Comparative study on the processing and preservation of white dragon (*Hylocereus undatus*) and red dragon (*Hylocereous ploryhizus*) fruit jelly.

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LETTER OF TRANSMITTAL

18th December 2018

Professor Dr. Md. Bellal Hossain

Head

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Subject: Submission of thesis report.

Dear Sir,

I am here by submitting my thesis report as a part of the Nutrition and Food Engineering program curriculum at Daffodil International University.

I have prepared this report based on the acquired taste knowledge during my thesis based on comparative study on the processing and preservation of white dragon (*Hylocereus undatus*) and red dragon (*Hylocereous ploryrhizus*) fruit jelly. It is great achievement to work under supervision of **Dr. Md. Rezaul Karim.** This thesis gives me both academic practical exposures.

I therefore, would like to place this report to your judgement and suggestion. Your kind advice will encourage me to perform better planning in future.

Sincerely Yours

Kaniz Fatima Nipa

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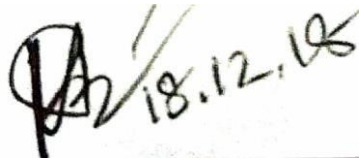
CERTIFICATE APPROVAL

I am pleased to certify that the thesis report on Comparative study on the processing and preservation of white dragon (*Hylocereus undatus*) and red dragon (*Hylocereous ploryrhizus*) fruit jelly by **Kaniz Fatima Nipa**, bearing ID No: **151-34-344** of the department of Nutrition and Food Engineering has been approved for presentation and defense/viva-voice.

I am pleased to hereby certify that the data and finding presented in the report are the authentic work of Kaniz Fatima Nipa I strongly recommended the report presented by Kaniz Fatima Nipa for further academic recommendations and defense/viva-voice. Kaniz Fatima Nipa bears a strong moral character and a very pleasant personality. It has indeed a great pleasure working with him. I wish him all success in life.

Supervisor



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DEDICATION

To my parents, without whom I would not be able come such beautiful world and without their support it was impossible to stand this stage of life.

Abstract

The goal of this study to analyze the composition of dragon white and red dragon fruit jelly, also to promote dragon fruit jellies to entry its acceptance in market. The dragon fruit jellies were prepare with 1% pectin and 5g of agar power. The process dragon fruit jellies were in package in bottle glass jar which is storage circumambient temperature at 27- 30°C and refrigerated at 4°C. The proximate and microbial analysis, and also quality parameters such as color, texture flavor and overall acceptance were measured by sensory evaluation with 30 panelist. The total soluble solid for raw red dragon fruit was 4.5°Brix while white dragon fruit was 3°Brix. However, total soluble solid were 30°Brix and 35°Brix, pH were 0.05 and 0.08, moisture were 0.8% and 0.5%, ash were 0.01% and 0.0%, fat were 0.3% and 0.0%, protein were 0.5% and 0.3% for red dragon fruit and white dragon fruit jelly respectively. Total plate count for bacteria were 10 and 12, no total viable count were found for red dragon fruit and white dragon fruit jelly respectively. Red dragon fruit was more acceptable than while dragon fruit jelly in respect of color, flavor appearance and texture. Therefore; red dragon fruit jelly can be more acceptance in market. .

Key words: Dragon fruit, jelly, microbial growth, sensory quality.

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CHAPTER ONE

1. Introduction

Pitaya fruit, pitahaya fruit also known as dragon fruits of various cactus species which is genus of Hylocereus undatus. Dragon fruit is among the most nutritious and amazing extraneous fruits. At present these fruit being cultivated at least 22 countries including Australia, Cambodia, China, Malaysia, Thailand, Srilanka, and Bangladesh. And also Dragon fruit are origin to Mexico, Central America, and South America. There are three species of dragon fruit such as Hylocereus undatus which is white-flesh red feel dragon fruit, Selenicereus megalathus which is white flesh with yellow peel dragon fruit and Hylocereus polyrhizus which is red-flesh with red peel dragon fruit. (1).

Sweet pitaya have delicate and sapid. Dragon fruit texture is more similar to kiwi or watermelon. And also is dragon fruit have black tiny comestible seeds that are similar in appearance to kiwi seeds. Pitahaya is lightly sweet and low calories have glamorous and juicy with fruity flavor. Dragon fruit belong to family of cactaceae and semi-epiphytic plant which can be cultivated dry place, tropical, subtropical climates with an average temperature 21-29 degree C. The demand for dragon fruit widely increases and the fruit nowadays can be found on almost all external market around the world. (2).

A maturate dragon fruit weighs 120-1200g and their difference depends on size and shape of the fruit as well as depends on their pulps. The average weight of a dragon fruit approx.350g. This fruit is seasonal fruit most probably available July to November.

Dragon fruit are rich sources of nutrients, minerals, like vitamin B1, vitamin B2, vitamin B3 and vitamin C, potassium, Iron, calcium, sodium. The dragon fruit seeds oil also rich sources of polyunsaturated fat which is benefit for health defecation and body weight control. The dragon fruit pulps are present high level of antioxidant activity. (3). It has a pH between 4.7 to 5.1 and Brix value between 11 to 19 degree brix.

Figure 1.1: Three Types of Dragon Fruit

The fresh and ripen dragon fruit which is eaten raw. Dragon fruit is a mouthwatering light sweet taste. Dragon fruit and fruit products both are rarely common in our market and also very small work has been

done in our country both on processing and preservation. Bangladesh has many food processing and preservation industries which are development many food products day by day, if quality product become dragon fruit are develop, it might be enrichment by the consumer and day by day face value of the market in Bangladesh. Dragon fruit pulp contains 82.5-83% moisture, 0.16-0.23% protein, 0.21-0.61 % fat, 0.7-0.9% fiber, 6.3-8.8% calcium, 30.4-36.2mg phosphorous, 0.5-0.61mg Iron; 8-9 mg vitamin C. (4). Dragon fruit also contains pectin which is help to make jam or jelly. (5). It can be used industrialized products like ice-cream, syrup, yoghurt, candy, pastry, ketchup, fruit juice with wine. At times pulp is used in pizza and also red and pink dragon fruit used in coloring agent. The dragon fruit flower buds are used to make soup, mixed in salad, and also eaten as a vegetable.

Nowadays Bangladesh has some areas which are cultivation of dragon fruit and after more years dragon fruit are available in our country. So these fruit product is developing day by day ultimately this is huge market in our country.

