



FORMULATION AND STANDARDIZATION OF TAMJACK BAR

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Abstract: Fruit provide high amount of energy, vitamins, minerals, and dietary fiber. Preparation of fruit bar from jackfruit and tamarind is used to study the sensory properties and nutritional benefits of the product. In this fruit bar prepared by jackfruit pulp, tamarind pulp extract, sugar or jaggery, binders like corn flour, and some minor ingredients like citric acid, cardamom. Typical steps in bar production are pulping, mixing, heating, concentrating, and drying. For this process using shade dryer. Jackfruit flesh and tamarind pulp extract were developed by incorporating in various proportions. The mixed fruit bar was prepared by the different blending ratio of jackfruit pulp and tamarind extract in a ratio (90:10, 80:20, 70:30) in preparation of mixed fruit bar. Among them, 70% jackfruit pulp and 30% tamarind extract of treatment recorded as best blending ratio for fruit bar.

Key words: Jackfruit, Tamarind, bar, blending ratio, Drying.

I. INDRODUCTION:

Jackfruit (*Artocarpus heterophyllus* Lam) is a tropical fruit species found in tropical, rain area, and sea areas of the world. It belongs to Moraceae family. The name derived from the Malayalam name Chakka. It's also called kathhal in Hindi, Pala in Tamil, halasina hannu in Kannada, panasa pandu in Telugu. India considered to be the native of jackfruit. This mostly cultivated in tropical regions of India, Bangladesh, Nepal, Sri Lanka, Malaysia, and the Philippines. Ripe jackfruit consisted 29% of pulp, 12% of seeds, 54% of rind. The jackfruit contains high amount of protein, calcium, iron, vitamins and other essential nutrients when compare to all other fruits. In this fruit rich in carbohydrates and calories and it also consists of simple sugar (i.e, sucrose and fructose), In this sucrose and fructose used for digestion to our bodies. Jackfruit contain calcium, which is effective in providing strength and helps to maintain a healthy bone. This fruit is very efficient in preventing anemia which occurs due to the iron insufficiency. In this fruit rich in iron and used to enhance the production of red blood cells in the human body. Presence of vitamin C in this jackfruit is lead to improving the absorption of iron in the body. This fruit is good in fiber content and thus prevents the constipation. Vitamin A content of this fruit is used to improving the eyesight and preventing from cataracts, night blindness, and glaucoma. The presence of vitamin C in this fruit is providing the healthy capillaries and effective in the proper functions of retinal cells. It also includes lutein and zeaxanthin which are very efficient for the eye health. Jackfruit have antifungal properties, which has the capacity to prohibit the growth of fusarium moniliforme and saccharomyces cerevisiae.

Jackfruit may help to promotes the cardiovascular health. It can be balancing the thyroid hormones. Jackfruit have a high dose of nutrients so it may improve the body immunity. This fruit preventing a calcium loss from the body. It is rich in antioxidants that essential for bone health and nervous system. It has 13% potassium that important for maintaining normal blood pressure and kidney health. Jackfruit is used to produce a value-added product like, fruit leather, candy, crackers, nutritional powder. It can be used to make a different variety of dishes, including custards, cakes and shaved ice. It can be preserved by applying various techniques like drying, freezing, canning, or by converting various products. And also, this jackfruit leaves, bark, inflorescence, kernel, and latex are used in conventional medicines. The variation of jackfruit is differentiated according to the characteristics of the fruit flesh. In India there are two variations of jackfruit that is called *muttomvarikka* and *sindoor*. Muttomvarikka has a slightly hard inside flesh when its start to ripe but sindoor has soft inside flesh when that fruit ripe. The jackfruit varieties come under two types: firm or soft. That jackfruit variation in the United States Include Black Gold, Dang Rasimi, Golden Nugget, Honey Gold, Lemon Gold, and NS1. The black gold jackfruit is a healthy jackfruit arise from Queensland. The golden nugget variety was selected in Queensland and Australia. This tree is rapid growing, with distinctive dark green, rounded leaf. Honey gold jackfruit originated from Australia, that have slow moderate growth habit. The Kun Wi Chan jackfruit have a fast growth habit and it's originated from Thailand. NS1 jackfruit have a firm texture and it's originated from Malaysia.

