

Study of physiochemical properties and sensory evaluation of jam produced from different sources of plants

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Received: May 16, 2025	Abstract The current study was undertaken to investigate the quality of pumpkin pulp <i>Cucurbita moschata</i> and dry roselle <i>Hibiscus sabdariffa</i> jam formulations by using three different types of pectin (high methoxyl pectin, low methoxyl pectin, and commercial pectin), and stored at room temperature for 90 days. In this study, FTIR was used to identify the functional groups of pectins. Consequently, physicochemical properties were analyzed using key parameters such as total soluble solids (TSS), pH, reducing sugar, total polyphenol (TPP), total carotene (TC), and total anthocyanin, as well as sensory evaluation were analyzed. The results showed that the range of TSS% was between 18.73-63.30% and increased after 90 days. Moreover, the range of total carotene in pumpkin, total anthocyanin in roselle, and total polyphenol in both pumpkin and roselle jams was observed as (13.20-16.93 mg/100g), (89.23-93.24 mg/100g), and (38.32-608.41 mg/100g), respectively. As well as all compounds significantly decreased at the end of storage. Finally, the sensory evaluation, such as flavor, mouthfeel, taste and appearance, color, and overall acceptability of different jam formulations, was unstable during the storage period, and jam formulations with a high amount of sugar were more acceptable compared to those formulations with stevia. Keywords: Pumpkin, Roselle, Jam, Pectin, Phytochemicals
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Introduction

Fruits and herbs are a good source of macro and micronutrients, but because they are perishable, they need to be handled carefully to avoid inactivation of enzymes, microbial growth and maintain their rich nutritional value [1].

Cucurbita moschata, commonly referred to as pumpkin, belongs to the Cucurbitaceae family [2]. Pumpkin production in tropical and subtropical America produces various varieties with a yellow-orange color due to carotenoids and pectin. Available year-round, pumpkins have problematic skin. Pumpkin can be eaten raw or as a component in pies, soups, pastries, jams, and marmalades [3].

Although Roselle (*Hibiscus sabdariffa* L.) is a member of the Malvaceae family, it can be found in tropical and subtropical areas of the world [4]. In tropical regions,

this herb is thought to have significant economic potential. According to [5] its products have been proposed as natural food coloring agents, emulsifiers for carbonated drinks, and for use in the production of jam and juice. Processing is necessary to retain their quality over their limited shelf life. Manufacturing of jam, jelly, marmalades, candies, and squashes increases consumption and maintains fruit quality[6]. Jam is a classic fruit product used to preserve seasonal fruits and enable fruit consumption in the off-season. Fruit pulp, sugar (sucrose), pectin, acid, and other compounds (preservatives, coloring agents, and flavorings) are boiled until the mixture is solid enough to hold the fruit tissues in place. Jam is one of the most commonly consumed fruit preserves [7]

Pectin is one of the most valuable bioactive components that may be extracted from fruit wastes. It is found in fruit cell walls usually and has important technological and nutritional attributes, mainly because it can gel with sugars and acids under the right conditions [8]. Therefore, the current study aimed to investigate the physicochemical properties and sensory evaluation of jam produced from different sources of plants.

Materials and Methods

Pumpkin and dry roselle jams preparation

Choosing a high-quality pumpkin, washing it with tap water, using a knife to cut off the skin, seeds and fibrous threads, slicing the pulp into pieces and then grinding it in a grinder were the steps involved in producing pumpkin pulp jam. Adding pectin powder and citric acid to a pot of water, sugar, and pumpkin pulp that had been heated on a hot plate, then spoon test was then used to judge endpoint of the final result. After being removed from the hot plate, it was carefully hot packed and placed in a sterile, clean glass jar to be kept at room temperature for 90 days. For making the dry roselle jam, the unwanted parts and anything else that would harm the jam were removed at the beginning. To extract the flavor, color, and scent, wash the roselle, then add water at a 6:1 ratio and cook for 2 minutes at 80°C. After filtering, we cooked the juice on a hot plate and mixed it with sugar. Next, we added pectin and citric acid. Once the endpoint has been determined by the spoon test, the hot jam is placed in sterile, clean glass jar and allowed to cool at room temperature for 90 days.