To prepare dragon fruit jelly both red and white for consumption the fruit cut open to expose the flesh. A jelly is a semi-solid product which is makes from dragon fruit juice by boiling clear solution. Pectin must be containing fruit juice and pulp is extract from juice. Addition of sugar, citric acid, pectin, KMS which are increased jelly's more softness, creamy and suitable. After final product jelly has been 65% solids, 45% fruit extract and 0.5-0.75% acid. Pectin extraction by dragon fruit peels with three different extraction conditions was identified as a duplicated source of marketing pectin. The highest yield of pectin gave extracted with ammonium oxalate with high purity and low ash content. Red-fleshed dragon fruit (Hylocereus polyrhizus) is rich in antioxidants which feel are suitable for meet sausages. (6)

The dragon fruit are many different products in market such as jam, juice, ice-cream, jelly, wine, cream, yoghurt etc. The dragon fruit demand for widely increases and the fruit today can be established on around all exotic fruit markets around the world. Dragon fruit and its products may be used as ingredients for innovative food products that respond to consumers self-interest that are identify in using customer demanded with many analysis. Dragon fruit is high increasing processing results in high amounts of waste materials such as peels and seeds. Therefore, the knowledge related to the characterization of dragon fruit is necessary to improve quality of dragon fruit and its co-products. This work done by two species of dragon such as white-flesh dragon fruit (Hylocereus undatus) and red-flesh dragon fruit (Hylocereus polyrhizus).

1.1. Objective

This work was goal is to develop good nutritious food and good shelf-life of product. Purpose of this study development of food processing technology to preparation of the value added products from dragon fruit take on. Destination was made to inquire into the available variety dragon fruit and also effect on different treatment of the fruit quality. However, the work was hoped to supply cost effective of processing maturates dragon fruit for people consumption. In the present investigation is an effort was made to develop the agro-economically possible technologies for production of jelly from dragon fruit. The main purpose of this work is including below:

1) The proximate composition analysis of dragon fruit.

2) Development of processing technology and preparation of value added products.

3) Assess the nutritional quality sensory analysis, storage condition of the prepared Product.

4) To study of microbial growth of prepared products.

5) Comparative study of red and white dragon fruit jelly.

CHAPTER TWO

2. Method and Materials

The present experiment studies of red-flesh and white flesh dragon fruit and take advantage of value added products. The experiment was conducted in the laboratory department of Nutrition and Food Engineering, Daffodil International University. The fresh, fully ripen red and white both dragon fruit was collected from Daffodil agro complex at Gazaria. The major ingredient for jelly preparation such as citric acid, KMS, pectin and other food grade chemicals were used from the laboratory store. Required Instrument for preparation of dragon fruit jelly such as electrical balance machine, refractometer, etc. are available in Daffodil laboratory. And other hand packing materials such as glass bottle, glass jar, lid, etc. are required for storage condition which is buying from local market.

Figure 2.1: Red and white dragon fruit without skin.

2.1. Juice extract from dragon fruit

These fruit were washed totally with drinkable water and also skin was removing by a knife. Then dragon fruit was cut into small pieces and blended the dragon fruit by blender machine. After complete blending process then dragon fruit juice are extract from dragon fruit pulp. Then possessed juice was preserve by freezing. Red and white dragon both worked done by separately.

Figure 2.2: White dragon fruit juice.

Figure 2.3: Red dragon fruit juice.

2.2. Preparation of dragon fruit jelly

To prepared white dragon fruit jelly takes into 350gm dragon fruit juice, 150gm sugar, 1.0gm citric acid, 0.3gm potassium Meta by sulfate (KMS), 0.5 gram pectin and 5gm agar agar powder. Then put into this juice in boiling. Then this juice heated at slowly then added sugar again heated slowly. Then gradually mixed pectin, KMS, and at last added agar agar powder. Sometimes Brix are checking. And also pectin was mixed equally. If brix are 30 degree present then stove are stop as soon as possible. Then put into bottle jar or glass jar. Then cooled the dragon fruit jelly and passed it into refrigerator at 4-5 degree C. Remember that before sugar was mixed it will be solution was done.

Figure 2.4: Red dragon fruit jelly

Figure 2.5: White dragon fruit jelly

Table1. Formulations of dragon fruit jelly for (500gm)

Ingredients (gm)	Red dragon fruit jelly	White dragon fruit jelly
Dragon fruit juice	350g	350g
Sugar	150g	150g
Pectin	1.0 g	1.0g
Citric acid	0.5g	0.5g
KMS	0.3g	0.3g

2.3. Chemical analysis of dragon fruit

The chemical analysis is total soluble solid, pH, ash content, moisture content, protein content, fat content, of dragon fruit jelly which work were done.

2.3.1. Total soluble solid

The dragon fruit pulp was mashed with mortar and pestle. Then one drops of pulp put into the prism of head refractometer. Then record was total soluble solid.

2.3.2. pH

The pH of a solution may be exactly and easily determined by electrochemical measurements with a device known as a pH meter with pH-sensitive electrode. The pH is a measurement of acidity of quality food products. pH value range is standard of 0-14 with being 7 is neutral.

Determining was the pH by using a digital pH meter after standardizing buffers of pH.

Material and instrument for pH determination:

- Glass biker
- Graduated pipette
- an automatic pipette
- a pipette pump
- a glass rod
- pH tester Checker
- Phosphate-citrate buffer.

At first turn on the pH meter which is red cover of the pH meter. Then prepared the semi-solid sample that is dragon fruit jelly. Take into 5g sample and dilution with 5ml water. Then turn on pH meter wait until for measurement mode pH. Then mixed the solution continuously before the measurement. Then takes a glass beaker and take 5ml solution in the beaker. Dip the electrode into the test solution and wait until the value on the display stabilizes. It the measurement value of pH was seen in display. The electrode must be dipped in the solution only for necessary period of time. It is necessary to rinse the electrode with distilled water after each measurement. If pH measurements are not performed immediately after each other, it is necessary to keep the electrode between measurements in a test tube with the storage solution (electrode must not dry out). Then the measurements scour diligently the electrode with distilled water and dip it back into the storage solution. Turn off the pH meter.

2.3.3. Determine of ash content

Ash which is inorganic relic remaining after the water and organic matter have been transfer by heating in the arrival of oxidizing agent that are provided a measure of total amount of minerals among food. Defined as ash the inorganic residue remaining after a process of burning. Minerals characterize from all the other components within a food in some measurable way are the one and only method of analytical techniques applied which is give the minerals content experience. Different condition ash is determined differently. Ash is determined generally two way dry ashing and wet ashing.

