PROXIMATE ANALYSIS OF MIXED FRUITS JAM DEVELOPED FROM DATES INCLUSION OF APPLE AND ORANGE FRUITS

A PROJECT REPORT

BY

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Submitted to the Department of Nutrition and Food Engineering in the partial fulfillment of B.Sc. in Nutrition and Food Engineering

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APPROVAL

This Project titled "***Proximate analysis of mixed fruits jam developed from dates inclusion of apple and orange fruits***", submitted by **Abu Hanif Noman**, has been accepted by the Department of Nutrition and Food Engineering at Daffodil International University as meeting the necessary requirements for the partial fulfilment of the B.Sc. degree in Nutrition and Food Engineering. The style and contents of the work have also been approved.

EXAMINING COMMITTEE

Chairman of the Board ____________________________ ____________

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DECLARATION

The undersigned affirms that the present project was conducted under the guidance of **Md. Harun-Ar Rashid**, Assistant Professor at the Department of NFE, Daffodil International University. The author of this project affirms that it has not been previously submitted for the purpose of obtaining any degree or diploma, nor has any portion of it been utilized for such purposes.

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ABSTRACT

The objective of this study was to prepare mixed fruits jam developed from date's inclusion of apple and orange fruits. The proximate analysis revealed it contains 40.10% moisture, 0.44% Ash, 10.57% Crude fiber, 0.69% Fat, 1.86% Protein, and 46.34% Carbohydrates. The pH of jam was 3.14 and TSS was 67°Brix. Total titrable acidity was 0.58%. The jam consists of 199.01 Kcal energy, which include 185.36 kcal from carbs, 7.44 kcal protein and 6.21 kcal from fat. Microbial load of Mixed fruit Jam was accordingly 3.2×10^3cfu/g, 2.6×10^4cfu/g, 1.8×10^5cfu/g for 10^2,10^3 and 10^4 dilutions. The sensory analysis was conducted among 45 participants, which revealed the sensory attribute color scored 7.64±1.30, texture scored 7.38±1.01, mouthfeel scored 7.56 ±1.24, flavor scored 7.67±1.13 in 9 scale hedonic test. The overall acceptance scored 7.64±0.98. the texture attribute scored the lowest which can be improved further.

Keywords: Date, Orange, Apple, Jam, Proximate, Microbial, Sensory**.**

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CHAPTER 1

INTRODUCTION

1.1 Introduction of Jam

With or without the inclusion of water, jam is produced by simmering fruit puree from whole fruit or multiple types of fruit with enough sugar at a low pH (2.5-3.2) to form a firm, gel-like mass (Codex Alimentarius, 2009). Pectin and acids are added to create an excellent jam. The minimum percentages of total solids and fruit should be 65 and 45 percent, respectively. When people consume breakfast in the morning, jams are an excellent way to provide them with sugar, fiber, and other beneficial compounds from fruit.

Dates are a nutritious food because they contain a variety of essential nutrients and may provide numerous health benefits. Dates can be consumed in a variety of methods. At the Rutal (half-ripe) and Tamar (ripe) stages, they are consumed raw (30–40%) or desiccated (60–70%) with minimal or no processing (Al-Hooti *et al.,* 1997). Dates pair well with coffee, milk, and cheese. When prepared, they can be consumed as paste, syrup, pickled vegetables, and preserves. In addition to chocolate, coconut, honey, and vinegar, they are used in many baked products and desserts (Al-Hooti *et al.,* 1997; Besbes *et al.,* 2009). During Ramadan, the Muslim sacred month of fasting, individuals break their fast with the greatest quantity of dates. Supposedly, dates inhibit the development of cancer and combat free radicals. Dates and their aqueous solutions have been shown to destroy free radicals, halt the growth of tumours, and alter the immune system (Vayalil, 2002).

Figure 1.1: Dates

Figure 1.2: Apples

Figure 1.3: Oranges

Date palms contribute to the economy because their produce is nutritious. The fruit contains 44.88% sugar, fat (0.2-0.5%), potassium (2.5 times more than bananas), calcium, magnesium, and iron, protein (2.3-5.6%), dietary fibre (6.4-11.5%), vitamins, and amino acids (Merriam-Webster, 2000; Al-Shaib and Marshall, 2003). Jams are prepared by simmering sugar until it becomes viscous. They are used to create items such as bread, cakes, and pastries, among others. According to Pamplona-Roga (2008), jam is created by combining fruit, sugar, pectin, and citric or lemon juice, and then simmering the mixture until it thickens. Fruit and sugar are their primary ingredients. For the jam to set properly, the fruit must contain a great deal of pectin and acid. By crushing and pounding apples, apple juice is a type of fruit juice. By utilizing enzymes and centrifugation, sugar and pectin can be extracted from the extracted liquid.

Making jam is a great method to preserve the freshness of fruits and utilize excess produce during their prime season. Typically, jam is only produced during the growing season of its constituents. This created a significant production gap for the remainder of the year. Throughout the year, jam can be made with desiccated or other forms of preserved fruits. This study discusses the use of dates, apples, and oranges to prepare mixed fruits jam.

