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Formulation and Biochemical Evaluation of Watermelon Rind Jam

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ABSTRACT:

The increasing demand for fruits and vegetables has led to a surge in novel technologies for their preservation, including jam processing. Watermelon rind jam presents a unique and creative approach to utilizing a typically discarded part of the fruit. The jam is prepared by cooking watermelon rind with sugar and vanilla essence, resulting in a flavourful spread. The analysis of value-added watermelon rind jam revealed notable findings regarding physicochemical properties, nutritional composition, and phytochemical content. The jam exhibited favourable characteristics with a total soluble solids (TSS) of 65°brix, pH of 4.9, and titratable acidity of 2.57%, indicating high-quality standards. Nutritional analysis revealed moisture content (10.2%), ash (1.08%), fat (1.94%), dietary fiber (0.91%), protein (4.61g/100g), carbohydrate (91.54%), and total energy content (401kcal/100g). The presence of flavonoids, quinones, terpenoids, phenolic compounds, and glycosides in the jam suggests potential health benefits, while tannins and saponins were absent. These findings underscore the promising nutritional and health-enhancing properties of watermelon rind jam, positioning it as a valuable addition to the food industry. Despite its unconventional green color, watermelon rind jam offers a novel and sustainable solution to waste reduction and introduces new flavours to consumers while promoting environmental sustainability.

1. Introduction:

In recent times, there have been challenges in agro-wastes management due to yearly increase in production in perishable fruits which does not commensurate with consumer utilization (Apsara and Pushpalatha, 2002). Hence more wholesome fruit are discarded indiscriminately in the environment. Almost one third of all fruits and vegetables produced in the world are not consumed as a result of post-harvest losses, of which watermelon is no exception (Kader, 2005). Watermelon is an important horticultural crop grown for their fleshy fruit having juicy, crisp, delicacy in taste, sweet, refreshing and thirst quenching (high water) quality attributes along with appreciable nutritional health benefits (Maoto et al., 2019). Watermelon is ranked among the top five fruits worldwide (Gao et al., 2020).

Watermelon (*Citrullus lanatus*) is a tropical fruit widely consumed around the world. It belongs to the family of Cucurbitaceae, which is popular thirst-quencher during the hot summer weather. The Cucurbitaceae is a large plant family found mainly in the warmer parts of all continents. It consists of 119 genera with altogether 825 species. Fruits of Cucurbitaceae have a considerable economic value (Schipper, 2002).

Watermelon rind is one of the major solid wastes generated by several restaurants, cottage fruit juice producers and food industries. Unfortunately, more than 90% of the rind is discarded indiscriminately into the environment thereby constituting environmental challenges. This waste rind is not presently being utilised for any value added processes due to limited research activities focusing on the possible conversion of the waste to other valuable products thereby making it available for dumping as solid waste. Several fruits and mixed fruits wastes have been reutilised for producing value added product such as jam with acceptable physical, chemical and rheological properties(Apsara and Pushpalatha, 2002).

Watermelon rinds are completely edible and can be used in a variety of food applications, despite their frequent discarding. They are rich in minerals like potassium, magnesium, and zinc, vitamins like vitamin C, vitamin B6, and antioxidant-rich citrulline. The rind of watermelon can be preserved and jammed, stir-fried, or pickled (Nayik et al., 2020) .

Jam is made from fresh fruit that has been cooked according to a precise recipe , the natural pectin and acid are extracted. Sugar is then added to the combination to create a colourful and flavorful mixture that settles well and keeps for a long time. Firm in consistency, bright in colour, even in fruit distribution, soft in skin and flesh texture, authentic fruit flavour, packed to the brim of the jar, and able to be stored without syrup, crystals, mould, or fermentation are all characteristics of a good jam. Although jam is less hard than jelly, it will still maintain its shape. Sugar and crushed fruit are used to make jam (Swe Oo et al., 2018).This novel use of Watermelon rind will among other things reduce the amount of the waste discarded, create more income for farmers, food processors and more importantly reduce environmental impacts of the waste. Therefore, the main focus of this thesis is to successfully document the preparation of watermelon rind jam, and test it's physicochemical, proximate analysis and organoleptic characteristics of the jam made from Watermelon rind.

2. Materials and methods:

The following methods were used for the present research. They are:

- Extraction of watermelon rind
- Processing of watermelon rind
- Preparation of watermelon rind jam
- Biochemical evaluation of watermelon rind jam
- Organoleptic characteristics

2.1 Extraction of watermelon rind:

Watermelon which is used in this research was bought from local market. The watermelon was washed with water to get rid of any dirt or unwanted materials, watermelon is peeled and separated rind from watermelon red flesh.

2.2 Processing of watermelon rind:

Before going through blanching watermelon rind was soaked in lemon water for 30 minutes. Then watermelon rind is blanched in 70°C to 100°C for 30 minutes. The blanched rind aims to obtain the soft rind and still has the coarse/fibrous texture of the watermelon skin, as well as to improve/maintain the characteristic of watermelon. After blanching watermelon rind is blended, it was low in brix.