The main objective of ash determination is to measure of the total amount solid partials like menials are present in the food. Where the minerals content is a measured of the amount of specific inorganic component present within a food, such as calcium, sodium, potassium and others.

Ash returns to any inorganic materials, present in the food. It's called ash because its residue that remains after heating water and organic materials such as fat and protein. Ash can include both compounds with essential minerals such as calcium, potassium and toxic materials such as mercury.

Determination of the ash and minerals content of food in important for number of reasons.

- Nutritional labelling
- Quality food
- Microbiology stability.

Apparatus for the ash determination:

- Electronic balance
- Crucible lids
- Desiccator
- stop watch

At first take two crucible lids. Then crucible lid was clean at properly. Take into 5gm red dragon jelly at crucible lid. This crucible lid weight was 23. 38 gm. Again take into 5g white dragon jelly at crucible lid. This crucible lid weight was 24.49 gm. Then maffle furnace set at 550-600 degree C. Then it was kept in maffle furnace for about for 6 hours at 550-600°C. After 6 hours this crucible lid cooled in desiccator and weights both crucible lid red and white fleshed. The red dragon was ash content…. And white dragon was ash content …. This result is calculated by difference between the initial weight and final weight.

% Ash= weight of ash divided by weight of sample taken multiple into 100.

The result of red dragon jelly= 0.01%

The result of white dragon jelly= 0.0%

2.3.4. Determine of moisture content

Water content or moisture content is the quality of water contained in materials such as soil which is called soil moisture, rock, crops, or wood. Water content is used in a wide range of specific and technical areas and is expressed as a ratio, which can range from completely dry to the value of the materials porosity at standard. It can be give on a volumetric or mass basis.

The purpose of this test was to determine the water content within select semi-solid product that is dragon fruit jelly through experimentation.

Apparatus and materials including below:

- Crucible lid
- Spatula
- Measuring balance
- Desiccator
- Drying oven
- Sample red dragon fruit jelly and white dragon jelly.

First of all take two crucible lids. Then pre-heated crucible lids at 105 degree C for 30 minutes. Then this crucible lids was clean properly. Then crucible lid was weight is 23.45 gm and another crucible lid weight is 25.5 gm. Then Take into 5gm red dragon fruit jelly and another takes into white dragon fruit jelly in crucible lid. These sample are applied methods was drying oven. This drying oven temperature was set at 105 °C. Then put the sample at crucible lid both red and white dragon fruit jelly separately. Then these crucible lids are put into drying oven at 105 °C for 2-3 hours. After 2-3 hours these crucible lids cooled at desiccator. Then weight at red dragon jelly crucible lid. The result was calculated by using difference between initial weight and final weight.

%moisture= Loss in weight of sample after drying divided into weight of sample taken multiple into 100

2.3.5. Determine of protein analysis

The protein test is determined by using KJELDAHL method. These method are using many apparatus such as kjeldhal flask which are required for digestion, these flask was total capacity 500-800ml these are made of hard thick better burn down.

Digestion heater that is required for 600W and heat until boiling 250 ml of water for 5 minute. Distillation flask that is capacity 500-800ml with rubber stopper by which passed lower, and another is end of effective bulb to remove sodium hydroxide existent thing steered on mechanically during distillation. Connect superior termination of bulb tube to condenser tube by means of rubber tubing.

Many regents are required for determination of protein analysis that is including below:

- 93-98% of sulfuric acid, nitrogen free.
- Digestion mixture (2g CuSO4+98g K2SO4)
- 0.1N HCL
- 40% Sodium hydroxide solution, nitrogen free
- 0.1 NaOH
- Methyl red indicator
- Distilled water

Procedure of digestion for protein analysis:

At first takes 0.4gm sample, H2SO4 10 ml and digestion mixture 2gm. Then put it on digestion flask. Then used two digestion flasks for this procedure so that average value can be taken. Then heat slowly and increased the heat and heat about 3-4 hours, but heating problem that's why it was heated 15-18 hours. The end point will be no white smoke of H2SO4 and the solution will be crystal clear. Then cool it for some time.

Figure 2.6: Digestion machine.

Distillation for protein analysis:

Pour the solution in a conical flask and make it 100 ml level distill water. Then take 10 ml from that conical flask to the distillation flask. Take 150 ml distilled water and 10 ml of 40% sodium hydroxide to the distillation flask. And also take 150 ml of distilled water and 10 ml 0.1 HCL and 2-3 drop pf methyl red (1%) in the trapping conical flask. Use three distillation flasks for this procedure where one pf them will be blank i.e. number of sample only take 150 ml distill water with 10 ml 40% sodium hydroxide. Use three trapping solution in 3 trapping conical flaks remaining the same thing. Then set up the condenser and start it. Start the distillation unit and run for 30 minutes.

Figure 2.7: Distillation machine.

Titration for protein analysis:

First of all fill the burette with 0.1N sodium hydroxide. Then do the titration 3 times with 3 trapping solution. The end point will be color changes from pink to light yellow.

Calculation:

(B-S) multiple 1.4 multiple 10 multiple 5.95 multiple 0.1 divided sample weight.

2.3.6. Determine of fat content

Lipid in food present in various forms such as, triglycerials and sterol, monoglycerides, diglycerides and free fatty acid, phospholipid, carotenoids and fat soluble vitamins. Lipid is soluble in organic solvent insoluble water. Because of this organic solvent like hexen, petroleum ether have the ability to solubilize fat and fat is extracted from food in combination with the solvent. The fat test was using by soxhlet method. The purpose of the fat test both red dragon fruit jelly and white dragon fruit jelly to determine the amount of fat present in the preparation sample.

Equipment and chemical are required for this test,

- Weight balance
- Soxhlet apparatus
- Round bottom flask
- Drying oven
- Thimble
- Heating mental
- Glass rod
- Desiccator with silica gel
- N-hexen
- Sample (red and white dragon)

First of all rinse all the glass apparatus and drying it in the oven at 105°C for 30 minutes. Then weight 5gm of samples both red dragon fruit jelly and white dragon fruit jelly. Then takes the thimble weight, weight of thimble is 4.095g. At first place red dragon fruit jelly into the thimble. Then place the thimble in the soxhlet extraction. Take round bottom flask and fill it with 250ml N-hexen. Then place the whole setting on a heating mental and allow the N-hexen to boil. This process is continuing the extraction almost 6 hours. After 6 hours allow the sample to cooldown. Then place the sample in the oven place it into the dry it. After removing from the oven place it into the desiccator. Then take the weight of the sample. Then calculate this result.