For making sugar-free jam with dry roselle and pumpkin pulp stevia was used as sweetener instead of sugar. Calcium chloride (CaCl_2) and potassium metabisulfide (KMS) were used as a preservatives to produce the gel with low methoxyl pectin. Thus, the control jam formulation was included all ingredients except the pectin.

Table (1): Jam formulations with various ingredients and methods

Treatment	Comedies	Sugar	water	Stevia	Pectin	Citric acid	Calcium chloride	Potassium metabisulphite
C(control)	100g pumpkin pulp	100g	100ml	-----	-----	1g	-----	-----
A1	100g pumpkin pulp	100g	100ml	-----	2g HMP	1g	-----	-----
A2	100g pumpkin pulp	100g	100ml	-----	2g CP	1g	-----	-----
A3	100g pumpkin pulp	-----	-----	3 g	0.5g LMP	-----	0.2g	0.1g
B1	100g dry roselle juice	100g	100ml	-----	4g HMP	1g	-----	-----
B2	100g dry roselle juice	100g	100ml	-----	4g CP	1g	-----	-----
B3	100g dry roselle juice	-----	-----	3 g	0.5g LMP	-----	0.2g	0.1g

HMP: high methoxyl pectin, LMP: low methoxyl pectin, CP: commercial pectin.

Infrared Fourier-Transform Spectroscopy (FTIR)

Pectin (commercial, HMP, and LMP) were analyzed using Fourier-transform infrared spectroscopy. A Fourier Transform Infrared (FTIR) spectrometer (SHIMADZU IR Affinity-1S) fitted with a ZnSe Attenuated Total Reflectance (ATR) accessory was used to evaluate the three varieties of pectins. This ZnSe ATR crystal was cleaned.

A small amount of the pectins was placed directly on top of the ATR crystal, and pressure was applied using the integrated press to ensure optimal contact. The scan was carried out between 4000 and 400 cm^{-1} , and the resulting spectra were analyzed to identify distinctive functional groups[9].

Determination of pH

For this test, a Testo 206-pH meter (RS Components Ltd., Northants, United Kingdom), at room temperature was used. The pH meter was first calibrated by using calibration buffers (pH 4, 7 and 10), after that, the samples were tested in triplicate [10].

Total Soluble Solids (TSS)

To measure the jam's TSS, a digital refractometer (HANNA model HI96801, Bedfordshire, UK) with a range of 0-85% was employed. Following calibration with dis-

tilled water, a few drops of jam were applied to the glass plate, and the TSS was measured [10].

Reducing sugar

A 2.0 mL portion of the solution was diluted to 10.0 mL after 0.25 g of sample was dissolved in 25.0 mL of distilled water. A 2.0 mL portion of the diluted solution was filtered, combined with 1.5 mL of DNS solution and 6.5 mL of distilled water, heated for 10 minutes in a water bath at 80 °C, and then cooled for 20 minutes with water. Using the UV-Vis technique, the resultant solution was measured at the wavelength of maximum absorption 540 nm. The same process was used to prepare the blank sample[11].

Total carotene content

The pigment was extracted using two grams of jam and twenty milliliters of 80% acetone. To stop the carotene pigment from oxidizing, 0.1 g of sodium bicarbonate was also added to the mixture. A spectrophotometer was used to measure the samples optical density at 480 nm after the solution had been filtered [12]. utilizing a Jenway-7205UV-VIS spectrophotometer (Cadmus Products, Essex, UK).

to determine the total carotenes using the following formula:

$$X = \frac{EY}{e \times 100} \times 1000$$

Whereas:

X = carotene concentration in solution (mg/100 g).

E = device reading at a wavelength of 480 nm.

Y= volume of the final solution after dilution with acetone.

e = represents the specific extinction coefficient (Specific for the total carotene and is equal to 2300

Determination of the total polyphenols content (TPP)

The method for determining the total polyphenols, as described by [13] involved taking 5 grams of jam and added it in 100 ml of ethanolic (%95): HCl 1.5N (85:15). The mixture was then diluted five times with 500 milliliters of HCl to get the total volume, and the solution was left for 24 hours at 4 °C for extraction purposes. The suspension was then filtered through filter paper, and the absorbance was calculated using a spectrophotometer device at 280 nm based on the following equation:

$$\begin{aligned} & \text{total polyphenols} \left(\frac{\text{mg}}{100\text{g}} \right) \\ &= \frac{\text{optical density at a wavelength of 280} \times \text{volume of the solution used in the extraction} \times \text{total volume}}{\text{weight of sample} \times 98.2} \times 100 \end{aligned}$$

