Enhancing Strawberry Jam with Chia Seeds: Analysis of Physicochemical Characteristics and Nutritional Benefits

Abstract

This study presents the preparation and characterization of strawberry chia seed jam, a novel and health-conscious alternative to traditional fruit spreads. The jam was prepared using a simple recipe combining fresh strawberries, chia seeds, and a natural sweetener. The process involved macerating strawberries, mixing them with chia seeds, and allowing the mixture to thicken over time. The resulting jam was analyzed for various physicochemical properties including pH, titratable acidity, total soluble solids, ascorbic acid and sugars. The treated sample was also undergone for nutritional and functional properties. Finally shelf life of the developed jam was observed and went for packaging. The nutritional analysis revealed that the moisture content 13.03%, ash 4.29%, fat 1.02%, protein 1.26g/100g, crude fibre 3.5%, carbohydrate 80.4%, and the total energy content was 335.82kcal. It was concluded that treated sample has TSS 69.1° brix, pH 3.539, titratable acidity 0.7% The ascorbic acid of the developed jam was obtained to be 63.29 mg /100g.The total sugar, reducing sugar and non-reducing sugar of the developed jam obtained to be 52.1%, 54.35% and 2.23%. Functional analysis was done for the developed product which includes water absorbing capacity, viscosity, density. The water absorbing capacity of the developed product was 15.13%, viscosity was 4783.2 Pa s and density1.372 g/ml. The microbial test shows that this product is safe to use and can be stored for three months and more than three months with proper storage conditions. Overall, this study provides valuable insights into the preparation and characterization of strawberry chia seed jam, offering opportunities for further research and product development in the realm of functional foods highlighting the potential of strawberry chia seed jam as a nutritious and flavourful option for consumers seeking healthier alternatives to traditional jams.

Keywords: **Strawberry jam, chia seeds, Nutritional analysis, Physicochemical analysis, Functional analysis**

1. Introduction

In modern times, preserving fruits and vegetables is a processing method that is getting more and more common. The commercial fruit strawberry offers several processing options. Purees, squash, juice, sweets, preserves, jams, and blended drinks are among the many things that it is frequently used for. Jam is made by putting in enough sugar to the fruit pulp to make it fairly thick. By doing this, the fruit tissues are kept securely in place. The fruit's preservation activity might be benefited from due to the high sugar content in the fruit pulp. Jam's sweetening, gel formation, and colour retention were all facilitated by the addition of sugar (Rahman *et al.,* 2018). Most jams are made using fruits along with different types of sugars that can be greatly enhanced by heating (Sawant *et al., 2*013). To make jam, a semi-solid food product, fruit or vegetable pulp, pectin, acid, and sugar are boiled together to a workable consistency. A minimum of 45% pulp and a maximum of 65% TSS are required for jam (Demirel *et al.,* 2019). Jam's sugar prevents bacteria from growing and ruining the fruit. Sugar prolongs the shelf life of products by retaining water. Pectin can be used to improve the textural, stabilizing, and thickening qualities of a wide range of foods, such as confections, beverages, jams, and jellies. Citric acid is used to achieve the exact balance required for manufacturing jam.

The best preservation technique is to make jam. The definition of jam is the pulp or juice of fruits or vegetables mixed with sugar, pectin, and citric acid. Typically, the blend is heated to a suitable temperature (spreadable). For jam to be produced, it is necessary to have access to raw materials and affordable sources of additional components such sugar, citric acid, pectin, and jam jars. Preserving fruits and vegetables may be achieved with greater effectiveness by using jam. Comparing it to other preservation techniques like freezing and drying, it takes less time. The definition of jam in the US is a semi-solid food that comprises at least 45 parts fruit by weight to every 55 parts sugar by weight. This mixture is concentrated to 68 percent total soluble solids in order to achieve the desired quality. It is feasible to incorporate colouring and flavouring agents (Awulachew 2021).