Calculation for red dragon fruit jelly:

%fat = (initial weight of sample+ thimble) - (final weight of sample+ thimble) %100

(Weight of sample+ thimble) – (weight of thimble)

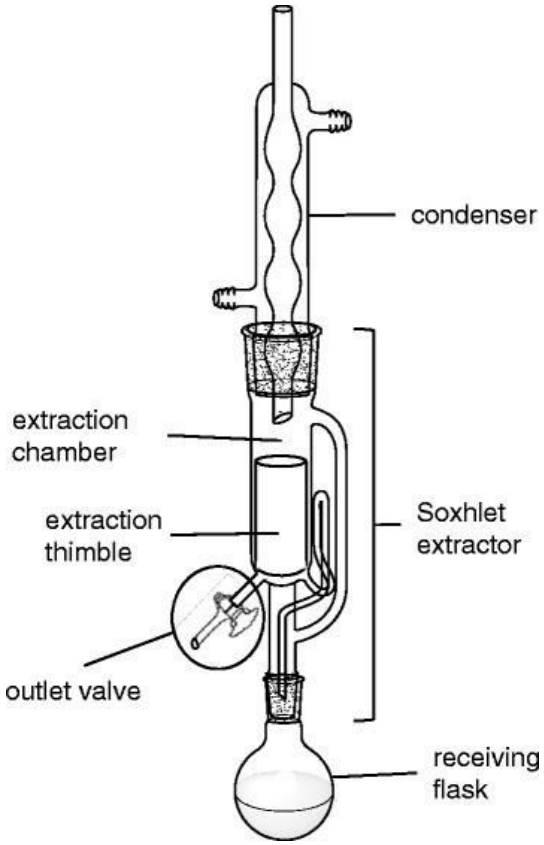

Figure 2.8: Soxhlet Methods

This experiment was done by white dragon fruit jelly. At first place red dragon fruit jelly into the thimble. Then place the thimble in the soxhlet extraction. Take round bottom flask and fill it with 250ml N-hexen. Then place the whole setting on a heating mental and allow the N-hexen to boil. This process is continuing the extraction almost 6 hours. After 6 hours allow the sample to cooldown. Then place the sample in the oven place it into the dry it. After removing from the oven place it into the desiccator. Then take the weight of the sample. Then calculate this result.

Calculation for White dragon jelly:

%fat = (initial weight of sample+ thimble) - (final weight of sample+ thimble) %100

(Weight of sample+ thimble) – (weight of thimble)

2.3.7. Determination of brix from prepared sample

Brix is the measurement in percentage by weight of sucrose in pure water solution. This digestion of brix degree is only valid for pure sucrose solution. One degree brix is 1 gram of sucrose in 100gm of solution and represent the strength of the solution as percentage by mass. The brix is indirectly used in wine, sugar, carbonate beverage, fruit juice and dairy industries.

The main objective of the brix determination is to determine the percentage of the sucrose or sugar present in the dragon fruit jelly both red and white on solution. Through the brix determination can be able to know the exact amount of degree of sweetness of red and white dragon fruit jelly.

Apparatus and materials for both red and white dragon fruit jelly:

- Electrical mass balance
- Bowl
- Beaker
- Refractometer
- Sample (Red and white dragon fruit jelly)
- Water

First of all measured the sample both red and white dragon fruit jelly solution as separately. The whole refractometer cleans by the tap water. After that dried it on soaked all the water from the refractometer by tissue. Then takes 1 drop of red dragon fruit jelly solution and spread it into the refractometer. Another is takes into white dragon fruit jelly solution and spread in into the refractometer. After that got it so close to our eye and saw the degree of sucrose.

The result of red dragon fruit jelly = 30°Brix

The result of white dragon fruit jelly= 35°Brix

Table2. Chemical composition of dragon fruit jelly both red and white

Parameters	Red dragon fruit jelly	White dragon fruit jelly
Total soluble solid (for dragon fruit and jelly)	4.5 °Brix and 30°Brix	3°Brix and 35°Brix
pH	0.05	0.08
Ash	0.01%	0.0%
Moisture	0.8%	0.5%
Fat	0.3g	0.0g
Protein	0.5%	0.3%

2.4. Microbial examination of prepared products

The significant study of microbiological analysis for different food and food ingredients required for appropriated description that are used employing microbiological limits to food. Different microbial growths are many different criteria on different food products. The applications of microbiological criteria as quality grade of foods, multiplication of quality adaptable to assessing by microbiological criteria also are examined. The purpose of microbiological determination is types of microorganism, group of microorganism, toxic produce of microorganism present or not, and other this self-life increased time of quality food products. The microbiological criteria should be including below:

- To explanation describing the identity of the food or food products and food ingredients.
- To describe of contamination concern as like microorganism group, various microbes, toxic group of microorganism.
- To analytical method was used for dictation contamination concern, qualification, and quantification.
- Alert to deficiency in processing, preservation, storage, distribution.

The standard guidelines for microbiological criteria that are widely used in the United States and other nations to explanation. There appears not need for additional terms. This report following definitions of these terms are advice by the subcommittee for application by the food industry and governmental agencies in the United States and will be used throughout. The standard of microbiological is a criterion that is a part of a law, ordinance, or administrative regulation. The microbiological guideline is a criterion that mostly is used by the food industry or a regulatory agency for monitoring and manufacturing process. To use the processing efficiency critical control point with the good manufacturing practices. The microbiological guideline is an instruction criterion in that a given lot of food excessive the limitation for a nonpathogenic organism would not be taken off the market and also downgraded.

The main purpose of microbial criteria as describe the below:

- To safety of food
- To good manufacturing practices
- To utilization of food and food products of their own purpose
- To keep quality of perishable, semi-perishable food
- To identify categories of spoilage risk.
- To effect of processing on the microflora of the food
- To categories of consumer risk
- To detect of toxic microorganism, quantify of microorganism concern.