1.2 Background

Dates, which originate from the Phoenix dactylifera L. palm, are cultivated in numerous Middle Eastern nations. FAO reports that in 2018, the top three producers of dates are Egypt (1.5 million tonnes), Saudi Arabia (1.3 million tonnes), and Iran (1.2 million tonnes). Indonesia imported 399,07 tonnes of dates in the same year, making it the sixth largest importer in the world (FAO, 2012). Indonesia, on the other hand, does not produce dates, despite being a tropical country with high humidity that could be an ideal location for date cultivation. According to (Rostita *et al.,* 2009), date cultivation can be used as an alternative agricultural enterprise, as a tourist attraction, and as a means to cultivate decorative plants. There are numerous varieties of dates on the market, but is one of the most popular because it is unique. It can be consumed whenever, whereas the other can only be consumed when it is available. Dates are climacteric crops, meaning they continue to ripen after being harvested. Dates deteriorate rapidly, so they must be preserved in other ways to last longer. Jam is a prepared food manufactured from fruits, sugar, pectin, citric acid, water, and permitted food ingredients. Important because the concentrations of pectin and citric acid will alter the appearance and texture of the jelly if they are not chosen properly. When pectin, sugar, and citric acid are combined, they form a polymer complex that imparts texture to the jam (Buckle et al., 2007). Between 0.75 and 1.5 percent pectin is optimal for gel formation (Simamora *et al.,* 2017). Jam requires pectin to form its structure. If the pectin level is too low, the jam will not congeal because it will be too fluid, whereas if the pectin level is too high, the jam will form a solid, stable bulk. Adding 0.5% citric acid concentrate to preserves will improve their flavour. Between 3.2% and 3.4% is the optimal pH range for citric acid (Yuliani et al., 2011). For the finest and most ideal jam, it is essential to follow the correct recipe. Therefore, it is essential to optimize the date jam recipe. On the other hand, there aren't many linked studies available yet, so it's essential to make date jam under optimal conditions for optimal results.

1.3 Objectives

1. To produce mixed fruits jam from dates, oranges and apples.
2. To determine the proximate composition.
3. To find out the microbial load.
4. To assess the sensory acceptance of mixed fruits jam.

CHAPTER 2

LITERATURE REVIEW

2.1 Dates

Since the Middle Ages, the primary sustenance in the Arab world has been date fruit. In the past four decades, the global production of date produce has increased by 2.9 times. The global production reached 7.68 million tonnes in 2010 (Tang *et al.,* 2013). Date fruit can provide vital nutrients and may be beneficial to one's health. As a date ripens, it undergoes four stages known as kimri, khalal, rutab, and tamer. The primary fundamental components of date fruit include, among others, carbohydrates, fibre, enzymes, protein, lipids, minerals, vitamins, phenolic acids, and carotenoids. Numerous studies have demonstrated that date fruit possesses anti-mutagenic, anti-inflammatory, gastroprotective, hepatoprotective, nephroprotective, anticancer, and immune-stimulant properties, among others. Date fruit has been used to create a variety of products, including date liquor, date paste, date liquid, and their derivatives (Tang *et al.,* 2013). Date byproducts can be used as basic materials to produce organic acids, exopolysaccharides, antibiotics, date-flavored probiotic fermented cheese, and culinary yeast, among other things.

The origin of dates is the Middle East (Sunarharum *et al.,* 2021). This fruit is tropical. Dates ripen rapidly; therefore, they must be processed more to extend their shelf life. One method is to create a date delay. This research was conducted to determine the optimal method for making jam. To determine the optimal solution, Response Surface Methodology with Centre Composite Design was utilized. Pectin and citric acid concentrations were the two independent variables, and the responses were the total colour difference (E) and the ability to disseminate. The optimal date jelly contained 0.52 percent pectin and 0.69 percent citric acid. Sunarharum *et al.,* (2002) determined that its total colour difference (E) was 6.77 and its spreadability was 9.2 centimetres. A quality acceptability test indicates that consumers can tolerate date blockage (Sunarharum *et al.,* 2021).

2.2 Oranges

Orange is highly nutritious and a source of phytochemical compounds (Teixeira *et al.,* 2020). However, its by-products are usually discarded. The effect of orange peel (OP) addition in orange jam on sensory, physicochemical, and nutritional characteristics. Four jam formulations were elaborated with different OP levels: OP0 (standard), OP4, OP8, and OP12 (Orange Peel 0, 4, 8 and 12%, respectively). All samples were evaluated for sensory acceptability, and physicochemical and nutritional composition. The addition of 12% orange peel in jam reduced ($p < 0.05$) the acceptability for all evaluated attributes, as well as overall acceptance and purchase intention. However, orange peel utilization increased ($p < 0.05$) the levels of water activity, soluble solids, titratable acidity, and sugars. Soluble solids/titratable acidity ratio, luminosity (L^*), and yellow content (b^*) decreased in all added OP jams, while red content (a^*) increased. No change in the pH and moisture values of the product were observed after orange peel addition. Ash, protein, lipid, dietary fiber, ascorbic acid, carotenoids, phenolic compounds, and antioxidant capacity values increased after orange peel addition, while carbohydrate and energy content decreased. A texture test showed that adhesiveness decreased, while gumminess, chewiness, and elasticity increased after orange peel addition. The addition of up to 8% orange peel in jam maintains sensory acceptability similar to that of the standard product. Orange peel addition is a viable alternative to improve some of the product's physicochemical and nutritional characteristics (Teixeira *et al.,* 2020).

2.3 Apples

Lee, S. M. (2014) conducted a study to investigated the quality characteristics of apple jam added with ginger. The jam was prepared with apples, sugar, lemon juice and various amounts (0, 2, 4, 6, 8%) of ginger. Increasing the amount of ginger decreased moisture contents and sugar content of the jam, whereas the pH gradually increased. With increased amount of ginger, the lightness(L) and yellowness(b) significantly decreased, while redness(a) gradually decreased. There wasn't any significant difference in the samples with up to 4% ginger ($p<0.05$). In the texture profile analysis, hardness and adhesiveness increased significantly with increased amount of ginger. When more amount of ginger was added, cohesiveness increased with no significant difference based on the amount of ginger. With increased amount of ginger, springiness and chewiness gradually increased. The results of the sensory evaluation show that the apple jam added with 4% ginger got the highest overall-acceptability scores. It is possible to enhance the quality and acceptability of apple jam by adding 4% ginger (Lee, S. M. 2014).