Due to their high nutritional value and potential medical benefits, people are eating more fruits these days. One of them that deserves special attention is the strawberry, which is becoming more widely available for "organic" consumption and whose agro-industrial products are enjoyed globally because of its delicious flavour and high nutritional content. Strawberry jam has been a beloved staple in households for generations, cherished for its sweet, fruity flavour and versatility. However, as consumer preferences shift towards healthier options, there's a growing demand for value-added products that not only taste great but also offer nutritional benefits. In response to this trend, the incorporation of chia seeds into strawberry jam presents an innovative approach to enhance its nutritional profile and appeal to health-conscious consumers. The strawberry, also known as Fragaria Ananassa Duch, is a fruit that draws attention due to its distinctive features, which include its bright red colour, aroma, soft texture, and somewhat acidic tasting. This hue is due to the presence of bioactive substances such anthocyanins and flavonoids that have anti-carcinogenic

properties. It is abundant in vitamins, fibre, folic acid, and minerals and is enjoyed by people all over the world (Kmiecik *et al.,* 2019). Due to its high fruit and sugar content and low carbohydrate content, it is utilised to lose weight. It aids in the body's absorption of iron due to its high vitamin C concentration as well as the presence of citric and malic acids. Additionally, it is promoted as a remedy for a few ailments and dysfunctions, including constipation and hypertension. It has a mild laxative and diuretic effect and promotes bowel movement and urine elimination. This fruit is an excellent source of energy for the liver because of its high natural sugar content. Its aromatic ingredients also heighten appetite by stimulating the senses of taste and smell (Matos *et al.,* 2022).

Chia seeds, or Salvia hispanica L., provide a wealth of dietary and therapeutic benefits. The chia plant is about one metre tall and has simple leaves that are oval-elliptic in shape, 4 to 8 cm long and 3 to 5 cm wide, with a pointed tip. The foliage has pubescent leaves. Chia seeds are oval-shaped seeds that range in size from 0.8 to 1.3 mm in diameter, 0.8 to 1.4 mm in length, and 0.8 to 2 mm in width. Its smooth and glossy peel might be black, brown, grey, black speckled, or white. Consumption of chia has been increasing over time because to its ability to prevent chronic illnesses such as diabetes, cancer, heart disease, and obesity. The main source of these health advantages is the high concentration of proteins, dietary fibre, antioxidants, vitamins, minerals, carotenoids, and vital fatty acids found in chia seeds (Grancieri *et al.,* 2019).

The Mayans and Aztecs used the chia plant species for food and medicinal for a very long time. It yields an indehiscent, dry fruit that is commonly called a seed. The plant's seeds are becoming more and more well-known because of its culinary uses and possible health benefits. In actuality, seeds are a rich source of nutrients, the most important of which are the polyunsaturated omega-3 fatty acids, which have the ability to reduce cholesterol, improve cognitive function, and reduce inflammation. Polyphenols, which are antioxidant compounds that protect the body from ageing, cancer, and free radicals, are also rich in seeds. Caffeic acid is converted into polyphenols. Large amounts of fibre derived from carbohydrates have also been connected to bowel control, cholesterol reduction, and inflammation reduction (Taga *et al.,* 1984).

As a result of its high nutritional fibre content, chia seeds have the potential to be employed as an ingredient in food industry applications. Dietary fibre is a category of materials that can also contain oligosaccharides and polysaccharides like cellulose, hemicellulose, and extra mucilage. Other materials that may be included in this category include lignin, pectins, and gums (Marcinek *et al.,* 2017). Total dietary fibre (TDF) is now considered an essential component of the diet due to the presence of carbohydrates with free polar groups that interact with hydrophilic links within the matrix to form a gel and subsequently increase peristalsis. This is especially true given that TDF's physiological functionality is based on its swelling property after water absorption.

Published research have connected the usage of TDF to several health benefits. TDF, which is present in chia seeds, is composed of soluble dietary fibre (SDF) and insoluble dietary fibre (IDF). In particular, the

SDF are partially released from the seed as a mucilaginous gel upon contact with water and undergo fermentation in the colon (Lanzotti *et al.,* 2017).

The aim of this project was to develop a strawberry jam with chia seeds that adds value and introduces a new product with improved nutritional value and general health benefits as during processing or preparation, a portion of the jam's nutritional value is lost. The treated product was carried out for physicochemical analysis, functional analysis, phytochemical analysis and shelf-life assessment to know about its nutritional value and length of time for safe consumption.