2.4.1. Total coliform bacteria count

The total coliform bacteria are refers a large group of gram negative which are rod shaped bacteria that are various characteristics. The total coliform bacteria are groups of thermotolerant coliforms which are bacteria of faecal sources, and some bacteria which are may be isolated from environmental sources. Total coliform are presence may not be indicated faecal contamination. For thermotolerant coliforms count in extreme cases is high count for the total coliform group may be amalgamated with a low or even zero. The result have been seen necessarily indicate the presence of faecal contamination. That caused by entry from soil or organic matter into the water or by conditions suitable for the growth of other types of coliform. (7). The total coliform in the laboratory are growth on medium containing lactose temperature are required of 35-37 degree C. They are for now dictation by the production of acid and gas from the fermentation of lactose. These microbial analyses are applied for total coliform bacteria count.

The detection of coliform bacteria used the lauryl sulfate broth. For this solution 35.3g of lauryl sulfate broth are solution for 1000 ml water. This work done by dragon fruit jelly both red and white dragon fruit. For this solution it was used 3.5g lauryl sulfate broth and 2gm agar powder for 100 ml water. If this is broth then must be used agar powder because media are congealed by agar powder.

Apparatus and regents for total coliform bacteria count:

- Test tube
- Test tube box
- Test tube stand
- Conical flask
- Glass rod
- Pipettes
- Micropipette
- Pipettes tips
- Petri dish
- Spreader
- Distil Water
- Lauryl sulfate broth
- Autoclave
- Alcohol burner
- Laminar air flow
- Vortex machine
- Magnetic stirrer hotplate
- Hand gloves

A standard total coliform bacteria count was refers by the membrane filtration technique. First of all to prepared the sample semi-solid to liquid by using water. Take 1 gram of red and white dragon fruit jelly and 9ml water to dilution the red dragon fruit jelly by using vortex machine. After prepared sample then it's put into test tube. Then takes 3.5g lauryl sulfate broth and 100 ml water this was media diluted. Then weight into 2g of agar powder for 100 ml water and added this agar powder of lauryl sulfate broth.

Mixed was this media was lauryl sulfate broth by using Magnetic stirrer hotplate. Then take into 6 petri dish, many micropipettes, glass rod, spreader, and conical flask with water and also takes lauryl sulfate media for sterilization in autoclave.

Then run the autoclave at 121 degree C for 25-30 minutes. After sterilization of all equipment that are put into laminar air flow. But before materials put the laminar air flow it will be ultraviolet light cab be on because if laminar air flow presence of microbes which is killed by using ultraviolet light. Firstly takes into Auto-calve all the apparatus for 15-20 minutes that are needed for test. After autoclave all the tools should be kept into the laminar air flow. Before shifting all the equipment in the laminar air flow, to start the laminar airflow and should be start the UV light for 10-15minutes after that we stop the UV light and start the airflow and kept them all equipment into the laminar airflow. For making 100ml solution was take 3.5g lauryl sulfate broth that is added with 100ml water. Then takes 6 petri dish and take the all the solution into the four petri dish for making culture then we kept them for 10-15 minutes into the laminar airflow for solidify the culture. After that takes 7 test tubes for serial dilution and 9ml water in each test tube. For serial dilution we take 9ml water and 1ml apple in test tube 1 and then shake it with the help of vortex mixer. Then takes 1ml solution from test tube 1 with help of micro pipet and then we shake it with help of vortex mixer. This way does 6times serial dilution like 10~1, 10~2, 10~3…….10~7. Then takes 100micro liter solution from 10~7 solution with the help of micro pipet and deep into the culture. Then takes 100 micro liter solution from 10~6 solution with the help of micro pipet deep into the culture. After that the solution is speared in the culture media with help of spreader. Then keep that petri dish into the shaking incubator for 30minutes at 30degreeC. And those bacteria are grown up into the culture. Then calculate the colony that is form in the culture media.

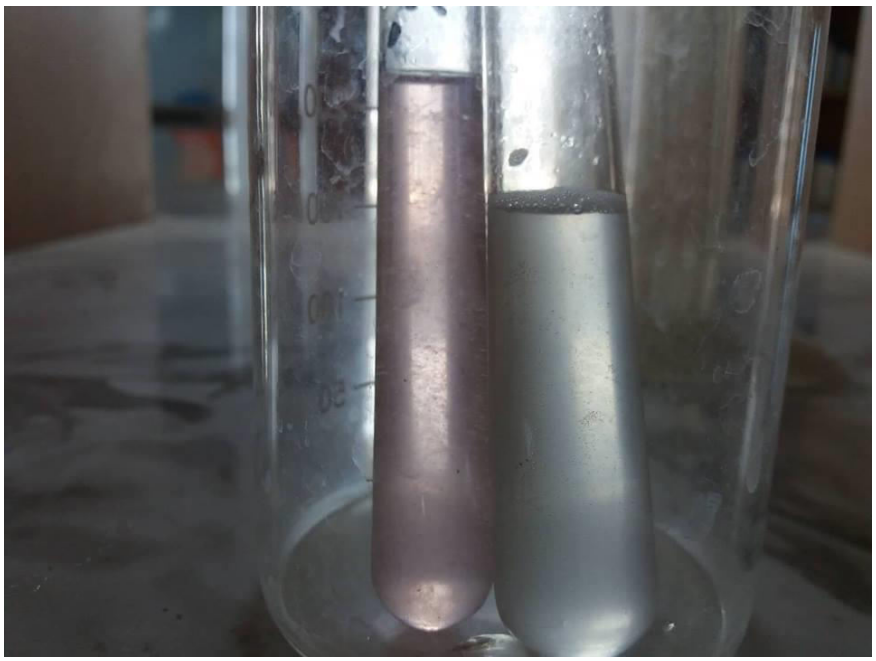

Figure 2.9: prepared sample (Red and white dragon jelly)