Kim *et al.,* (2010) conducted a study on various contents of Rosa rugosa Thunb fruit (0, 10, 20%), which is grown along the seashore of Gangwon province, were applied to apple jams having different sugar concentrations (20, 40, 60%). According to Kim *et al.,* (2010) the resulting jams were analyzed using a sensory scoring test as well as a response surface methodology to identify the optimum conditions for the preparation of high-preference apple jams. The sensory properties based on sense of sight, smell and taste appeared to be linked to the sugar contents (Kim *et al.,* 2010).

2.4 Relevant studies

Besbes *et al.,* (2009) discovered that three probable Tunisian date varieties with a firm texture contained the same levels of sugar (73.30–89.55 g/100 g dry matter), fibre (7.95–18.83 g/100 g dry matter), and total phenolics (280.6–681.8 mg of GAE/100 g) as dates of superior quality. Dates had a high concentration of sucrose and a low concentration of reducing sugar. (Besbes *et al.,* 2009) The objective of this project was to add value to these basic materials by transforming them into jam. Besbes *et al.,* (2009) examined the chemical composition, physical (texture and capacity to retain water) and flavour characteristics of the preserves that accompanied them. Besbes *et al.,* (2009) discovered that the variety of date had a substantial effect on the chemical composition and physical properties of date preserves. In fact, jam contained more lowering carbohydrates and was firmer and water-retentive than jelly. We compared these new products to quince jam, the most popular jam in Tunisia, to determine whether or not they would appeal to consumers. Overall, the results indicated that individuals preferred date conflicts. (Besbes *et al.,* 2009) This research revealed crucial information that could aid in the marketing of date jam.

According to ul Haqa *et al.,* (2014), jam is a viscous, sugary condiment prepared by simmering minced or pulverised fruits with sugar, with or without pectin. In this investigation, conducted by ul Haqa *et al.,* (2014), it was determined if desiccated apricots could be transformed into jam. The results indicated that creating jam from dehydrated apricots and preserving it was a smart idea. According to Haqa *et al.,* (2014), combining apricots and dates makes preserves more nutritious and imparts a unique character. These rich sources of vitamins A (beta carotene) and C, potassium, phytochemicals, and fibre (both soluble and insoluble) are available year-round in desiccated form and appear in Kashmir and Ladakh as the first signs of summer (ul Haqa *et al.,* 2014).

Date pits (Phoenix dactylifera) are a significant agricultural waste because they contain a high amount of dietary fibre (Alqahtani *et al.,* 2020). Despite their limited use in food processing, date pits (Phoenix dactylifera) are an important agricultural byproduct. Due to this, Alqahtani *et al.,* (2020) believe that making jam with date pits powder (DPP) instead of pectin could be a worthwhile area of research. This study aimed to determine what happened when pectin in strawberry jelly was substituted with Khalas palm dates pits powder (DPP) as a new source of fibre (Alqahtani *et al.,* 2020). 25% of the pectin in the treatments was substituted by DPP (0.1% DPP and 0.3% pectin), 50% (0.2% DPP and 0.2% pectin), 75% (0.3% DPP and 0.1% pectin), and 100% (0.4% DPP and 0% pectin) compared to the control treatment, which contained 0% DPP and 0.4% pectin.

CHAPTER 3

MATERIALS AND METHODS

3.1 Study Location

The study was carried out in the facility of department of nutrition and food engineering, Daffodil International University, DSC, Ashulia, Dhaka.

3.2 Materials

All the raw materials used in this study were collected from local market of Savar, Dhaka.

3.3 Ingredients

Table 3.1: Mixed Fruit Jam Ingredients

Jam Ingredients	Quantity	Percentages
Fresh Dates	250g	47.57
Oranges	60g	11.42
Apples	60g	11.42
Sugar	150g	28.54
Sodium Benzoate	0.5g	0.10
Agar Agar	3g	0.57
Citric Acid	2g	0.38
Water	100ml	

3.4 Procedures

- First the raw materials were collected from local market.
- Fruits (Dates, Apples, Oranges) were sorted and damage ones was removed.
- Those were washed and cleaned with safe potable water.
- After washing those were cut in lengthwise.
- Then bulbs and seeds were removed from fruits.
- Fruits were blended together in an electric blender for pulping.
- The pulp was collected in a beaker.
- The pulp was cooked for 25mins with the addition of 100ml water and 100g sugars. The brix was check for the endpoint.
- Sodium benzoate, citric acid, agar agar was added and mixed well.
- After the cooking was done it was left for setting.
- Then it was cooled and poured in a glass container.
- Finally, the mixed fruit jam was produced and stored at room temperature.