Tamarind (*tamarindus indica* L) is one of the utmost widespread trees of the Indian landmass. Tamarind fruit was at first / initial thought to be produced by Indian palm, as the word tamarind arrive from a Persian word 'tamar-i-hind', it meaning 'date of India'. It is produced throughout the whole India, exclude in the Himalayas and western dry areas. Tamarind tree is a one of the most important leguminous tree family. The pulp of the tamarind fruit has been mostly used as a seasoning agent in Asian cuisine, mainly in the southern part of India. Almost every part of the tamarind tree, like leaves, pulp, and seed has identify a use in the

food, chemical, pharmaceutical, and textile industries. The Tamarind fruit pulp, both mature and dry, contains mostly tartaric acid, lower sugar, pectin, tannin, fiber content, and cellulose. That tamarind pulp contains high amount of potassium, calcium, and phosphorous and also its rich in minerals like sodium, zinc, and iron. The most precious and useful part of the tamarind tree is tamarind fruit pulp. The fruit pulp constitutes of 30% to 50% ripe fruit. The pulp is the main agent of curries, sauces, chutneys, and certain beverages throughout the most part of India. This pulp is very useful for dietary uses, ayurvedic medicine and mainly for food industry. In Thailand, they mainly used tamarind in sauces for sour flavor and acid taste. Tamarind products, that tamarind leaves, fruit and seeds are significantly used in Indian Ayurvedic medicine and mostly used in African medicine. Tamarind is used to anthelmintic, antibiotic, antiseptic, anti-infectious, antiviral, sunscreen, and used to promote wound healing medicine in the ensuing conditions like: asthma, bacterial skin infections, chest pain, cholesterol metabolism disorders, colds, colic, pinkeye, constipation, diabetes, diarrhoea, dry eyes, eye swelling, fever, gastrointestinal problem, gingivitis, liver related disorders, nausea, vomiting, pharyngitis and nephrolithiasis.

The important objectives of this study were to formulate the jackfruit bar incorporated with tamarind, to standardize the jackfruit and tamarind mixed fruit bar, to evaluate the sensory attributes of the fruit bar, to calculate the nutrient content of the fruit bar, and to determine the packaging material.

II. MATERIALS AND METHODS:

This chapter carried with the materials and methods related to the study of “**Formulation and standardization of tamarind jackfruit fruit bar**”. The project was carried out in the Slcs galley, department of food science and processing management, college of Subbalakshmi Lakshmi pathy college of science.

2.1 Materials:

The fully matured jackfruit and tamarind were procured from the Madurai fruits market. Sugar \ jaggery, corn starch, and citric acid were procured from the Madurai local market for this study. Stainless steel vessels, mixing bowls, drying tray, and plate were used for preparing the products. Liquid petroleum gas (LPG) used for heating purpose and Mixer used for grinding purpose. Electronic weighing balance machine with 0.1 accuracy used to determine the weight of the samples and raw materials. And other materials like, muffle furnace, hot air oven, Soxhlet unit are used for determine the nutrient content of the sample. Packaging material like aluminium foil and PET boxes are used for storing the product.

2.2 Methodology:

The fully mature, disease free, fresh jackfruit and tamarind were selected for the preparation of fruit bar. The fruit flesh was washed in water for removing the adhering dirt. After washing a fruit preliminary trial was conducted to standardize the method of extraction of pulp. In jackfruit pulp preparation procedure, jackfruit was cut into small pieces with the help of stainless-steel knife. Small pieces of jackfruit flesh grind in a mixture for 5 to 10 min for making pulp. For tamarind juice extraction process, the tamarind was washed and soaked in water for few minutes, then grind the tamarind using of bender to extract the tamarind juice. The mixed fruit bar was prepared by the mixing of jackfruit pulp with tamarind extract according to different combinations. Then heat the mixed fruit pulp at 80⁰ C for 10 minutes with addition of sugar, citric acid, cardamon and corn syrup. The butter sheet was cut according to size of trays and greased with oil or butter. Then mixture of fruit pulp was poured into the trays of 1.5 – 2.0 cm thick layer. After that, trays placed into the shade dryer for 2 days. Dried mixed bar was cut into uniform pieces of size and wrapped into aluminium foil or packed into PET boxes and it's stored at room temperature.