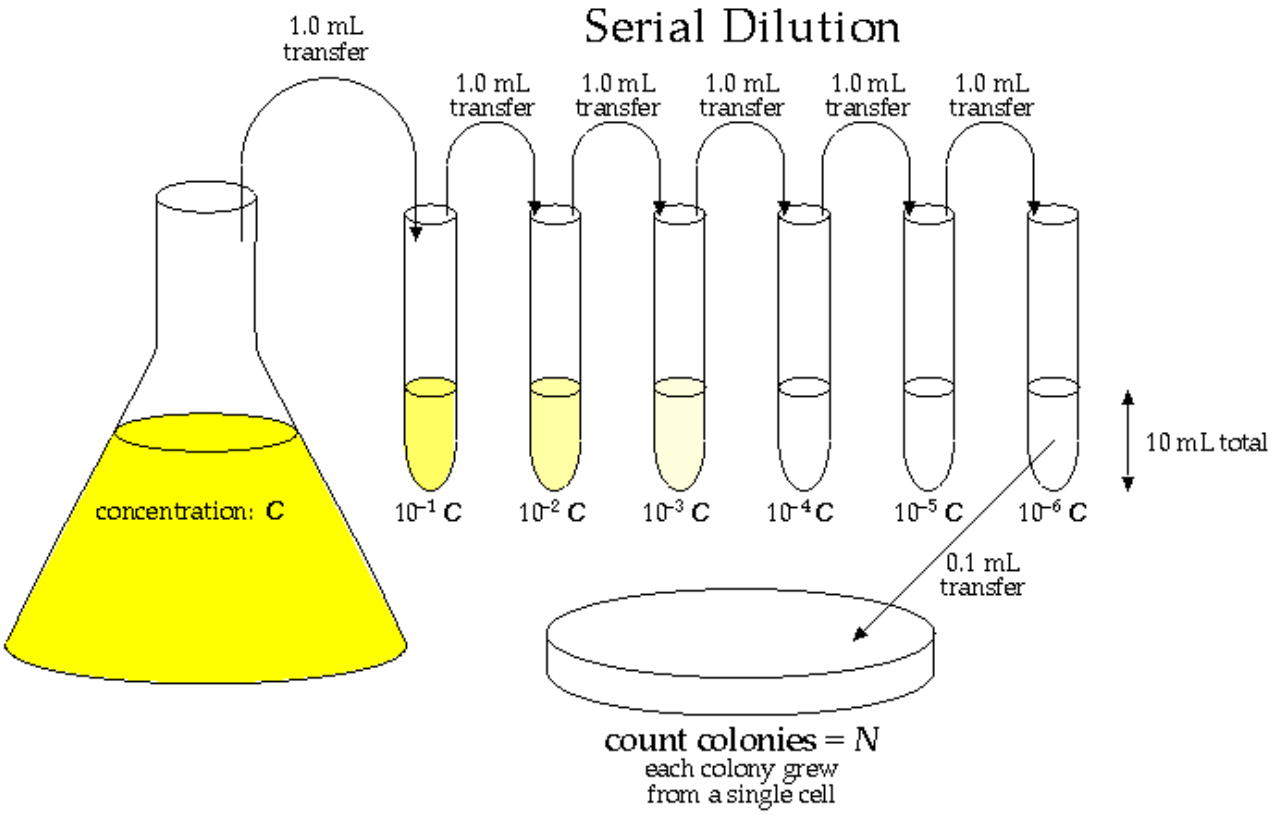

Figure 2.10: Serial dilution.

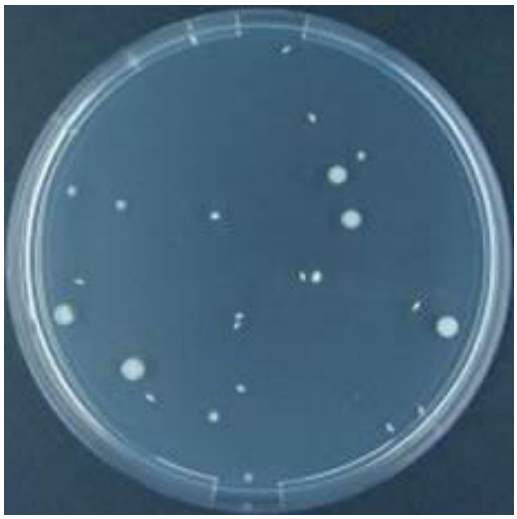

Figure 2.11: Red dragon fruit jelly.

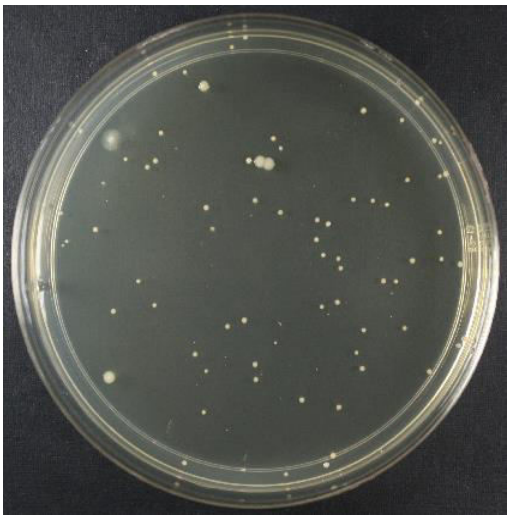

Figure 2.12: White dragon fruit jelly.

2.4.2. Total viable count (TVC):

The most common procedure for calculation of total viable count of bacteria. These methods are applied by serial dilution into a preferable growth media. The total viable counts are estimated total cell of the bacteria. The total viable count was assumed that every bacterial colony origin from a separate cell that has tolerate cell division. Consequently, through counting the number of colonies and bookkeeping for the dilution multifactor, then number of bacteria in the original sample can be determined. There are various defects to the viable count method. The major drawback is that it is elective and therefore partiality. The nature of the growth conditions, with the composition and pH of the medium used as well as the conditions like temperature, determines which bacteria in a mixed population can grow. The growth of all microorganisms whereas there is no international set of environment that permits, it is calculated to difficult all microorganisms by viable plating. This same drawback, though, occurs, convenient when one is associated in only a specific microbial population. For example, the design elective procedures for the calculation of coliforms and another physiologically defined microbial groups. (8).

The detection of total viable count used total plate count agar. For this solution 23.5g of total plate count ager are solution for 1000 ml water. This work was done by dragon fruit jelly both red and white dragon fruit. For this solution it was used 2.35g plate count agar for 100 ml water.

Apparatus and regents for total plate count agar:

- Test tube
- Test tube box
- Test tube stand
- Conical flask
- Glass rod
- Pipettes
- Micropipette
- Pipettes tips
- Petri dish
- Spreader
- Distil Water
- Lauryl sulfate broth
- Autoclave
- Alcohol burner
- Laminar air flow

- Vortex machine
- Magnetic stirrer hotplate
- Hand gloves

A standard total plate count agar was refers by the membrane filtration technique. First of all to prepared the sample semi-solid to liquid by using water. Take 1 gram of red and white dragon fruit jelly and 9ml water to dilution the red dragon fruit jelly by using vortex machine. After prepared sample then it's put into test tube. Then takes 2.35g total plate count agar and 100 ml water this was media diluted. Mixed was this media which is total plate count agar by using Magnetic stirrer hotplate. Then take into 6 petri dish, many micropipettes, glass rod, spreader, and conical flask with water and also takes total plate count agar for sterilization in autoclave.