2. Materials and Methods

2.1 Materials

The present research was conducted at Babasaheb Bhimrao Ambedkar University, Lucknow 226025, Uttar Pradesh, at the Department of Food and Nutrition's School of Home Science. The study focused on standardizing value-added strawberry jam made using chia seeds. For this research, strawberries and chia seeds were bought from the local market of Lucknow. To guarantee that the food would have enough nourishment without compromising flavour or texture, the proportions of each ingredient were carefully considered.

2.2 Preparation of Jam

Strawberries that were ripe, healthy, and fresh were brought from the Lucknow local market. They were taken out of their sepals. They underwent a thorough washing to remove dust, grime, and other foreign objects from their surface after being graded and sorted. Next, with the use of a grinder, it was chopped into small pieces and pulped. Weighing each component individually was done. Once the pulp was reached, it was boiled for a few minutes and then continually stirred with the incorporation of sugar. Chia seeds were added after a few minutes, and then pectin. The mixture was heated slowly, stirring occasionally, until the cooking mass attained the desired consistency. When the mass thickened enough, a spoon dipped into the mixture was allowed to drip the mixture from its edges. The product was deemed to have reached its end point and ready for filling the container when it cooled down and slid off in a sheet instead of running readily in a single stream. After adding the citric acid, the mixture was boiled until the TSS reached 68˚– 65˚ Brix. The clean, sterile, airtight glass container was filled with hot jam and kept in a cold spot. Thus, strawberry chia seed jam was developed by incorporating 3% chia seeds into 41% strawberry pulp and 56
% sugar. As food additive 0.5% of citric acid and 0.3 of pectin was added to strawberry pulp while cooking (Matos *et al.,* 2022).

2.3 Physiochemical analysis

Physiochemical properties of treated jam such as pH, Total Soluble Solids (TSS), Titratable acidity, Vitamin C were analysed.

2.3.1 Determination of pH

The strawberry chia seed jam underwent physiochemical examination using a Ph-Digital pH metre (ATC model no:6032). 10 g of the sample was dissolved in distilled water in a sterile beaker, and the pH was measured in a sterile environment (Thomas *et al.,* 2023).

2.3.2 Determination of Titratable Acidity

Titratable acidity is a measure of the total acid content in a solution and is commonly used in various fields such as food and beverage industry, winemaking, and chemistry. For jam and fruit titratable acidity, an aliquot of fruit juice and fruit were taken and dissolved in distilled water and titrated against 0.1 N NaOH with phenolphthalein as a marker to the endpoint, and stated as (%) of citric acid. The end point is denoted by the appearances of Pink Colour. (Hayat et al., 2005).

Acidity was calculated by using following formula,

$$\text{Titrable acidity} = \frac{\text{ml NaOH} \times \text{N NaOH} \times \text{meq. Weight of acid} \times 100 \text{ ml}}{\text{Sample titrated}}$$

meq = milli equivalent

meq weight of citric acid = 0.06404.

2.3.3 Determination of total soluble solids

The index of refraction was used to calculate a solution's total soluble solids content. (AOAC 2005) The refractive index of a liquid may be determined using an analog device called a handheld refractometer. Distilled water was used for the refractometer's calibration. The glass was closed after a tiny drop of sample was placed there. °Brix is the reading, which was detected with the use of a magnifying eyepiece.

2.3.4 Determination of Ascorbic acid

One essential component of fruits and vegetables is ascorbic acid. Its interaction with 2, 6-dichlorophenol indophenol indicates that it is a reducing agent. The dye is reduced to a colourless form; it is blue in an alkaline solution and red in an acidic solution.

After blending 10 g of treated sample with 3% HPO3 to create a 100 mL total volume, filter or centrifuge the mixture (Sawant *et al., 2*013). The ascorbic acid can be calculated as Equation.

$$\mathbf{A_a} = \frac{\mathbf{T_r} \times \mathbf{D_f} \times \mathbf{V_m} \times \mathbf{V_s}}{\mathbf{V_e} \times \mathbf{V_t}} \times 100$$

where, Aa is ascorbic acid, Tr is titer, Df is dye factor, Vm is volume of solution made, Vs is volume of sample, Ve is volume of extract, Wt is weight of sample taken.