Fruit bar was prepared from different proportion of jackfruit and tamarind with addition of sugar, corn starch, and citric acid as per requirements. These different proportions of fruit bar will be determined or finalized by sensory evaluation method.

Table no:1 – pulp ratio for different experiments:

S.no	Pulp and juice ratio	Notation
1.	90% jackfruit pulp + 10% tamarind extract	TJFB1
2.	80% jackfruit pulp + 20% tamarind extract	TJFB2
3.	70% jackfruit pulp + 30% tamarind extract	TJFB3

Table no:2- proportions of ingredients used in the development of different samples:

S.NO	INGREDIENTS	QUANTITY		
		TJFB 1	TJFB 2	TJFB 3
1)	Jackfruit	450g	400g	350g
2)	Tamarind	50h	100g	150g
3)	Sugar	50g	50g	50g
4)	Citric acid	2g	2g	2g
5)	Corn flour	5g	5g	5g
6)	Cardamon	2g	2g	2g

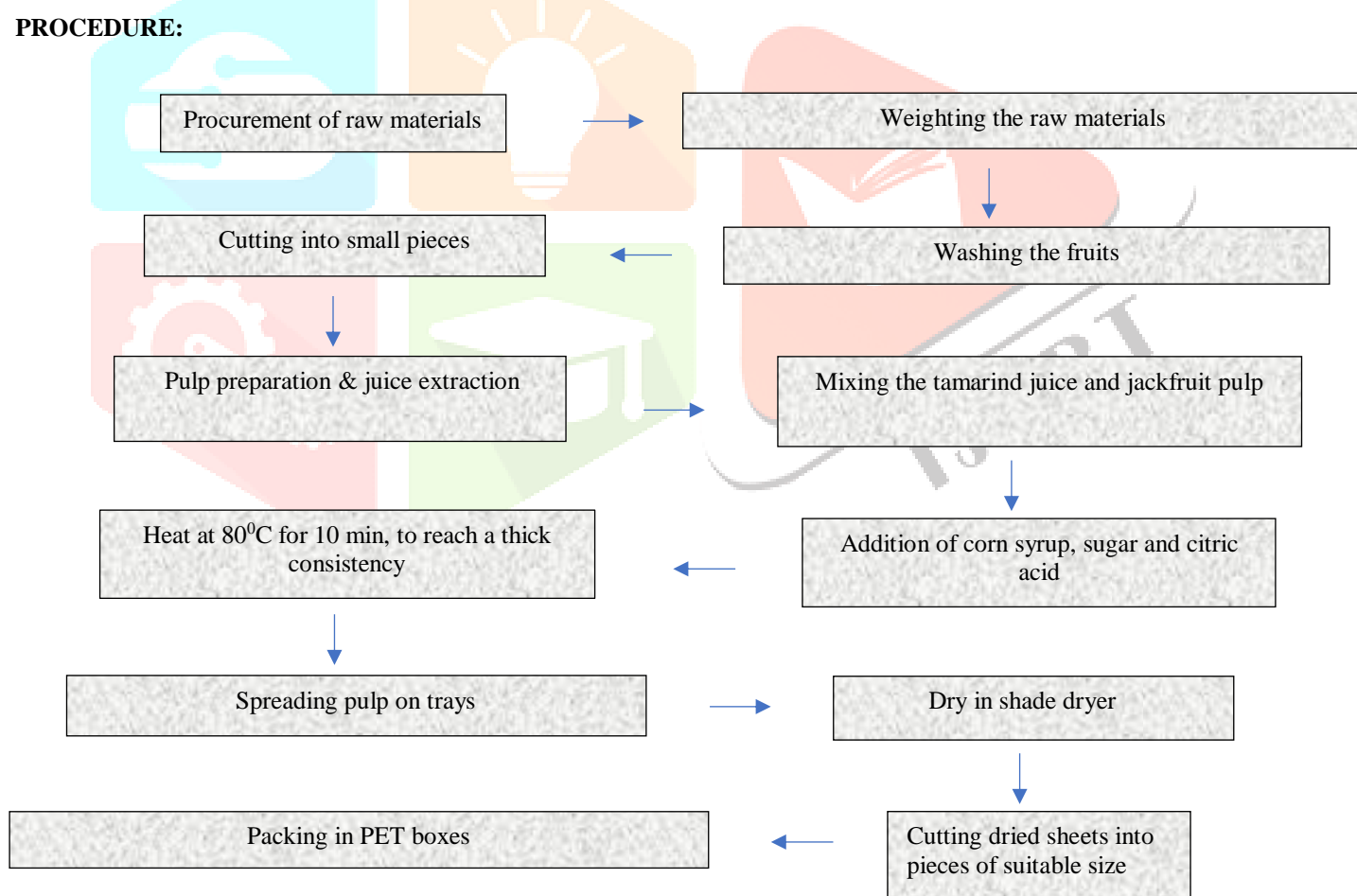
PROCEDURE:

Figure:1- flow chart for preparation:

III.SENSORY EVALUATION OF TAMARIND JACKFRUIT FRUIT BAR:

A consumer acceptability sensory evaluation was conducted by department of food science and processing management, in sensory evaluation laboratory. Panellist comprised 20 members who were staff or students at the department. The sensory evaluation was conducted to assess the acceptability of the developed fruit bar. Each panellist was asked to taste sample. Attribute selected for the mixed fruit bar were Appearance, colour, taste, aroma, texture and overall acceptability.

The developed fruit bar along with its variation was evaluated by the panel of judges, by using 5 points hedonic scale rating. On a scale of 1 to 5 there were tabulations of scores, where 1 indicates “extremely dislike” and 5 indicates “extremely like” for accuracy purpose, drinking water was given to the panel members to rinse their mouth between evaluation. An overall acceptability score was calculated from the hedonic scores of the 20 members.

Table no:3- overall mean score for different sample:

Sensory attributes	Appearance	Colour	Flavour	Texture	Taste	overall acceptability
Sample A (TJFB 1)	4.25	4.2	3.9	4	3.7	4.01
Sample B (TJFB 2)	4.55	4.45	4.3	4.4	4.35	4.41
Sample C (TJFB 3)	4.5	4.5	4.55	4.35	4.7	4.52

IV.STANDARDIZATION OF TAMARIND JACKFRUIT FRUIT BAR:

There are three treatments are conducted to select a standardized product. In this test, first treatment (TJFB1) taken 450g of jackfruit and 50 g of tamarind and second treatment (TJFB1) taken 400 g of jackfruit and 100 g of tamarind and third treatment (TJFB1) taken 350 g of jackfruit and 150 g of tamarind. And other products like sugar, corn flour, citric acid and cardamom taken in same level (sugar- 50g, corn flour-5g, citric acid-2g, and cardamom-2g).

These preliminary sensory evaluation experiments were conducted to select the correct level of each ingredient like jackfruit, tamarind, sugar, citric acid, corn flour, and cardamom (Table-4). The excellent level of ingredients was finalized by sensory evaluation method. The sensory evaluation is conducted by a panel of minimum 20 semi-trained panel members using 5 points hedonic scale. After using of sensory evaluation, the standardized product ingredients quantity is finalized.

Table no:4- standardization of tamarind jackfruit fruit bar:

Ingredients	Quantity
Tamarind	350g
Jackfruit	150g
Sugar	50g
Citric acid	2g
Corn flour	5g
Cardamom	2g

V.NUTRIENT ESTIMATION:

This nutrients analysis is conducted to estimate or determine nutrient content or quality of the product. Moisture, carbohydrates, fat, crude protein, total ash, and crude fibre of the sample were determined by nutritional analysis method. It's done by food product analytical lab and research centre, Madurai.

Energy value of the fruit bar/sample was expressed as kcal/100 g and was determined by multiplying the values of protein, fat and carbohydrates by recommended factors like (9,4, and 4, respectively). Carbohydrates was calculated by adding the values of Moisture, Protein, Fat, and total ash. Then subtract the value from 100. Total ash was calculated by using of Muffle furnace. The total moisture was determined by using of hot air oven. For fat was determined by using of Soxhlet extraction unit. For crude fibre estimation, use the fat free sample to determine the crude fibre content.

VI.PACKAGING:

For tamarind jackfruit fruit bar use polyethylene terephthalate (PET) box as packaging material. These packaging materials are used to extent the shelf life of the fruit bar which leads to maintaining the quality of product. The standardized sample of TJFB-1 was packed in PET box. Because, the supporting study of Pawase PA et al., (2019) carried that the studies on effect of different packaging materials on shelf life of mixed fruit bar. This study suggests that use of aluminium foil and PET as packaging material for long storage of fruit bar.

