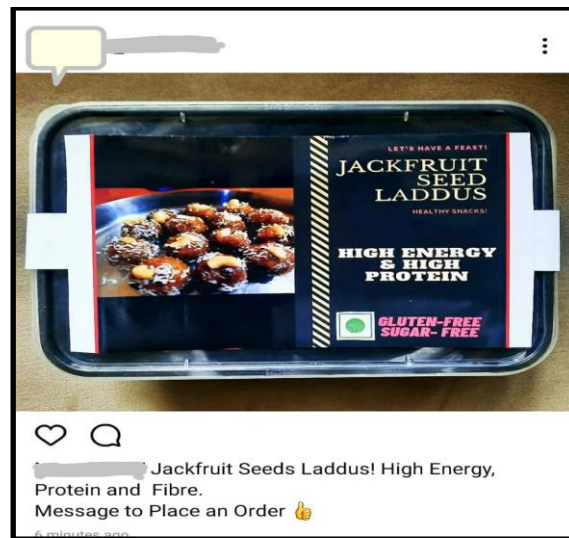


Figure no. 9 - Social Media Post for Marketing

BUDGETING

Budgeting is important because it helps in controlling spending, tracking expenses, and saving more money. Additionally, budgeting can help to make better financial decisions, prepare for emergencies, get out of debt, and stay focused on long-term financial goals.[12] Budgeting is a very important aspect while developing a food product because it helps to achieve financial success and decides the pricing of the product. The product's budget must be cost effective so that everyone can afford it.

TABLE 2 - COST OF INGREDIENTS

| Ingredients | Amount | Price (in Rupees.) |
|--------------------|-----------------------|---------------------------|
| Jackfruit seeds | 250 gms (20-25 seeds) | Rs. 30 |
| Coconut | 250 gms | Rs. 30 |
| Jaggery Powder | 250gms | Rs. 80 |
| Cashew nuts | 50 gms | Rs. 60 |
| Cardamom Powder | 100 gms | Rs. 20 |
| Desiccated coconut | 100 gms | Rs. 30 |
| Salt | 5 gms | Rs. 10 |
| Total | | Rs. 260 |

TABLE 3 - BUDGET PER BOX

| Expenditure | Price (in Rupees) |
|---|---------------------------|
| Raw Ingredients | Rs. 260 |
| Labelling | Rs. 20 |
| Packaging Material | Rs. 10 |
| Miscellaneous (Travel, Rent Employer's Salary , Electricity , Gas , Maintenance) | Rs. 35 |
| Total | Rs. 325 |

- Using the total raw material of ingredients 14 laddus were prepared but only 10 were packaged in the box to round off. The raw materials were bought from the wholesale market and therefore profit was

more. As per table 3, the total expenditure for making 14 laddus is Rs.325 which makes the cost of each laddu Rs. 23. (Total expenditure i.e. Rs.325 divided by no. of laddus prepared i.e.14)

- To achieve profit each laddu was sold at the price of Rs.25. Thus, the total cost of one box of Jackfruit seed laddus was Rs 250 /- which consisted of 10 laddus. The profit behind one box was Rs. 20.
- If 50 such boxes were to be sold, the amount earned by selling would be Rs. 12,500 and the profit would be Rs.1000.

SUMMARY

Jackfruit seed laddus are multi-nutrient rich and can be recommended to all the age groups. It provides a good amount of carbohydrates, proteins, B-Complex vitamins and fibre. They are gluten-free and sugar free which makes them a good option of food for the diabetics. Shelf life of the jackfruit seed laddus for a month proved that they have a very good shelf life and all the characteristics did not deteriorate and if stored in proper storage condition (refrigerator) can easily last long. It also got positive feedback when marketed from the consumers.

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