2.3.5 Determination of sugars

The Lane and Eynon Method was used to determine the sugars (total sugars, reducing sugar, and non-reducing sugar), as James (1995) specified.

Total sugar and decreasing sugar: We put 100 mL of warm water and 5 g of the sample into a beaker. After agitating the mixture until all the soluble components had been dissolved, Wattman paper was used to filter the mixture into a 250 volumetric flask. put 10 mL of diluted HCL to a conical flask, pipetted 100 mL of the prepared solution into it, and let it boil for five minutes. After cooling, use 10% NaOH to neutralize the phenolphthalein solution and fill a 250 volumetric flask to capacity. This solution was used to determine the reading after it was titrated against Fehling's solution and reading was calculated equations (Sawant *et al., 2*013).

$$T_t = \frac{4.95 \times 250 \times 2.5}{T \times W \times 10} \times 100$$

$$R_s = \frac{T \times W \times 10}{49.5 \times 250} \times 100$$

where,

Tt is total sugar %

T is titre

Rs is reducing sugar %.

Non-reducing sugar: The difference between the total sugar content and the reducing sugar content was used to determine non-reducing sugar.

2.4 Nutritional Analysis

2.4.1 Moisture content

The moisture content of the sample was determined by the AOAC method by using the oven drying method (AOAC 1990).

$$\text{Moisture content\%} = \frac{Wm}{W_m + W_d} \times 100$$

2.4.2 Ash content

The total ash content of jam sample was determined by the using the muffle furnace (AOAC 1990). For this the procedures are followed as:

$$\text{Ash content \%} = \frac{\text{Weight of ash } (g)}{\text{Weight of sample (g)}} \times 100$$

2.4.3 Fat content

The Soxhlet extraction method for determining the crude fat content of food samples. A 2g sample that did not contain of moisture was stored in a thimble. After that, the sample-containing thimble holder was filled with 250 ml of diethyl ether. Next, the soxhlet apparatus was turned on, and it ran for 6 hours at a temperature of 34±20C. Subsequently, the extracted sample that was placed in the bottom flask was weighed (AOAC 1990).

The fat content was calculated by the following formula:

$$\text{Crude fat \%} = \frac{W4 - W3}{W2 - W1} \times 100$$

Where, W1 = Weight of empty thimble (g)

W2 = Weight of thimble + sample (g),

W3 = Weight of empty flask (g)

W4 = Weight of flask + fat (g)

2.4.4 Analysis of Crude Fiber

The manufactured jam's crude dietary fibre content was ascertained using the AOAC's sequential acid and alkali hydrolysis technique (AOAC 1990). The boil in base was 0.313M sodium hydroxide, while the boil in acid was 0.128M sulfuric acid. The 2g of material were first weighed, then cooked for 30 minutes in 0.128M sulfuric acid before being filtered. After boiling the filtrate once again for 30 minutes in a base solution of 0.313M sodium hydroxide, it was filtered. Weight was determined by first drying the filterate in an oven for 2 hours, then ashing it in a muffle furnace for five hours.Then the crude fibre was percentage was obtained by using the formula:

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

Where, W_1 = Weight of the sample before ashing, g

W_2 = Weight of the sample after ashing,g

W = Weight of the sample, g

2.4.5 Protein estimation

The total protein by the Kjeldahl method is defined as the amount of nitrogen experimentally found and multiplied by an appropriate conversion factor. The protein content of the jam sample was estimated by the IS: 7219-1973 RA method (AOAC 2005). The method of estimation of nitrogen by Kjeldhal method includes three steps;

(a) Digestion: 0.2gm sample, 2gm digestion mixture, and 20ml concentrated sulphuric acid. Boiled for at least 3 to 5 hours. Digested sample and distilled water make upto 100ml.