Determination of the total anthocyanin content

According to [13] the procedure for identifying the anthocyanins entailed adding 5 grams of jam to 100 milliliters of ethanolic (%95): HCl 1.5N (85:15). After diluting the combination five times with 500 milliliters of HCl to determine its total volume,

the solution was allowed to sit at 4 °C for 24 hours in order to facilitate extraction. After passing the suspension through filter paper, the absorbance was measured at 535 nm using a spectrophotometer equipment and the equation below: A Jenway-7205UV-VIS spectrophotometer (Cadmus Products, Essex, UK) was used.

$$\text{anthocyanin} \frac{\text{mg}}{100\text{g}} = \frac{\text{optical density at a wavelength of 535} \times \text{volume of the solution used in the extraction} \times \text{total volume}}{\text{weight of sample} \times 98.2} \times 100$$

Sensory evaluation

Ten panelists from the University of Raparin's College of Agricultural Engineering Science in Iraq, five of them were men and five of them were women, and whose ages ranged from twenty to thirty-five, were shown the jam samples that were being used as carriers. Using a five-point hedonic test, panelists were asked to score the sample's flavor, mouthfeel, taste, appearance and color, and overall acceptability. The analysis was performed on the seven samples[14].

Statistical analysis

The Completely Randomized Design (CRD) was used to set up the one-factor experiment with three replications. IBM SPSS (2021) version 27.0.1.0 program was used to statistically evaluate the data collected on different parameters. The Duncan test, one-way ANOVA, and a completely randomized test were used to determine the significance of the mean results at $P < 0.05$.

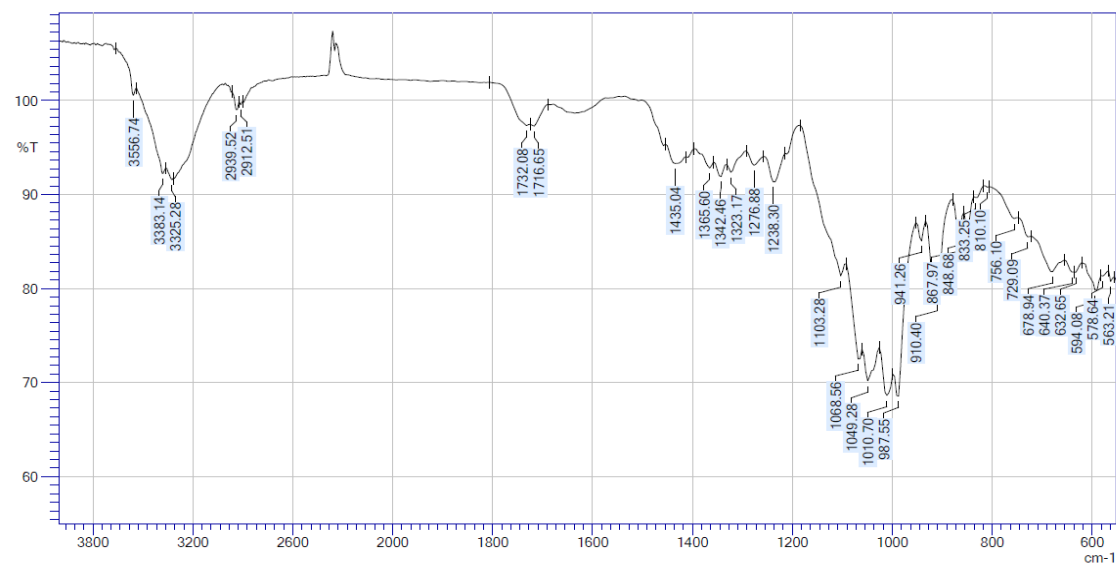
Results and Discussion

Determination functional groups of pectin's using (FTIR)

Fourier transform infrared spectroscopy FTIR plays a crucial role in identifying functional groups and compounds found in plant materials. Figure (1) presents the results of the FTIR analysis.