Then run the autoclave at 121 degree C for 25-30 minutes. After sterilization of all equipment that are put into laminar air flow. But before materials put the laminar air flow it will be ultraviolet light cab be on because if laminar air flow presence of microbes which is killed by using ultraviolet light. Firstly we have to Auto calve all the apparatus for 15-20 minutes that are needed for test. After autoclave all the tools should be kept into the laminar air flow. Before shifting all the equipment in the laminar air flow, to start the laminar airflow and should be start the UV light for 10-15minutes after that we stop the UV light and start the airflow and we kept our all equipment into the laminar airflow. For making 100ml solution was take 2.35g total plate count agar that is added with 100ml water. Then takes 6 petri dish and take the all the solution into the four petri dish for making culture then we kept them for 10-15 minutes into the laminar airflow for solidify the culture. After that takes 7 test tubes for serial dilution and 9ml water in each test tube. For serial dilution we take 9ml water and 1ml apple in test tube 1 and then shake it with the help of vortex mixer. Then takes 1ml solution from test tube 1 with help of micro pipet and then we shake it with help of vortex mixer. This way does 6times serial dilution like 10~1, 10~2, 10~3…….10~7. Then takes 100micro liter solution from 10~7 solution with the help of micro pipet and deep into the culture. Then takes 100 micro liter solution from 10~6 solution with the help of micro pipet deep into the culture. After that the solution is speared in the culture media with help of spreader. Then keep that petri dish into the shaking incubator for 30minutes at 30 degree C. And those bacteria are grown up into the culture. Then calculate the colony that is form in the culture media.

Figure 2.13: Red dragon fruit jelly and White dragon fruit jelly.

2.5.1. Storage studies of dragon fruit jelly

The process dragon fruit jellies were in package in bottle glass which is storage circumambient temperature at 27- 30°C and refrigerated temperature at 4 degree C for 6 months these quality parameters such as total soluble solid, pH, color, flavor and over all acceptancy.

2.6.1. Sensory evaluation of dragon fruit jelly

Dragon fruit jelly were analysis for sensory evaluation. Optimization of individual treatment for sensory quality was evaluation for dragon fruit jelly such as, appearance, color, flavor, texture, and overall acceptance. The sensory evaluation by a 30 untrained members using a 9-ponit hedonic score sheet.

The analysis indicates which a significant difference in color was, those samples at $p \leq 0.05$. If the enhancement levels of pectin the texture quality of the dragon fruit jelly improved. The flavor of the red dragon fruit jelly are similar to containing 1% pectin in significantly differed from white dragon fruit jelly. If pectin 0.5% of both red and white jelly it was not significantly differed due to low pectin content in fresh dragon fruit jelly. The red and white dragon fruit jelly of overall preference into the sample analysis showed that there was equally acceptable.

Table3. Sensory score for red dragon fruit jelly

Score	Appearance	Flavor	Color	Texture	Overall acceptance
(9) like extremely	9	8.5	10	8	10
(8) like very much	9	9	9	8.5	8.5
(7) like moderately	7	8	8	7	8
(6) like slightly	6	8	8	6.5	7
(5) Neither like or dislike	0	0	0	0	0
(4) dislike slightly	4	4	4	4	4
(3)dislike moderately	3	2	2	3	3
(2) dislike very much	2	3	4	3	3.5
(1) dislike extremely	0	0	0	0	0

Table4. Sensory score for white dragon fruit

Score	Appearance	Flavor	Color	Texture	Overall acceptance
(9) like extremely	9	8	9	8	8.5
(8) like very much	8	7	7	6	7
(7) like moderately	7	6	6	5	6
(6) like slightly	6	6.5	5	5	5.5
(5) Neither like or dislike	0	0	0	0	0
(4) dislike slightly	5	5	4	5	5
(3)dislike moderately	4	5	4	4	4
(2) dislike very much	2	3	3	2	3
(1) dislike extremely	0	1	1	1	1

CHAPTER THREE

3. Results and Discussion:

The present result was observation on studies of dragon fruit (Hylocereus spp.) jelly and its suitability in value added products was developed in the department of Nutrition and food engineering University of Daffodil International University. The main purposes of this work were to properly process and preservation value added products which is jelly from dragon fruit. And also the study of nearest composition of dragon fruit after preparation of dragon fruit jelly, and nutritional quality, sensory evaluation of this products with their storage stability at circumambient temperature.

The results regarding to several analytical evaluation were showed within scientific topicality and are short as follows under suitable main headings:

- Characteristics of dragon fruit both red and white dragon.
- To analysis of nearest composition of red and white dragon fruit jelly.
- Evaluation of separately treatment for sensory quality attributes of the developed products
- To the developed of nutritional value.
- To the improvement of storage studies
- To the evaluation of microbial load of the store product
- To the attributes of the sensory quality products.

3.1. Total soluble solid:

The total soluble solid was 4.5% for red dragon fruit and 3% for white dragon fruit. This result was seen raw dragon fruit.

3.2. pH:

Then the measurements scour diligently the electrode with distilled water and dip it back into the storage solution. The measurement of pH was 0.05 for red dragon fruit jelly and 0.08 for white dragon fruit jelly. The pH were seen other journal which is 0.02, [Islam et al. /The Agriculturists 10(2): 29-35 (2012)] (5). Those are similarly to my work result.

3.3. Ash content: For red dragon fruit jelly

Crucible lid weight= 24.49g

Crucible lid + sample weight= 24.49+ 5g

After heating,

Crucible lid -sample= 24.50-24.49

= 0.01%

So, 5 gm of red dragon fruit jelly contain 0.01% ash.

3.4 Ash content for white dragon fruit jelly:

Crucible lid weight= 23.38g

Crucible lid + sample weight= 23.38+ 5g

After heating,

Crucible lid -sample= 23.38-23.38

= 0.0%

So, 5 gm of white dragon fruit jelly contain 0.0% ash.

Ashes are other journal result for red dragon fruit ±0.01% which was similarity to my work result but white dragon work not done by another journal. [Islam et al. /The Agriculturists 10(2): 29-35 (2012)] (5).