Figure 3.1: Pulp

Figure 3.2: Mixed Fruit Jam

Figure 3.3: Mixed Fruit Jam in Container

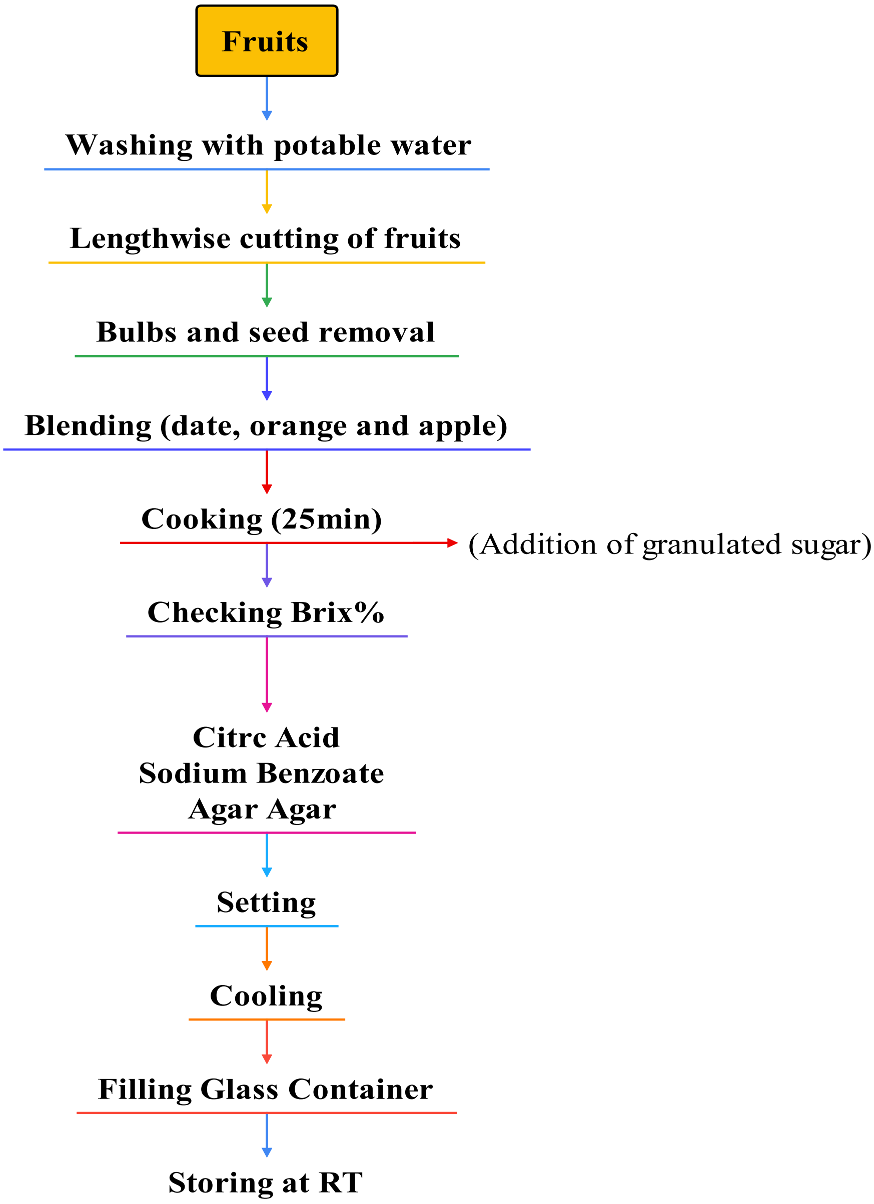

Figure 3.4: Flowchart of Mixed fruit Jam production

3.5 Proximate Analysis

3.5.1 Determination of Moisture

The determination of moisture content reported by AOAC (2005), in prepared mixed fruit jam using a Digital Moisture Analyzer (MA-105MW) at 120°C involves a straightforward and accurate method.

Materials and Equipment:

1. Prepared mixed fruit jam sample
2. Digital Moisture Analyzer (MA-105MW)

Procedure

1. The moisture analyzer was properly calibrated according to the manufacturer's instructions.
2. Turned on and allowed to warm up and stabilize to the desired testing temperature, which is 120°C in this case.
3. Weighed a clean, dry, and empty sample container or dish using an analytical balance.
4. Carefully placed a measured amount of the mixed fruit jam sample into the sample container. Place the sample container with the mixed fruit jam sample into the moisture analyzer's sample chamber.
5. Start the moisture analysis process on the moisture analyzer. The analyzer will heat the sample to 120°C and measure the moisture content using a method such as loss on drying (LOD).
6. Once the analysis is complete, the moisture analyzer displays the moisture content percentage.

3.5.2 Determination of pH

The determination of pH reported by AOAC (2005) in jam using a pH meter like the Hanna HI 8424 involves a simple procedure of calibration and measurement. Here are the steps involved:

Materials and Equipment

1. Prepared mixed fruit jam sample
2. Hanna HI 8424 pH meter
3. pH 4 and pH 10 buffer solutions
4. pH electrode
5. Clean beakers or containers for sample preparation
6. Stirring rod (if needed)

Procedure

1. Ensured that the mixed fruit jam sample is at a suitable temperature for measurement (often room temperature).
2. Turned on the Hanna HI 8424 pH meter if it was turned off after calibration.

3. Immersed the clean and calibrated pH electrode into the prepared mixed fruit jam sample. Make sure the electrode is fully submerged but not touching the container's bottom.
4. Allowed the pH meter to stabilize and provide a pH reading. The reading may take a few seconds to stabilize.
5. Recorded the pH reading from the pH meter. This reading represents the pH of the mixed fruit jam.
6. Rinse the pH electrode with distilled water after measurement to prevent contamination between samples.

3.5.3 Determination of °Brix

This was determined through the use of Refractometer ATAGO according to Pearson (1981). Before use, the refractometer was adjusted to zero reading using distilled water. Aliquot from the samples were placed on the prism surface of the refractometer and the total soluble solid directly as the sugar contents.

The determination of °Brix, which measures the total soluble solids (primarily sugar content) in a solution, is commonly performed using a refractometer. Here are the steps involved in determining °Brix using an ATAGO refractometer:

Materials and Equipment:

1. Sample (mixed fruit jam or juice)
2. ATAGO refractometer
3. Distilled water
4. Pipette or dropper
5. Clean, lint-free tissue or cloth

Procedure

1. Ensured that the sample (in this case, the mixed fruit jam) is well-mixed and at the desired temperature, typically at or close to room temperature.
2. Clean the prism surface of the refractometer using a clean, lint-free tissue or cloth to remove any residue from previous measurements.
3. Use a pipette or dropper to place a small aliquot.
4. Close the daylight plate gently to spread the sample evenly across the prism surface. The refractometer will bend and refract light passing through the sample.
5. Look through the eyepiece of the refractometer, and saw a scale or digital reading that indicates the °Brix value. This value represents the percentage of sugar content in the sample.
6. Record the °Brix reading obtained from the refractometer. This reading represents the total soluble solids (sugar content) in the mixed fruit jam.