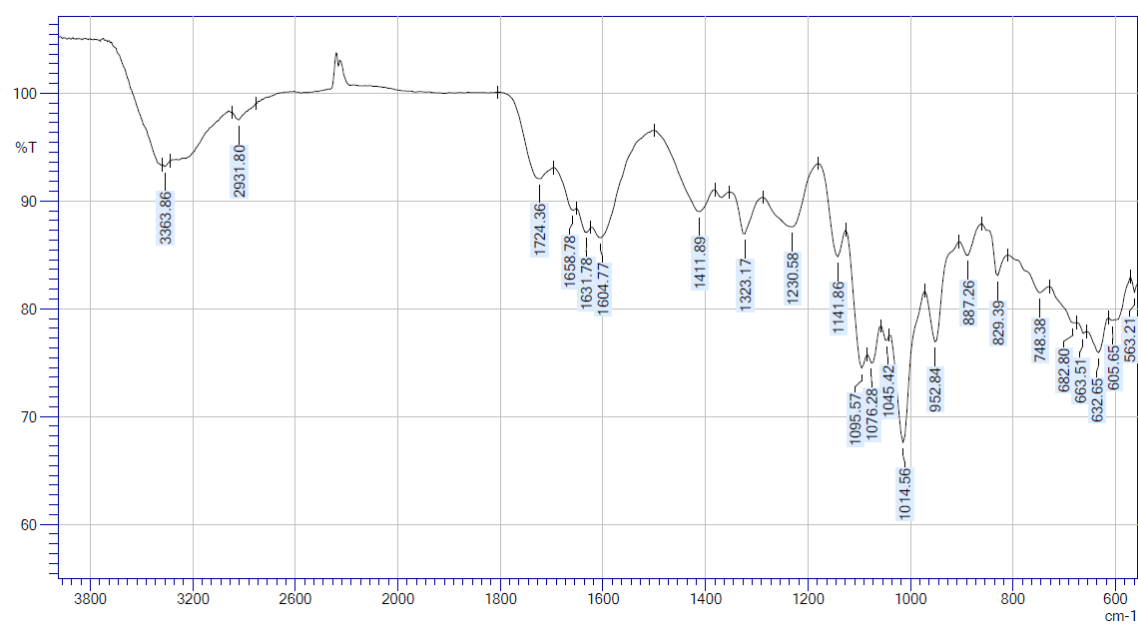
The important absorptions at 3363.86 cm^{-1} in the low methoxyl pectin spectral range of commercial pectin and HMP samples are due to stretching of the hydroxyl group, occurring within the ranges of $3325.28\text{-}3560$ and $3325.28\text{-}3556.74 \text{ cm}^{-1}$.

The medium bands near 2939.52 cm^{-1} in commercial pectin (2931.80 and 2912.51 cm^{-1} in Low methoxyl pectin and high methoxyl pectin, respectively) are produced by the C-H stretching vibrations of CH_2 groups. The bands within the frequency range of $3000\text{-}2800 \text{ cm}^{-1}$ are widely recognized [15,16]



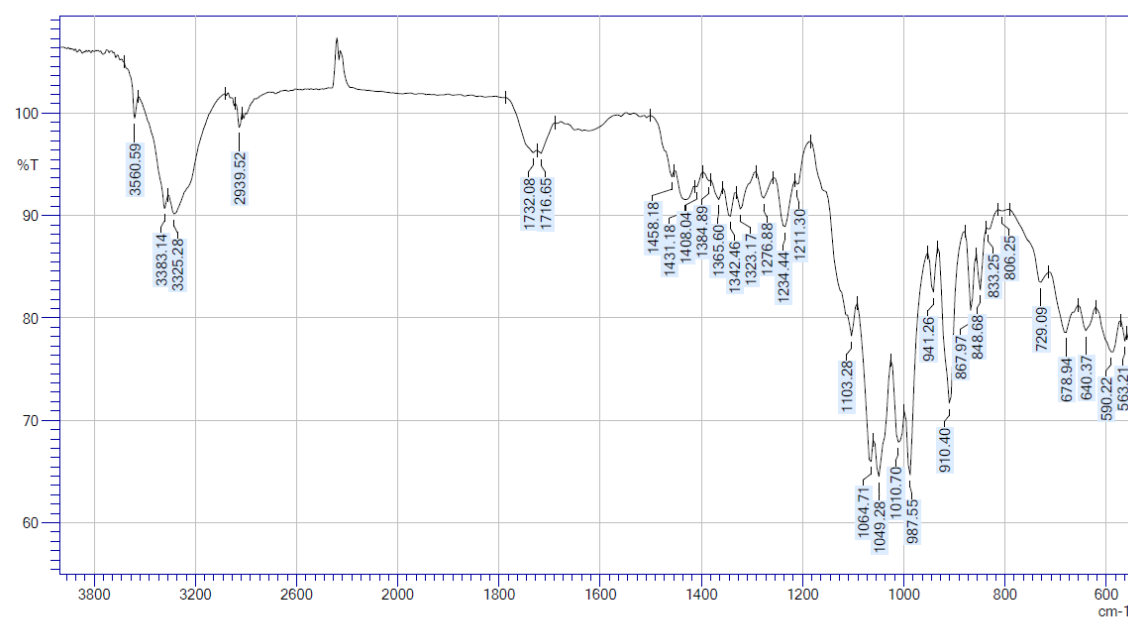
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A. High Methoxyl pectin (HMP)