(b) Distillation: 30ml of 4% boric acid, 10ml digested sample, 50ml of 40% NaOH and 50 ml distilled

water into distillation flask and heated at 200^0C.

(c) Titration: 0.l N HCl into burette and 10-20ml sample into conical flask with 2-3 drops of methyl red indicator. Titrated it for 3 to 4 times.

$$\text{Protein g/100 g} = \frac{(c\text{-}b) \times 14d \times 6.25}{a \times 1000} \times 100$$

2.5 Functional analysis

2.5.1 Water absorbing capacity

The procedure of (Sathe et al., 1982) was used. Exactly 10 mL of water was added to 1 g of each sample. The suspension was then stirred for 5 min. The suspension was transferred into centrifuge tube (centrifuge 0151, Corning brand, United State) and centrifuged at 3,500 rpm for 30 min. The supernatant obtained was measured using 10 mL measuring cylinder. The density of water was assumed l g/mL. The water absorbed was calculated as the difference between the initial water used and the volume of the supernatant obtain after centrifuging. The result was expressed as a percentage of water absorbed by the starch on g/ml basis.

Water absorbing capacity = (wet sample weight – dry sample weight) ÷ (dry sample weight) x 100

2.5.2 Density

Density of jam was determined by using a densimeter.

Procedure:

Carefully place the densimeter into the jam placed in a bowl, bottom bulb first. Turn the densimeter on itself to remove any air bubbles and let it float. It should be vertical and not stick to the sides. Once stabilized, a meniscus will be on the surface of the liquid. The measurement is made by observing the scale under the meniscus.

2.5.3 Viscosity

Viscosity of jam was determined by using a viscometer. Poured the sample to be tested into the sample tank behind the spring door. Pressed the lock on the spring door to make the spring door pop up instantly, and use a stopwatch to start timing at the same time. The progress of the fluid flow in the instrument were accurately measured by the precision scale on the base plate. The viscosity was calculated by comparing the flow rate over a specific time period (usually 30 seconds).

2.6 Shelf-life evaluation

Nutrient agar was utilized at various intervals to analyze the shelf life of the manufactured jam with valuable addition. In order to perform this test, samples that were collected on 1, 5, 10, 15, 20 days of varied times were examined for microbial growth on nutrient agar. For 24 hours, the nutrient agar plates containing the sample were incubated to monitor the development of colonies of microorganisms. In order to create the nutritional agar for this test, 25 g of nutrient broth were mixed with one litre of distilled water. The mixture

was then autoclaved for 15 minutes at 15 psi and 1210C. After cooling, the mixture was transferred into petri plates with laminar air flow and allowed to harden. Subsequently, the diluted sample was serially diluted (10^1–10^4) and a dilution factor of 10^4 was obtained for pouring onto a petri plate containing medium. After that, it was incubated for 24 hours at 37^0C inverted. Next, a digital colony counter was used to count the colony forming units, or CFUs (Hayat *et al.*, 2005).

2.7 Packaging and Labelling

When packaging the developed jam, it was essential to use appropriate glass bottles that could safely store and preserve the beverage. Some factors that were considered when choosing glass bottles for packaging jam: Glass type, size and shape, closure, U,V protection, durability, reusability, branding and labeling,glass has a premium and an attractive look and increases shelf life.

Glass bottles are a popular choice for packaging Jam. They are inert, non-reactive, and provide an airtight seal, which helps maintain carbonation and prevents flavor contamination. Glass also offers excellent UV protection, preventing light from degrading the product. Glass is Inert and Unreactive: Jams have a unique ingredient composition, which requires packaging material that is inert and unreactive. In a jam packaging, the right mixture of acid, sugar, and pectin is required to achieve the needed gel structure. Also, the rapid boiling is required to remove water quickly, to concentrate the mixture before it darkens and loses its ability as a gel. The acidic part can react with packaging materials such as plastic and metal, which can alter the flavour, taste, and quality of the product apart from affecting the health of consumers negatively. This problem can be corrected by just using a glass jar for packaging jam.However, glass bottles can be more prone to breakage and are heavier to transport.