3.5.4 Determination of Total Titratable Acidity (TTA)

The determination of Total Titratable Acidity (TTA) in a solution as reported by AOAC (2000) involves titrating a known volume of the solution with a standardized base (in this case, 0.1 M NaOH) to a phenolphthalein endpoint

Materials and Equipment:

- 0.1M Sodium Hydroxide (NaOH) solution
- Phenolphthalein indicator
- Burette
- 10 mL pipette
- Erlenmeyer flask
- Analytical balance

Procedure:

1. The sample is well-mixed and homogeneous.
2. Before starting the titration, the exact concentration of NaOH solution was determined and recorded.
3. Pipette exactly 10 mL of the sample solution into an Erlenmeyer flask.
4. Added a few drops of phenolphthalein indicator to the Erlenmeyer flask containing the sample. The solution will turn colorless.
5. Start the titration by slowly adding the standardized 0.1M NaOH solution from the burette into the flask while swirling the contents. Continued adding NaOH solution until a faint, persistent pink color appears. This pink color indicates the endpoint of the titration.

Calculation:

$$\%\text{Acidity} = \frac{\text{Volume(ml)} \times 0.1 \times 192.13 \times 1}{3 \times \text{Sample(ml)}}$$

3.5.5 Determination of Ash

The determination of ash content in food products reported by AOAC (2005), such as jam, involves burning the sample at a high temperature to completely incinerate the organic matter and leave behind the inorganic ash.

Materials and Equipment:

1. Jam sample
2. Analytical balance
3. Crucible or ashing dish
4. Electric Muffle Furnace
5. Tongs or crucible holders
6. Desiccator
7. Analytical balance

Procedure

- Weighed sample of the jam using an analytical balance.
- Weighed a clean, dry crucible using the analytical balance.
- Transferred the weighed jam sample into the crucible or ashing dish.
- Placed the crucible with the jam sample in an oven to remove any moisture.
- After drying, re-weighed the crucible with the jam sample to determine the weight of the sample after moisture removal.

- Allowed the sample to incinerate in the furnace 600°C for 6 hours. During this time, all the organic matter in the sample will burn away, leaving only the inorganic ash.
- After 6 hours, turned off and allowed it to cool. Do not open the furnace until it has reached a safe temperature to handle.
- Weigh the crucible with the ash residue using the analytical balance.

Calculation:

$$\%\text{Ash} = \frac{\text{Crucible \& Sample after ashing(g)} - \text{Empty Crucible(g)}}{\text{Sample(g)}} \times 100$$

3.5.6 Determination of Crude fiber

The determination of crude fiber reported by AOAC (2005) involves a series of steps to remove non-fibrous components from a food sample through chemical digestion and solubilization. The remaining fiber residue is then corrected for ash content after ignition. This method is often used to analyze the fiber content of food and agricultural products.

Materials and Equipment:

- Food sample
- Analytical balance
- Crucibles or porcelain dishes
- Muffle furnace
- Sulfuric acid (concentrated H_2SO_4)
- Hydrochloric acid (HCl)
- Nitric acid (HNO_3)
- Funnel
- Glass fiber filter paper
- Distilled water
- Beakers
- Glass stirring rod

Procedure:

1. Weighed sample using an analytical balance.
2. Transferred the weighed sample to a crucible or porcelain dish.
3. Poured a sufficient amount of concentrated sulfuric acid (H_2SO_4) over the sample in the crucible to cover it completely.
4. Carefully heated the crucible and its contents over a low flame or on a hot plate. The sulfuric acid will dehydrate the sample and break down the organic matter. Continue heating until the contents become dark and the acid fumes cease to evolve. This step is critical for removing non-fibrous components.
5. Allowed the crucible to cool to room temperature. Then, added distilled water to the crucible to dilute the sulfuric acid. Carefully transfer the contents to a beaker and wash any remaining material from the crucible.

6. Added a mixture of concentrated hydrochloric acid (HCl) and nitric acid (HNO_3) to the beaker containing the washed residue. Heat the mixture gently to digest any remaining organic matter. Continue heating until all organic matter is removed.
7. Placed a glass fiber filter paper in a funnel and set it up in a filtration apparatus. Pour the contents of the beaker through the filter paper to separate the residue from the liquid.
8. Washed the residue on the filter paper with hot distilled water to remove any remaining acids.
9. Carefully removed the filter paper with the residue and place it in an oven to dry at a constant temperature until it reaches a constant weight. This weight represents the crude fiber residue.
10. Ignite the dried residue in a muffle furnace at a 600°C to burn off the organic matter. The remaining material is the ash.
11. Allowed the crucible or dish containing the ash to cool and then weigh it using an analytical balance.

Calculation:

$$\%\text{Crude fiber} = \frac{\text{Crucible \& Sample after ashing(g)} - \text{Empty Crucible(g)}}{\text{Sample(g)}} \times 100$$

3.5.7 Determination of Protein

The Kjeldahl method is a widely used technique for the determination of protein content in food samples. It involves three main phases: digestion, distillation, and titration. Protein content of mixed fruit jam was determined by Kjeldahl method (AOAC, 2005). The procedure consists of three phases; digestion, distillation and titration.