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B. Low Methoxyl Pectin (LMP)



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C. Commercial Pectin (CP)

Figure (1): FTIR to investigate functional groups of pectin

Another absorption band across the entire spectral region occurs in commercial pectin and high methoxyl pectin at 1716.8 and 1732.08 cm^{-1} , and for low methoxyl pectin at 1658.78 and 1724.36 cm^{-1} , which was ascribed to the absorption of ester carbonyl (COOR) groups and the carboxylate ion stretching band (COO). The low methoxyl pectin region also has an absorption at 1631.78 cm^{-1} .

In addition, the presence of phenolic compounds, specifically C=C stretching vibrations of the ring in the anthocyanins and flavones group, was linked to peaks in the 1500–1400 cm^{-1} range [17].

Polysaccharides, such as dietary fibers and pectin, were identified as the source of CH₂ bending vibrations at 1365 cm^{-1} , C–O stretching, and O–H bending vibrations at 1231 cm^{-1} .

The "fingerprint" area, which is the absorption interval between 800 and 1200 cm^{-1} , is one of the most important parts of the pectin molecule and presents an essential challenge to functional group analysis alone [18].

pH determination

Table 2 showed that Jam A3 had the maximum value of pH 4.82 at first day and this data was decreased to 4.75 after 90 days. In contrast, jam samples B2 and B3 showed the lowest values of pH 2.60 and 2.64 after one day of storage, after that the pH values were decreased to 2.30 and 2.35 after 90 days at room temperature. Therefore, all jam samples observed a reduction of pH value during storage. This result is agreement with [19] the pH of pumpkin guava blended jam decreased during the duration of six months of storage.

Total soluble solid (TSS)

Table 2 described that the total soluble solids percentage for free-sugar treatments A3 and B3 with values of 19.66% and 18.73% at the first day of storage, rising to 21.30 and 20.46% after 90 days. For high sugar jam, the treatment range is from 63.30% to 60.20% at the first day of storage. B1 indicates the highest TSS value, starting at 63.30% and increasing to 64.66 after 90 days of storage. In comparison, A2 is the lowest TSS value, beginning at 60.20% and rising to 63.76% over the same period. Sample C Is considered control without add pectin had the most change in TSS value during storage. Due to the addition of sucrose and acid, the high sugar treatments (C, A1, A2, B1 and B2) showed a higher TSS% compared to the stevia treatments (A3 and B3).

Sample C, a control without pectin, shows the most significant change in TSS value. High sugar treatments show higher TSS% [20]. Similar results about an increase in the TSS of guava jam during storage were also reported by [21]. According to [22] TSS of pitanga jam diet jam is 22.95%.

Reducing sugar

The results showed that the jam C was recorded highest value of reducing sugar (19.05%) and Jam A3 obtained lowest quantity of reducing sugar (1.59%) (Table 2). When comparing high sugar jam to free sugar jam, the high reducing sugar concentration can be explained by the inversion of sucrose. Several researchers reported that about this parameter. [23] were reported that increase amount of reducing sugar of apple and pear jam from 16.62% to 42.99% after 90 days of storage. According [24] to storing guava-papaya jam at room temperature for three months causes the reducing sugar content to rise. The hydrolysis sugars into inversion of sugars are responsible for the rise in the reducing sugar.

Table (2): pH, TSS and Reducing sugar of pumpkin and dry roselle jams during storage.