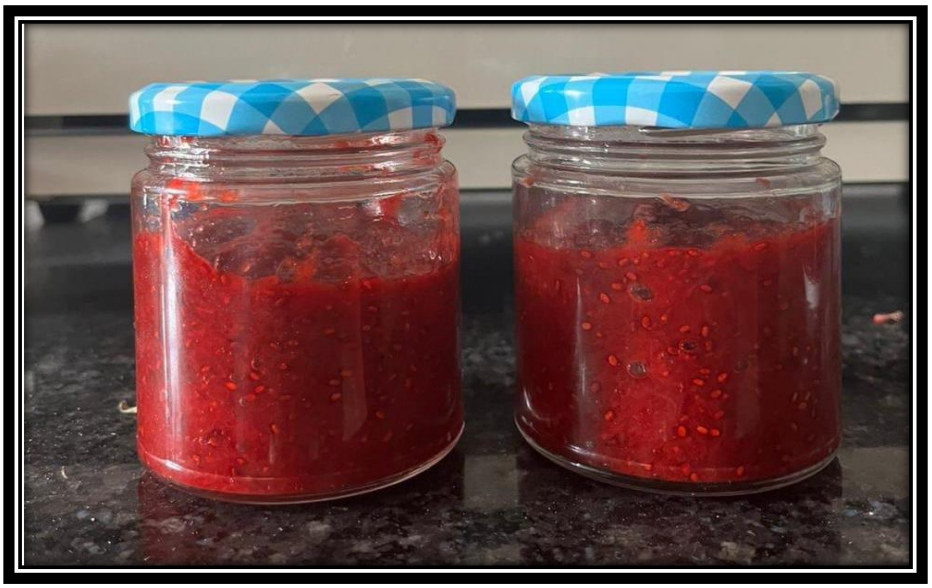

Figure 1 Glass bottle suitable for packaging of jam

Labelling

The internationally accepted definition of a food label is any tag, brand, mark, pictorial or other descriptive matter, written, printed, stenciled, marked, embossed or impressed on, or attached to, a container of food or Jar Cap Neck of the bottle Jar Bottom 54 food product. Food labelling is one way in which consumers can get knowledge about the food they consider buying. Correctly following the information provided on food labels (such as expiry dates, handling instructions and allergy warnings) can help consumers prevent unnecessary food-borne illness and allergic reactions.