VII.RESULT AND DISCUSSION:

The present research entitled “**Formulation and standardization of tamarind (*tamarindus indica L*) jackfruit (*Artocarpus heterophyllus Lam*) fruit bar**” was carried out the Department of Food Science and Processing Management.

The important objectives of this study were to formulate the jackfruit bar incorporated with tamarind, to standardize the jackfruit and tamarind mixed fruit bar, to evaluate the sensory attributes of the fruit bar, to calculate the nutrient content of the fruit bar, and to determine the packaging material.

This investigation used raw materials like, jackfruit, tamarind, sugar, citric acid, corn flour and utensils like mixing bowl, stainless steel pan, plate, tray and energy sources like Liquid petroleum gas (LPG) and mixer for product preparation. Muffle furnace, hot air oven, Soxhlet unit are used for determine the nutrient content of the sample.

This investigation was carried out with 3 test combinations consisting three different ratio of jackfruit pulp and tamarind juice (TJFB1, TJFB2, TJFB3).

7.1 Sensory evaluation:

The sensory evaluation based on appearance, colour, flavour, texture, taste, and overall acceptability was evaluated by panel of 20 members on a 5-point hedonic scale. The sensory evaluation results showed that the high score for appearance of sample (70% of jackfruit and 30% of tamarind) as 4.5 recorded. The average colour score of that mixed fruit bar were 4.5. The high flavour value of the sample is 4.5 rating. The average texture value of the fruit bar is 4.35. The average mean score of fruit bar taste is 4.7 registered.

So that, overall mean score in sample TJFB3 (70% of jackfruit and 30% of tamarind) was highly desirable and it is highly acceptable. The results revealed the TJFB3 (70% of jackfruit and 30% of tamarind) secured highest score in all sensory attributes which was more equal to the other developed product.

Table no:5 – attributes of accepted sample:

Attributes	Appearance	Colour	Taste	Flavour	Taste	Overall acceptability
Maximum score	5	5	5	5	5	5
TJFB3	4.5	4.5	4.55	4.35	4.7	4.52

7.2 Nutrient estimation:

7.2.1 Determination of Moisture:

Moisture content of the fruit bar was determined by using of Hot air oven temperature at 130⁰C. It's calculated by the formula below:

$$\text{Moisture (\%)} = \frac{W1 - W2}{W} \times 100$$

W- weight of the sample, W1- weight of the dish and weight of the sample before drying

W2- weight of the empty dish + sample after drying.

7.2.2 Determination of Fat:

Fat content of the sample was determined by using of Soxhlet Extraction unit/ Socsplus unit. Sample in the thimble is extracted with solvent in Soxhlet extraction unit. Solvent reservoir is gently boiled. Solvent vapours are condensed by a water-cooled condenser from which solvent drips into thimble and extract the fat from sample. The extraction will continue till the solute gets dissolved in solvent. Finally, the solvent is collected separately and fat weight after drying. It's calculated by the formula below:

$$\text{Fat (\%)} = \frac{W2 - W1}{W} \times 100$$

W- weight of the sample taken for this test, W1- weight of the empty Soxhlet flask, W2- beaker with the extracted fat.

7.2.3 Determination of Protein:

Crude protein content of the fruit bar was determined by using of three methods, like digestion, distillation, and titration. In this process using potassium sulphate and copper sulphate for catalyst mixture. And using sodium hydroxide and boric acid for distillation purpose. Methylene red indicator used for titration process. It's calculated by the formula below:

$$\text{Protein (\%)} = \frac{14.01 \times 0.1N \times (TV - BV) \times 100}{W \times 100} \times C$$

❖ TV- Titre value, BV-Blank Value, W- sample weight, C – Conversion factor.

7.2.4 Determination of total Ash:

Total ash content of the sample estimated by using of muffle furnace at 550⁰ to 600⁰ C. It's calculated by the formula below:

$$\text{Total ash (\%)} = \frac{W_2 - W_1}{W} \times 100$$

- ❖ W- weight of the sample, W1- weight of the empty crucible before igniting, g
- ❖ W2- weight of test portion after igniting, g.