	Day	C	A1	A2	A3	B1	B2	B3
pH	1	3.60±0.05 ^c	3.65±0.03 ^c	3.90±0.02 ^b	4.82±0.02 ^a	3.06±0.04 ^d	2.60±0.01 ^e	2.64±0.04 ^e
	30	3.52±0.02 ^d	3.63±0.01 ^c	3.83±0.03 ^b	4.79±0.03 ^a	2.83±0.03 ^e	2.50±0.02 ^f	2.40±0.01 ^g
	90	3.36±0.04 ^d	3.59±0.02 ^c	3.76±0.04 ^b	4.75±0.04 ^a	2.66±0.03 ^e	2.30±0.03 ^f	2.35±0.03 ^f
TSS	1	60.26±0.03 ^d	62.20±0.10 ^c	60.00±0.00 ^e	19.66±0.11 ^f	63.30±0.10 ^a	62.75±0.05 ^b	18.73±0.11 ^g
	30	62.28±0.03 ^d	62.53±0.05 ^c	61.40±0.00 ^e	20.33±0.05 ^f	63.90±0.10 ^a	63.10±0.10 ^b	19.60±0.10 ^g

	90	65.70±0.02 ^a	64.10±0.10 ^d	63.76±0.05 ^e	21.30±0.10 _f	64.66±0.11 _b	64.23±0.05 _c	20.46±0.05 ^g
Reducing sugar%	1	19.05±0.05 ^a	18.50±0.05 ^b	18.34±0.04 ^c	1.59±0.12 ^g	16.11±0.09 _e	17.44±0.05 _d	6.35±0.01 ^f
	30	24.29±0.02 ^c	20.19±0.07 ^e	22.80±0.06 ^d	2.37±0.10 ^g	24.74±0.13 _b	24.97±0.01 _a	9.14±0.01 ^f
	90	35.12±0.01 ^a	32.15±0.05 ^e	33.63±0.04 ^c	4.28±0.02 ^g	32.84±0.03 _d	34.62±0.01 _b	12.33±0.02 ^f

The mean± SD of three replicates is used to display the values. Within a same row, values with distinct superscripts show statistically significant differences (p<0.05).

Table (3): phytochemicals of pumpkin and dry roselle jams during storge

parameters	Day	C	A1	A2	A3	B1	B2	B3
Total Carotene mg/100g	1	13.20±0.10 ^d	15.23±0.05 ^b	14.16±0.05 ^c	16.93±0.05 ^a			
	30	11.63±0.11 ^d	14.30±0.10 ^b	12.20±0.17 ^c	15.73±0.05 ^a			
	90	7.59±0.01 ^d	11.33±0.11 ^b	9.73±0.05 ^c	13.23±0.15 ^a			
Total poly Phenol mg/100g	1	38.32±0.02 ^g	45.40±0.10 ^f	42.23±0.05 ^e	54.20±0.10 ^d	589.55±0.04 ^b	556.33±0.05 ^c	608.41±0.09 _a
	30	29.88±0.03 ^g	41.10±0.10 ^e	38.36±0.15 ^f	51.73±0.05 ^d	542.43±0.03 ^b	525.86±0.05 ^c	589.98±0.04 _a
	90	21.34±0.01 ^g	35.50±0.10 ^e	32.63±0.02 ^f	46.00±0.10 ^d	524.80±0.10 ^b	484.25±0.05 ^c	572.86±0.05 _a
Total Anthocyanin mg/100g	1					90.73±0.01 _b	89.23±0.01 ^c	93.24±0.03 ^a
	30					82.97±0.02 _b	80.61±0.02 ^c	88.85±0.00 ^a
	90					75.80±0.02 _b	72.55±0.05 ^c	85.68±0.01 ^a

The mean± SD of three replicates is used to display the values. Within a same row, values with distinct superscripts show statistically significant differences (p<0.05).

Total Carotene (TC)

After one day of storage, jam A3 total carotene content reached a maximum of 16.93 mg/100g, which decreased to 13.23 mg/100g after ninety days. However, by the conclusion of the storage time, the minimum total carotene content in jam C (13.20 mg/100g) had dropped to 7.59 mg/100g. However, compared to the jam sample with high sucrose, the findings of the total carotene analysis in the stevia sample jam A3 showed a greater amount. These findings concur with those of [22] who found that Pitanga diet jam has more carotene overall than traditional jam manufacture.