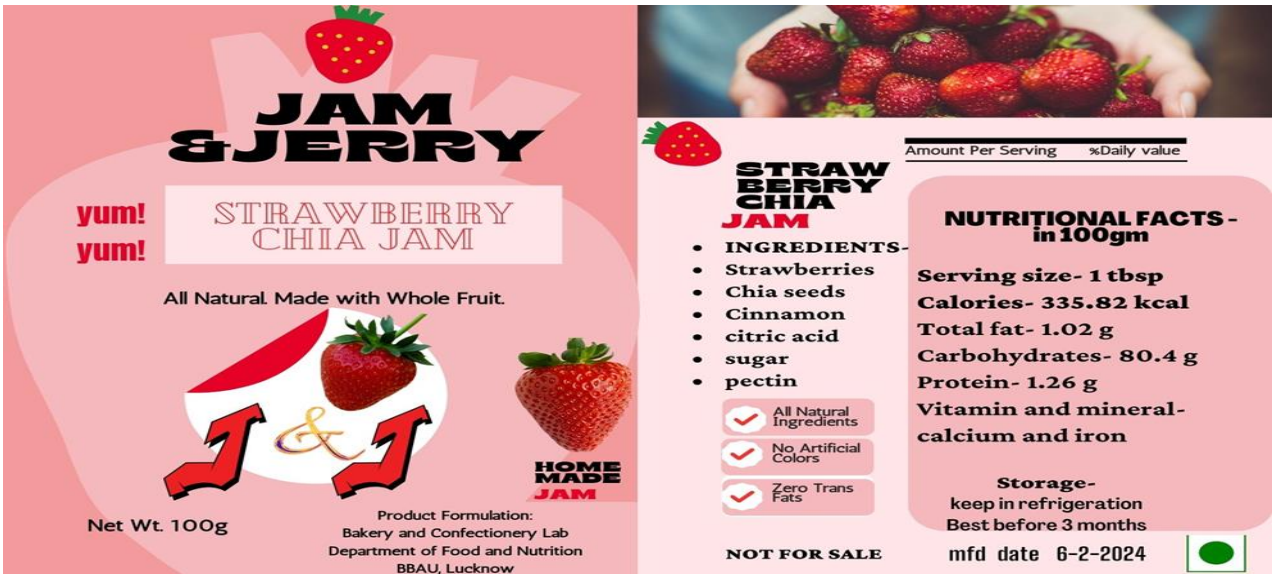

Figure 2 Label of the developed Strawberry Chia seed Jam

3. Results and Discussion

3.1 Physiochemical Analysis

This involves results of physicochemical properties (pH, titratable acidity, total soluble solids (TSS) and reducing sugar) were analyzed after development of treated sample.

Table 1 Results of Physiochemical Analysis of Treated sample

S.No.	Parameters	Result
1	TSS	69.1° brix
2	pH	3.539
3	Titratable Acidity	0.7%
4	Ascorbic Acid	12.3 mg/100g

5	Total Sugar%	54.35%
6	Reducing Sugar%	52.1%
7	Non Reducing Sugar%	2.25%

3.1.1 TSS (Total Soluble Solid) Measurement

The total Soluble Solid (TSS) of the prepared jam was checked using a refractometer undergoing a standardization procedure using water and finally determination of TSS by adding the sample in small amount in refractometer. The TSS of Treated sample was found to be 69.1° brix.

3.2 Ph Measurement

The pH of the prepared jam was checked using a pH meter undergoing a standardization procedure using buffer solution of 4 and 7 pH, finally determination of pH by measuring the sample using the pH meter metallic probe. The pH of Treated sample was found to be 3.539.

3.1.2 Titratable Acidity

The titratable acidity % was 0.7%. That shows that the total amount of all acids in solution/ sample where in this present sample the titratable acidity was found 0.7%. End point of the titration was attained
By the appearance of pink color due to phenolphthalein indicator.

3.1.3 Ascorbic acid

The ascorbic acid of the developed jam was obtained to be 63.29 mg/100g. It was noted ` (Rahman *et al.,* 2018) that the ascorbic acid content in strawberry jam was 61.65 mg/100g.

3.1.4 Sugar

The total sugar, reducing sugar and non-reducing sugar of the developed jam obtained to be 52.1%, 54.35%, 2.23%.

3.2 Nutritional Analysis

The nutritional or proximate analysis of T2 treatment was analyzed. This includes the moisture, ash, fat,crude fibre, protein and carbohydrates are analyzed and reported as the percentage composition of the product accordingly.The moisture content of the prepared jam was found 13.03%.The ash content of the prepared jam obtained was 4.29%. The total crude fat in the jam found was obtained 1.02%. The total crude fibre content in the prepared jam was obtained 3.5%. The protein content was found 1.26g/100g. The carbohydrate found was 80.4%**.** The total energy was calculated from the above formula show that 335.82 kcal.

Table 2 Nutritional Analysis of Treated sample as per percentage

S.No.	Parameters	Unit (% / g)	Sample portion in 100 g	Sample portion of 100 g in percentage %
1	Moisture content	13.03 %	13.03g	13.03
2	Ash content	4.29 %	4.29g	4.29
3	Fat content	1.02%	1.02g	1.02
4	Crude fibre	3.5%	3.5g	3.5
5	Protein	1.26g/100g	1.26g	1.26
6	Carbohydrate	80.4%	80.4g	80.4%
7	Energy	335.82 kcal	335.82 kcal	335.82 kcal

3.3 Functional Analysis

Functional properties of jam which includes water absorbing capacity, density and viscosity were analyzed. The results are shown below.

3.3.1 Water absorbing capacity

The water absorbing capacity was determined by centrifugating the sample in a centrifugator for 30 minutes at 300 rpm. The water absorbing capacity of Treated sample obtained was 15.13%.

3.3.2 Density

The density of jam was determined using densimeter. The density of Treated sample was found to be 1.372 g/ml.