7.2.5 Determination of Crude fibre:

Crude protein content of the sample was determined by using of fat free sample. In this process using sulphuric acid and Sodium Hydroxide for preparation, it's calculated by the formula below:

$$\text{Crude fibre (\%)} = \frac{W_2 - W_1}{W} \times 100$$

- ❖ W- weight of the sample, W1- weight of the empty Gooch crucible clean and dry.
- ❖ W2- weight of the Gooch crucible after dry.

7.2.6 Determination of Carbohydrates:

Total amount of Carbohydrates was calculated by adding the values of Moisture, Protein, Fat, and total ash. Then subtract the value from 100. It's calculated by the formula below:

$$\text{Carbohydrates (\%)} = 100 - (\text{moisture} + \text{protein} + \text{fat} + \text{total ash})$$

7.2.7 Determination of Energy:

Energy value of the fruit bar was expressed as kcal/100 g and was calculated by multiplying the values of protein, fat and carbohydrates by recommended factors like (4,9, and 4, respectively). It's calculated by the formula below:

$$\text{Energy kcal/100g} = 9 \times \text{Fat content} + 4 \times \text{Protein content} + 4 \times \text{Carbohydrates.}$$

table no:6- nutrient content of fruit tamarind jackfruit fruit bar:

S. No	Nutrients	Average value:
1.	Energy	258.4 kcal
2.	Fat	0.8%
3.	protein	4.21%
4.	Carbohydrates	58.6%
5.	Moisture	33.4%
6.	Crude fibre	6.1%
7.	Total ash	3.0%
8.	Insoluble ash	0.23%

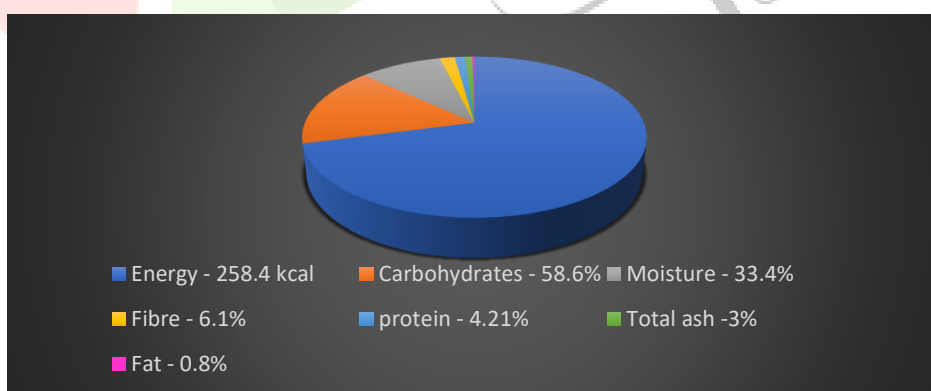


Figure 2 – average nutrient value of Tamjack bar.

VIII.CONCLUSION:

The mixed tamarind and jackfruit fruit bar was prepared by three variations. TJFB1 (90% of jackfruit pulp and 10% of tamarind juice) TJFB2 (80% of jackfruit pulp and 20 % of tamarind juice), TJFB3 (70% of jackfruit pulp and 30% of tamarind juice). That three variations are evaluated by sensory method. Sensory evaluation/ organoleptic evaluation is done by 20 trained and semi trained panel members using of 5- point Hedonic scale method. Sample TJFB3 (70% of jackfruit pulp and 30% of tamarind juice) ingredients are standardized by using of sensory evaluation. Standardized sample was used for nutrient estimation. This fruit bar packed in PET boxes for storage. Tamarind jackfruit fruit bar contain good quality and good amount of nutrients.so, this recipe can be recommended for every age group.

IX. ACKNOWLEDGMENT:

I wish to express my deep sense of gratitude and hearty thanks to my beloved guide Dr.K.U. Pavitra Krishna, M.Sc., PhD, NET, SET, Head and Assistant Professor, Department of Food Science and Processing Management, Subbalakshmi Lakshmipathy College of Science, Madurai for her valuable guidance, support, supervision, and encouragement during my research work.

I express my heartfelt thanks to all the teaching and non- teaching staff members of the department of college of science, Madurai, for their support and valuable advice on my study.

Last but not the least, I would like to thank my parents, friends without them without them it would not be possible.

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