Total polyphenol (TPP)

Jam B3 had the greatest total poly phenol value (608.40 mg/100g) on the first day of storage, and by the conclusion of the storage period, it had dropped to 572.86 mg/100g. In contrast, jam C had the lowest parameter value (38.32 mg/100 g), which dropped to 21.34 mg/100 g after 90 days. From the first to the last day of storage, the TPP amount often decreased.

this result is in agreement with [25] who reported that the total phenol content was higher in the jam samples prepared with LM pectin than in those prepared with HM pectin. These findings are consistent with those of a previous study [26] reported that roselle jam contained 644 mg/100g of TPP.

Total anthocyanin

After one day of storage, the maximum anthocyanin content was (93.24 mg/100g) and after 90days, it reduced to 85.68 mg/100g. B2 had the lowest anthocyanin concentration after one day, at 89.23 mg/100g, and after 90 days, it had dropped to 75.80 mg/100g.

Jam B3 formulation with low methoxyl pectin (LMP) was recorded high retention of anthocyanin and minimum lost during storage, this result agreement with [25] who reported jam samples use low methoxyl pectin was high concentration value of total anthocyanin compared to conventional jam.

Sensory evaluation

Appearance and color

According to the results, the first-day highest score for A1 treatments was 5.00, while the lowest acceptable score for B3 treatments which used stevia was 3.90. Compared to stevia jam (A3 and B3), high-sugar jams (C, A1, A2, B1, and B2) scored higher on appearance acceptability.

These findings were consistent with those of [27] who found a decrease in the color of apple jams during storage time . Similar results were also reported by [28] who observed a reduction in the beetroot jams appearance during storage time.

Table (4): Sensory evaluation of pumpkin and roselle jams during storge

Hedonic	Day	C	A1	A2	A3	B1	B2	B3
Appear- ance and color	1	4.90±0.31 ^{ab}	5.00±0.00 ^a	4.30±0.67 ^{cd}	3.90±0.31 ^{de}	4.40±0.51 ^c	4.50±0.52 ^{bc}	3.50±0.70 ^e
	30	4.60±0.69 ^{ab}	4.70±0.67 ^a	4.00±0.47 ^{ab} _c	3.70±0.65 ^{cd}	4.10±0.73 ^{abc}	3.90±0.86 ^{bcd}	3.20±1.22 ^d
	90	4.10±1.44 ^a	4.00±0.66 ^a	3.80±0.66 ^a	3.10±0.56 ^b	3.50±0.52 ^{ab}	3.40±1.07 ^{ab}	2.80±0.63 ^b
Mouth- feel	1	4.50±0.70 ^{ab}	5.00±0.00 ^a	4.60±0.51 ^{ab}	3.80±0.63 ^{cd}	4.80±0.42 ^a	4.20±0.78 ^{bc}	3.60±0.69 ^d
	30	4.10±1.10 ^{bc}	4.90±0.31 ^a	4.10±0.31 ^{bc}	3.40±0.69 ^{de}	4.60±0.51 ^{ab}	3.80±0.63 ^{cd}	3.20±0.42 ^e
	90	3.70±0.87 ^a	4.30±0.48 ^a	3.60±1.17 ^{ab}	3.20±0.42 ^b	4.20±0.63 ^a	3.20±1.03 ^b	2.90±0.31 ^b
Taste	1	4.80±0.42 ^{ab}	5.00±0.00 ^a	4.50±0.52 ^{ab}	3.70±0.67 ^c	4.90±0.31 ^{ab}	4.40±0.69 ^b	3.60±0.84 ^c
	30	4.50±0.70 ^a	4.80±0.42 ^a	4.40±0.61 ^a	3.20±0.78 ^b	4.80±0.42 ^a	4.20±0.78 ^a	3.30±0.94 ^b
	90	3.80±0.78 ^{ab}	4.30±0.67 ^a	3.80±0.78 ^{ab}	3.00±1.15 ^b	4.20±0.63 ^a	3.70±0.94 ^{ab}	3.10±0.73 ^b
Flavor	1	4.60±0.51 ^a	4.80±0.42 ^a	4.70±0.48 ^a	3.40±0.69 ^c	4.50±0.52 ^a	4.30±0.67 ^{ab}	3.90±0.73 ^{bc}
	30	4.20±1.10 ^{ab}	4.40±0.96 ^a	4.20±0.63 ^{ab}	3.30±0.48 ^c	4.00±0.00 ^{abc}	3.80±0.63 ^{abc}	3.50±0.70 ^{bc}
	90	3.50±0.63 ^a	4.00±0.47 ^{ab}	3.80±0.91 ^{ab} _c	2.90±0.48 ^d	3.20±0.91 ^c	3.40±0.69 ^{bc}	3.30±0.94 ^{bc}
Overall accept ability	1	4.50±0.70 ^{ab}	5.00±0.00 ^a	4.30±0.48 ^{bc}	4.10±0.73 ^{bc}	4.60±0.51 ^{ab}	4.60±0.51 ^{ab}	3.80±0.63 ^c
	3	4.30±0.67 ^{ab}	4.80±0.42 ^a	4.10±0.56 ^b	4.00±0.94 ^b	4.20±0.78 ^{ab}	4.00±0.66 ^b	3.30±0.67 ^c
	90	3.40±0.87 ^a	4.00±0.00 ^a	3.40±0.84 ^{ab} _c	3.10±0.56 ^{bc}	3.70±0.67 ^{ab}	3.20±0.42 ^{bc}	2.90±0.56 ^c