3.3.3 Viscosity

The viscosity of jam was determined using viscometer. The viscosity of Treated sample was found to be 4783.2 Pa s.

Table 3 Results of Functional Analysis of Treated sample.

S.No.	Parameters	Result
1	Water absorbing capacity	15.13%

2	Density	1.372g/ml
3	Viscosity	4783.2 pa.S

3.4 Shelf-life study

For the shelf-life study of the strawberry chia seed jam sample was analyzed for the microbial growth by pour plate method and the plates for incubated for 24 hours and no colonies was observed. The CFU count of the prepared sample was thus found to be zero.

Table 4 Colonies on Nutrient Agar media

S.No	Days	Dilution number	Number of colonies
1	1	10^4	Absent
2	5	10^4	Absent
3	10	10^4	Absent
4	15	10^4	Absent
5	20	10^4	Absent

From the above table it can be observed that the colonies were absent after 24 hours of incubation in the pour plate method conducted for microbial analysis. Colonies were found absent further when the plate was observed in Day1, Day 5, Day 10, Day 15, Day 20. The microbial test shows that this product is safe to use and can be stored for three months and more than three months with proper storage conditions. The microbial test shows that this product is safe to use and can be stored for three months and more than three months with proper storage conditions.

Figure 3: Nutrient Agar Media petri plates of Samples

3.5 Packaging and labelling

Packaging plays a critical role in preserving the quality and shelf life of jam and jelly. It must be able to protect the product from external factors that could cause spoilage, such as light, air, moisture, and microbes. Labelling helps to provides all the necessary information about the developed strawberry chia seed jam and also helps in marketing and branding.

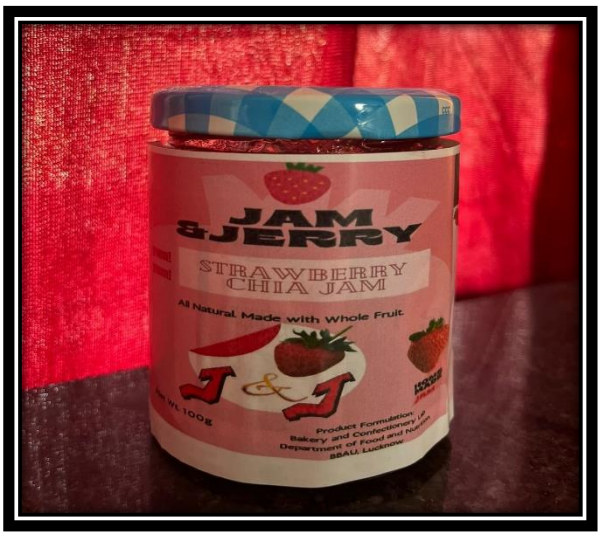

Figure 4 packaged and labelled strawberry chia seed jam

4. Conclusion

It was concluded that the prepared value-added Strawberry jam with chia seed has TSS of 69.1^0 brix, p^H of 3.539, titratable acidity was 0.7% and also has good sources of Ascorbic acid, crude fibre, protein, and many more nutrients which shows that the prepared value added is rich in nutrient that will help in daily requirement of nutrients. The phytochemical which presents in this value-added jam found are alkaloid, saponin, terpenoid, flavonoid, Quinone, Phenolic compound, Tannins, Glycosides whereas tannin is absent. Beside these, the prepared jam was also conducted for shelf life where the colonies were absent after 24 hours of incubation in the pour plate method conducted for microbial analysis. Colonies were found absent further when the plate was observed in Day1, Day 5, Day 10, Day 15, Day 20. The microbial test shows that this product is safe to use and can be stored for three months and more than three months with proper storage conditions. The microbial test shows that this product is safe to use and can be stored for three months and more than three months with proper storage conditions.

Thus, the development and characterization of strawberry chia seed jam demonstrate its viability as a nutritious, appealing, and shelf-stable product. This innovation aligns well with contemporary consumer trends favoring healthful, natural, and functional foods. As such, strawberry chia seed jam holds promise for both commercial success and positive impacts on public health.

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