Materials and Equipment:

1. Mixed fruit jam sample
2. Kjeldahl digestion flask with ground-glass joint
3. Kjeldahl condenser
4. Kjeldahl distillation unit
5. Burette
6. Receiver flask
7. Sulfuric acid (H_2SO_4)
8. Digestion tablets or catalyst (containing K_2SO_4 and $CuSO_4$)
9. Sodium hydroxide (NaOH)
10. Boric acid (H_3BO_3) solution
11. Methyl red or bromothymol blue indicator solution
12. Standardized hydrochloric acid (HCl) solution
13. Phenolphthalein indicator solution

14. Distilled water
15. Analytical balance

Procedure:

Digestion Phase

- Weigh sample of the mixed fruit jam using an analytical balance.
- Transfer the weighed sample into a Kjeldahl digestion flask.
- Add a digestion tablet or catalyst (containing K_2SO_4 and $CuSO_4$) to the flask. This catalyst helps in the breakdown of organic matter during digestion.
- Add concentrated sulfuric acid (H_2SO_4) to the flask. The acid will digest and oxidize the organic matter, converting the nitrogen in proteins to ammonium sulfate $(NH_4)_2SO_4$.
- Place the digestion flask on a heating mantle or digester unit. Heat the mixture gently to initiate digestion. Gradually increase the heat until the solution becomes clear or nearly colorless. Continue heating for about 1-2 hours until all organic matter is oxidized, and only inorganic ammonium sulfate remains.

Distillation Phase

- Allowed the digestion flask to cool after the digestion process is complete.
- Set up the Kjeldahl distillation unit with a Kjeldahl condenser and a receiver flask.
- Added a solution of sodium hydroxide (NaOH) to the digestion flask. This will convert the ammonium sulfate to ammonia gas (NH_3).
- Start the distillation process by heating the digestion flask. The ammonia gas will be released and distilled into the receiver flask.

Titration Phase

- Collect the distillate (ammonia) in a receiver flask containing a known volume of boric acid (H_3BO_3) solution and a few drops of methyl red or bromothymol blue indicator solution.
- Titrate the collected ammonia solution with standardized hydrochloric acid (HCl) solution. The titration should be performed until the color of the indicator changes (usually to a pink color). Record the volume of HCl solution used.

Conclusion:

$$\%\text{Nitrogen} = \frac{0.014 \times \text{Normality of HCl} \times \text{Volume of HCl} \times 100}{\text{Sample(g)}}$$

$$\%\text{Protein} = \%\text{Nitrogen} \times 6.38$$

3.5.8 Determination of Fat

The determination of fat content in mixed fruit jam using the Soxhlet method reported by AOAC (2005) involves extracting the fat from the sample using a solvent (in this case, n-hexane).

Materials and Equipment

1. Mixed fruit jam sample
2. Analytical balance
3. Soxhlet extraction apparatus
4. Extraction thimble (usually made of cellulose or glass microfiber)
5. N-hexane (solvent)
6. Round-bottom flask
7. Condenser
8. Heating mantle or hot plate
9. Rotary evaporator (optional)
10. Weighing paper
11. Analytical balance

Procedure

1. Weigh sample of the mixed fruit jam using an analytical balance.
2. Placed an extraction thimble in an oven or drying oven at a temperature suitable for drying (typically around 100-105°C) to ensure it is completely dry.
3. Weighed the dry extraction thimble.
4. Transferred weighed mixed fruit jam sample into the dry extraction thimble.
5. Assembled the Soxhlet apparatus, which consists of a round-bottom flask, extraction thimble, condenser, and heating mantle or hot plate.
6. Poured n-hexane (the solvent) into the round-bottom flask. The solvent was heated and vaporized, carrying the fat from the sample to the top of the Soxhlet apparatus.
7. Start the extraction process. The solvent will rise into the condenser, dissolve the fat from the sample, and then drip back into the round-bottom flask. This cycle will continue for several hours, allowing for thorough extraction.
8. Continue the extraction process until the fat collected in the round-bottom flask appears clear and free of the sample.
9. Carefully removed the fat residue from the round-bottom flask. Re-weighed the container after removing the solvent to determine the weight of the fat residue.

Calculations:

$$\%\text{Fat} = \frac{\text{Round bottom flask with fat} - \text{Round bottom flask without fat}}{\text{Sample weight}} \times 100$$

3.5.9 Determination of Carbohydrates

The carbohydrate content was determined by subtracting moisture, fat, protein, ash, fiber from 100 (AOAC, 2005). This method is often referred to as the "complementary method" for determining carbohydrates, as it calculates carbohydrates indirectly by accounting for the other major components of the food.

Materials

- Moisture content (previously determined)
- Fat content (previously determined)
- Protein content (previously determined)

- Ash content (previously determined)
- Fiber content (previously determined)

Procedure:

Already determined the percentages of moisture, fat, protein, ash, and fiber in the food product using their respective analytical methods.

Calculation:

$$\%\text{CHO} = 100 - (\text{Ash} + \text{Fat} + \text{Protein} + \text{Moisture} + \text{Crude Fiber})\%$$

3.6 Microbial Analysis

The media used are Nutrient agar (N.A), and Potato Dextrose Agar (PDA). All media used were prepared according to the manufacturer's instructions. The mean counts of bacteria in colony forming fruits per gram of samples were determined.

3.6.1 Total Plate count

Pour plate method was used for counting the number of colony-forming bacteria present in the sample. The plate is inverted and incubated at 37°C for 18-24 hours.