The mean± SD is used to display the values. Within a same row, values with distinct superscripts show statistically significant differences ($p < 0.05$).

Mouthfeel

The beginning mouthfeel of the jam samples ranged from 5.0 to 3.60 for samples A1 and B3, and it then decreased over the duration of the 90 days of the storage period. When compared to stevia jam (A3 and B3), high-sugar jams (C, A1, A2, B1, and B2) scored higher on the mouthfeel acceptability scale.

The pectin content of the jam is usually responsible for its mouthfeel and texture. Pectin helps the jam set by forming a network or creating a thickening effect.

This research showed that jams prepared with high methoxyl pectin and commercial pectin more acceptable in mouthfeel than LMP, this may be due to LMP without sugar effect to the texture, this result agrees with [25].

Taste

According to the results, the A1 score maximum acceptable level of taste is 5.0 at the start and drops to 4.80 and 4.30 over 30 and 90 days, respectively. In contrast, compositions A3 and B3 received the lowest acceptance ratings, 3.70 and 3.60, respectively. As a result, these scores decreased to 3.20 and 3.30 after 30 days and to 3.00 and 3.10 after 90 days following the first day of production. The taste acceptability score of high-sugar jams (C, A1, A2, B1, and B2) was greater. A3 and B3 are stevia jam comparisons.

The findings are consistent with those of [29] with apple jam sweetened with stevia that was stored at room temperature for 28 days. However, this research proved that, jams with HMP and CP more acceptable in taste this result agrees with reported that jams with sugar more acceptability [30] because it has a clean, quickly perceptible sweet taste and does not have an unpleasant aftertaste attributed to other low-calorie sweeteners.

Flavor

Sample A1 had the greatest mean value on the first day is 4.80, while Sample A3 had the lowest, 3.40. These values were lost during the course of the 90 days of stored jams. When compared to stevia jam (A3 and B3), high-sugar jams (C, A1, A2, B1, and B2) scored better on flavor acceptance.

The loss of highly volatile aromatic molecules at room temperature, enzymatic breakdown of phenols, and oxidative changes in sugars can all contribute to the flavor reduction that occurs during storage.

Overall acceptability

In fact, the quality of the jam including its appearance and color, texture, taste, and flavor had an effect on its overall acceptance. Sample A1 was the most chosen and sample B3 the least preferred of the jam samples, with an overall acceptability range of 5.0 to 3.8 at the start. The findings about the general acceptance of jam samples showed that, for all samples, this acceptability steadily declined throughout storage.

On the other hand, high-sugar jams (C, A1, A2, B1, and B2) had higher overall acceptability scores than stevia jams (A3 and B3), according to a study by [31] that examined 16 banana jam samples and found that the jam with the least amount of sugar was the least accepted.

In this study samples with HMP highest acceptability then CP, and LMP respectively, the reason for this variation in overall acceptability due to HMP and CP require a high sugar content and acidic conditions, high sugar content helps provide the color

of jam by enzymatic browning but LMP does not require sugar and acid to jam formulation and then affected the final product.

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