3.5 Moisture content for red dragon fruit jelly:

Crucible lid weight= 22.49g

Crucible lid + sample weight= 22.49+ 5g= 27.49

After heating,

Crucible lid -sample= 27.49-26.69

= 0.8%

So, 5 gm of red dragon fruit jelly contain 0.8% moisture. But other journal got the moisture were 0.03% [Islam et al. /The Agriculturists 10(2): 29-35 (2012)] (5), and there are only work at red dragon fruit, do not work at white dragon fruit. 0.02%

Crucible lid weight= 23.38g

Crucible lid + sample weight= 23.38+ 5g= 28.49

After heating,

Crucible lid -sample= 28.38-27.86

= 0.5%

So, 5 gm of white dragon fruit jelly contain 0.5% moisture.

3.7. Determine of protein analysis

In kjeldahl methods protein was calculate,

(B-S) multiple 1.4 multiple 10 multiple 5.95 multiple 0.1 divided sample weight.

This methods used to calculate the protein the result have been seen = 0.05% of protein in red dragon fruit jelly and 0.3% of protein white dragon fruit jelly.

3.8. Determine of fat content

In soxhlet methods fat was calculate,

%fat = (initial weight of sample+ thimble) - (final weight of sample+ thimble) %100

(Weight of sample+ thimble) – (weight of thimble)

(5+4.095) – (4.985+4.095) 100%

(5+4.095) – 4.095

=1.5/5

=0.3g

So, the result was seen for red dragon fruit is 0.3g of fat in present and white dragon fruit as same methods the result was 0.0g of fat that means no fat are present in white dragon fruit jelly.

3.9. Microbial examination for dragon fruit jelly

The collected fruits were processed for preparation of jelly by mechanically squeezing fresh fruits. Water, sugar, permitted color and preservatives were added to the pulp extract.

The total plate count agar medium was used for the enumeration of total aerobic bacteria present in the jelly sample. 10 gm jelly was suspended in a 500 ml conical flask containing 100 ml of sterile water. The flask was shaken thoroughly by mechanical shaker for 5 min. In each case the suspension was allowed to stand for 15 min to settle down the heavy particles and then the stock solution was prepared. Sample from each stock solution was then serially diluted. During dilution, 1.0 ml suspension was taken and added to 9.0 ml of sterilized distilled water in test tube and thus 10-1 diluted jelly sample was prepared. Similarly, up to 10-5 dilution was prepared. Then 0.1 ml of each diluted sample was spread in the respective labeled sterilized total plate count agar Petri plate under aseptic condition. Three replicas were made for each dilution of every sample. The result was seen there are no viable bacteria in present in this jelly.

And other side to use lauryl sulfate broth was used for the enumeration of total coliform and fecal coliform culture respectively. Briefly, 10 ml of 10-1 dilution was added in test tube containing 10 ml of double strength and 1 ml of each dilution (10-1 and 10-2) was added separately in test tube containing 10 ml of single strength lauryl sulfate broth. The total sets were incubated at 35±0.5ºC for 24 hours and examined for the presence of microbial growth accompanied by gas production.

The result was seen less the 10 colony was seen in total plate. And standard colony for jelly was less than 50 colonies. So this jelly was at least preserving 3-4 month.

3.10. Sensory evaluation

With the intention to enhance quality characteristics of the developed product, various treatments were given to the ripe dragon fruit pulp and juices during development of the product. It was hypothesized that the treatments with sugar, pectin and citric acid may favor the good setting of the developed products and also increases the storage stability. So determination of effect of these individual treatments on the sensorial quality of product was undertaken.

Dragon fruit jelly were analysis for sensory evaluation. Optimization of individual treatment for sensory quality was evaluation for dragon fruit jelly such as, appearance, color, flavor, texture, and overall acceptance. The sensory evaluation by a 30 untrained members using a 9-ponit hedonic score sheet. So this result was seen the red dragon fruit jelly extremely like more than white dragon fruit jelly. Because red dragon fruit jelly more color, appearance, flavor, color and overall acceptancy than white dragon fruit jelly. Based on every panelist are said that both jellies are perfect for marketability. This is the good products in our country.

Table 5: Red dragon fruit jelly result.

Quality	Red dragon fruit jelly	Overall acceptancy
Appearance	9	10
Color	10	10
Flavor	8	8
Texture	9	10

Table 6: White dragon fruit jelly result.

Quality	White dragon fruit jelly	Overall acceptancy
Appearance	7.5	8
Color	8	8
Flavor	7	7
Texture	9	9

The data indicate that score for color and appearance of jelly was decreased from 8.93 to 8.65 at ambient temperature and from 8.92 to 8.55 at the refrigerated temperature during storage period of 120 days. The decrease in color and appearance score from 8.65 to 8.19, 8.40 to 8.03 respectively was observed in dragon fruit jelly. Flavor and texture are also decreased if it were store more days in preserve. The data indicate that the overall acceptability score gradual decreased from 8.77 to 8.11 at ambient

temperature while, from 8.81 to 8.31 at refrigerated temperature. The average overall acceptability during 90 days storage was 8.47 and 8.55 at ambient temperature and refrigerated temperature respectively. The rate of decreased in overall acceptability was slightly higher in sample stored at ambient temperature as compared to refrigerated temperature during storage period. The acceptability of jelly was maintained up to four month of storage. The decrease in overall acceptability score was due to undesirable change in jelly.

CHAPTER FOUR

4.1 Conclusion

Dragon fruit is comparatively new in Bangladesh. At present it being implantation in Bangladesh. The study was indication that a best quality value added products becomes the dragon fruit. The bright prospect of thus studies is processing of dragon fruit products is jelly. The future investigations to this study purpose of economic the products advice for commercially production. The present investigation entitled “Studies of dragon fruit (Hylocereus spp.) and its utilization in value added products” has been carried out and results are summarized here. Sincere efforts were made to exploit the use of dragon fruit through development of dragon fruit jelly. The aim of research work is to provide a cost effective way of processing dragon fruit with high nutritional values for human consumption, curtail post-harvest losses of dragon fruit and promote entrepreneurial opportunities through the sale of dragon fruit jelly. Hylocereus undatus variety of dragon fruit was used for the development of product. The effect of different treatments, individual or in combination during development of the product was assessed by using semi-trained panel members. Instrumental color measurement and texture profile analysis were also undertaken. The product which showed best results in terms of sensory qualities, instrumental color and textural parameters was studied for commercialization. Storage studies were also carried out for the period of three months.

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