Materials and Equipment:

1. Sample (e.g., mixed fruit jam)
2. Sterile petri dishes
3. Nutrient agar or other suitable growth medium
4. Sterile pipettes or a calibrated dropper
5. Incubator set at 37°C
6. Autoclave or pressure cooker for sterilization
7. Sterile glass or plastic rods (optional)
8. Sterile distilled water

Procedure:

1. Sterilized all equipment, including petri dishes, pipettes or droppers, and glass/plastic rods if used. Autoclave or use a pressure cooker to ensure proper sterilization.
2. Prepared the growth medium, such as nutrient agar, following the manufacturer's instructions. Sterilize the medium, cool it to a suitable temperature (around 45-50°C), and pour it into sterile petri dishes (enough to cover the bottom of each dish). Allowed the medium to solidify.
3. Prepared a series of dilutions of sample to ensure countable colonies. Typically, 1:10, 1:100, and 1:1000 dilutions. To do this, mixed 1 mL of the sample with 9 mL of sterile distilled water to make a 1:10 dilution, and so on for further dilutions.
4. For each dilution, took a known volume (e.g., 1 mL) and aseptically transfer it onto the surface of a solidified agar plate.

5. Inverted petri dishes placed in incubator set at 37°C for 18-24 hrs. This allows bacterial colonies to grow.
6. After incubation, observed the petri dishes.

Calculation:

$$\text{Colony forming unit} = \frac{(\text{no. of colonies x dilution factor})}{\text{volume of culture plated in ml}}$$

3.7 Sensory Analysis

Assessors evaluated the sensory quality of the mixed fruit jam using a number of different sensory criteria, including colour, texture, flavour, mouthfeel, and overall acceptance. Sample presented to the assessors was about 2 tablespoons.

3.7.1 Hedonic Scale Testing

A survey among 45 untrained assessors of the Daffodil International University including general students and some faculty members was conducted. The process was completed using a structured sensory evaluation form. Prepared a structured sensory evaluation form or questionnaire. The form included Identification of the product/sample. Space for assessors' demographic information (e.g., Name, ID). A hedonic scale for assessing product liking. The hedonic scale typically ranges from "1" (dislike extremely) to "9" (like extremely), with "5" as the neutral point (neither like nor dislike). Space for comments or additional notes.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Results

The mixed fruits jam were prepared and analyzed in the NFE lab. Proximate compositions, physical properties, microbial and sensory quality were analyzed and the results are presented as below-

4.1.1 Proximate Compositions

Table 4.1: Proximate composition of mixed fruit jam

Parameters	Results
Moisture content	40.10%
Ash content	0.44%
Crude fiber	10.57%
Fat content	0.69%
Protein Content	1.86%
Carbohydrates	46.34%

4.1.2 Physical Properties

Table 4.2: Physical Properties of jam

pH	°Brix	Total Titratable Acidity (TTA)
3.14	67%	0.58%

4.1.3 Calorie content

Table 4.3: Calorie content of jam

Carbohydrate	Protein	Fat	Total Calorie
46.34%	1.86%	0.69%	199 Kcal
185.36 kcal	7.44 kcal	6.21 kcal	

4.1.4 Microbial Quality

Table 4.4: Microbial load of mixed fruit Jam

Component	Dilution factors	Colonies	Colony forming Unit
Sample	10^3	13	2.6×10^4cfu/g

4.1.5 Sensory Quality

Table 4.5: Sensory Scores of Mixed Fruit Jam

Hedonic Scale	Sensory Attributes				
	Color	Texture	Mouthfeel	Flavor	Overall Acceptance
Disliked Moderately	1(2.2)	--	--	--	--
Neutral	2(4.4)	2(4.4)	5(11.1)	2(4.4)	1(2.2)
Liked Slightly	4(8.9)	6(13.3)	3(6.7)	5(11.1)	6(13.3)
Liked Moderately	9(20.0)	15(33.3)	9(20.0)	11(24.4)	8()17.8
Liked Very Much	17(37.8)	17(37.8)	18(40.0)	15(33.3)	23(51.1)
Liked Extremely	12(26.7)	5(11.1)	10(22.2)	12(26.7)	7(15.6)
Mean	7.64	7.38	7.56	7.67	7.64
Std. Deviation	±1.300	±1.007	±1.235	±1.128	±0.981

4.2 Discussion

The mixed fruits jam was prepared using dates, apples and oranges. The proximate analysis revealed it contains 40.10% moisture, 0.44% Ash, 10.57% Crude fiber, 0.69% Fat, 1.86% Protein, and 46.34% Carbohydrates. The pH of jam was 3.14 and TSS was 67°Brix. Total titratable acidity was 0.58%. According to Makanjuola et al., (2019) pH for the jam samples ranged from 3.14-4.52, total titratable acidity (TTA) varied from 0.60-0.68 while total soluble solid (TSS) indicating the brix level ranged from 43.00-51.00%. The newly developed jam slightly matched with mentioned study. The jam contains a total of 199 kilocalories (kcal) of energy, with 185.36 kcal derived from carbohydrates, 7.44 kcal from protein, and 6.21 kcal from fat.

Microbial load of mixed fruit Jam was 2.6×10^4 cfu/g. According to Makanjuola et al., (2019) sample DOA has 55.00×10^4 cfu/g, sample DO have 13.67×10^4 cfu/g while sample DA has 17.67×10^4 cfu/g respectively. There are differences in the microbial load results between Mixed Fruit Jam samples and the samples in the Makanjuola et al. (2019) studies. The microbial load in jam samples is generally lower, which is still considerably lower than the microbial load in DOA from Makanjuola et al. (2019). This suggests that the microbial contamination levels in the jam sample is lower that product developed by Makanjuola et al. (2019).

The sensory analysis was conducted among 45 participants. The texture attribute scored the lowest, which can be improved further. The mean score for the color attribute is 7.64±1.30. This suggests that, on average, the participants found the color of the Mixed Fruit Jam to be quite favorable. The mean score for the texture attribute is 7.38±1.01. This indicates that, on average, participants found the texture of the jam to be less favorable compared to the other attributes evaluated.

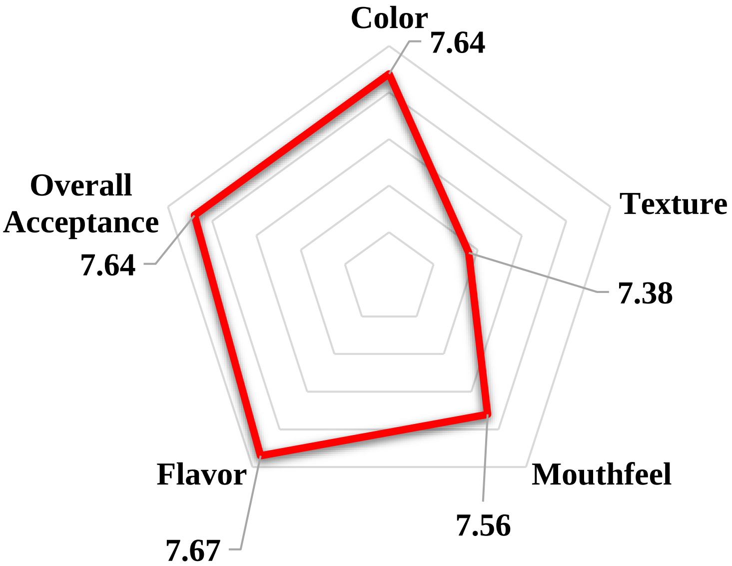

Figure 4.1: Graph chart representing Sensory mean score

The mean score for mouthfeel is 7.56±1.24. This suggests that participants generally found the mouthfeel of the jam to be reasonably good, although it didn't score as high as the color or flavor. The mean score for flavor is 7.67±1.13. This is the highest mean score among the attributes, indicating that participants found the flavor of the jam to be particularly enjoyable. The mean score for overall acceptance is 7.64±0.98. This score reflects the overall satisfaction of participants with the Mixed Fruit Jam, taking into account all sensory attributes. It is quite high, suggesting that, overall, participants liked the product.

CHAPTER 5

CONCLUSION

5. Conclusion

The conclusion is that underutilized date fruit can be combined with other essential fruits such as apple and oranges to create jam that is nutritionally and microbiologically safe. It is also an opportunity to see if the fruit can be transformed into other products, such as jam, so that less fruits are wasted after being harvested. The Mixed Fruit Jam was prepared using dates, apples, and oranges. The proximate analysis revealed its composition, including 40.10% moisture, 0.44% ash, 10.57% crude fiber, 0.69% fat, 1.86% protein, and 46.34% carbohydrates. It also had a pH of 3.14 and a TSS of 67°Brix, with a total titratable acidity of 0.58%. These findings provide a detailed snapshot of the jam's nutritional and physicochemical properties. The newly developed jam exhibited lower microbial contamination levels, indicating better quality and safety. The color attribute received a favorable mean score of 7.64±1.30, indicating that participants found the color appealing. However, the texture attribute scored the lowest at 7.38±1.01, suggesting room for improvement. Participants generally found the mouthfeel (7.56±1.24) and flavor (7.67±1.13) to be enjoyable. Importantly, the overall acceptance score was high (7.64±0.98), indicating that, despite the texture issue, participants liked the product.

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APPENDICES

Appendix 1: Synopsis

Title: Proximate Analysis of Mixed Fruits Jam Developed from Dates with Inclusion of Apple and Orange Fruits

Introduction

The investigation commences with the selection of high-quality dates, apples, and oranges, ensuring freshness and optimal ripeness. The fruits are processed, and their individual contributions to the jam's sensory attributes, nutritional content, and overall quality will be systematically analyzed.

Objectives

The study focuses on the development and proximate analysis of a unique mixed fruits jam formulated by incorporating dates, apples, and oranges. The research aims to create a wholesome and nutritionally rich jam alternative by blending these diverse fruits, each renowned for its distinct flavor profile and nutritional benefits.

Materials and methods

- *Selection of Ingredients:* High-quality dates, apples, and oranges are selected based on freshness and ripeness.
- *Processing:* Fruits are processed to create a homogeneous jam mixture.
- *Proximate Analysis:* The proximate analysis involves determining moisture content, ash content, lipid composition, protein content, and carbohydrate distribution following standard methods.
- *Sensory Evaluation:* Untrained panelists conduct sensory evaluations to assess taste, aroma, color, and texture.

The proximate analysis encompasses the assessment of various nutritional components, including moisture content, ash content, lipid composition, protein content, and carbohydrate distribution. Each element is scrutinized to understand the nutritional composition of the mixed fruits jam, providing valuable insights into its potential health benefits.

The study also explores the impact of the fruit combination on the organoleptic properties of the jam, such as taste, aroma, color, and texture. Sensory evaluations are conducted to gauge consumer preferences and acceptance of the mixed fruits jam compared to traditional single-fruit jams.

Furthermore, the research investigates the shelf stability and microbiological aspects of the developed jam, ensuring that it meets safety standards and possesses an adequate shelf life.

Expected outcome

The findings of this study are expected to contribute to the field of food science and technology by providing a detailed proximate analysis of a novel mixed fruits jam. The results will shed light on the nutritional advantages of incorporating dates, apples, and oranges into a single product, offering a potential new option for health-conscious consumers seeking diverse and flavorful food choices.

PROXIMATE ANALYSIS OF MIXED FRUITS JAM DEVELOPED FROM DATES INCLUSION OF APPLE AND ORANGE FRUITS

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