2.3 Preparation of watermelon rind jam:

The rind jam process begins with making caramelisation of sugar by adding 125g into 1cup of water. Add rind paste (250g) into the sugar syrup and cook for 20 minutes. And then add 1.5ml of vanilla essence and add 0.25ml of food colour Brilliant blue FCF (INS No. 133). Add 1.5g of pectin. Then cook for another 10 minutes. At last add 0.25g of sodium benzoate (class II preservative). Afterwards, transfer jam into bowl for cooling. After it cools down, the watermelon rind jam is stored in glass jar which is sterilized for 10 minutes in hot water, to avoid harmful microbial contamination.

a b c d e

f g h i

Fig 1: (a) Raw Watermelon; (b) Peeling outer layer; (c) Blanching; (d) Grinded rind into pulp; (e) Caramelization; (f) Cooking pulp; (g) Add pectin; (h) Add Brilliant blue FCF; (i) Packed rind jam

2.4 Biochemical evaluation of watermelon rind jam:

2.4.1 Physiochemical Analysis of watermelon rind jam:

a) Total Soluble Solids (TSS):

The TSS of the sample was estimated using a digital refractometer (Milwaukee MA887). First, the refractometer was turned on, and the surface was cleaned with distilled water and cotton or tissue paper. After that, a drop of sample was placed on the prism to determine the TSS, and the reading was recorded. Direct readings are made at room temperature.

b) pH measurement:

The pH of the sample was measured using a digital pH meter. In a beaker, 2 g of jam was weighed and dissolved in 25ml of distilled water to determine the jam's pH. By using distilled water to clean the knob and rod of the pH meter, the rod was dipped, and the values were recorded.

c) Determination of consistency:

The saucer test

Alternatively, you can let the spoonful of jam sit on the cold plate for 30 seconds and then push it with your spoon or finger; if it wrinkles up, you've achieved your setting point. The goal is a steady fall, not a runny mess.

2.4.2 Nutritional aspects of watermelon rind jam:

a) Determination of Moisture content:

Moisture content determination is the most significant proximate analytical characteristic for representing the quality of any sample. The sample's moisture content was determined (by AOAC 930.15).

b) Determination of Ash:

Ash content can impact food's physiochemical and nutritional qualities, among other aspects. The sample's moisture content was determined by Muffle furnace.

c) Determination of Crude fat:

The crude mixture of fat-soluble substance found in a sample is referred to as crude fat. It is a term used to characterise the overall fat content of a sample of food. The sample's moisture content was determined by Soxhlet.

d) Determination of Crude fiber:

The sample's moisture content was determined by Standard method.

e) Determination of Protein:

The sample's moisture content was determined by Kjeldahl method.

f) Determination of Carbohydrate:

The carbohydrate content was determined by standard formulae (AOAC, 2000). Total carbohydrates are calculated by the calculation method as gives:

Carbohydrate content = 100 - (crude fiber + crude protein + crude fat + ash)

g) Energy:

The total energy is determined by using formulae

Energy = carbohydrates 4kcal + protein 4kcal + fat 9kcal / 1g

2.4.3 Phytochemical analysis of watermelon rind jam:

The phytochemicals were determined as per (Sharma G et al., 2019).

2.5 Organoleptic characteristics:

The panelists were asked to rate the overall acceptability of the sample. They received written instructions, which asked them to rate the products overall acceptance and make notes on the Hedonic Rating Test form (where, 1 stands for “dislike extremely”, 9 stands for “Like extremely” and 5 stands for “Neither like nor dislike”).

3. Results:

3.1 Physiochemical Analysis of jam:

Table 1: Physiochemical analysis of jam

Parameters	**Results**
Total soluble solids (TSS)	65.2°Brix
pH	4.9

a) Total soluble solids (TSS):

The TSS of the sample was estimated using a digital refractometer (Milwaukee MA887). The TSS obtained in watermelon rind jam is 65.2% respectively.

b) pH of jam:

The pH of the sample was measured using a digital pH meter. The pH obtained in watermelon rind jam is 4.9 respectively.

c) Consistency of jam:

The sample was placed on white plate and tilted slightly to check setting point of jam by using saucer method. The goal is a steady fall, not a runny mess.

3.2 Nutritional aspects of jam:

Table 2: Nutritional aspects of jam

Constituents	**Sample (%/100g)**
Moisture	10.2%
Ash	1.08%
Fat	1.94%
Fiber	0.91%
Protein	4.61g
Carbohydrates	91.54%
Energy	401kcal

a) Moisture:

The moisture content of the sample is 10.2% respectively.

b) Ash content:

The ash content of the sample is 1.08% respectively.

c) Fat content:

The total crude fat found in the sample is 1.94% respectively.

d) Fiber content:

The fiber content of the sample is 0.91% respectively.

e) Protein content:

The protein content of the sample is 4.61% respectively.

f) Carbohydrate content:

The carbohydrate of the sample is 91.54% respectively.

g) Energy:

The total energy was calculated by the given formula shows that 401kcal.

3.3 phytochemical analysis of jam:

Table 3: Phytochemical analysis

Parameter	**Result**
Flavanoids	Positive
Quinones	Positive
Phenolic compounds	Positive
Terpenoids	Positive
Glycosides	Positive
Tannins	Negative
Saponins	Negative

3.4 Organoleptic evaluation of jam:

Table 4: Average score of organoleptic evaluation

Attributes	**Score**
Flavour/Taste	8.64
Aroma	8.48
Texture	8.45
Appearance	8.35
Acceptability	8.4
Overall	8.32
Total	8.44

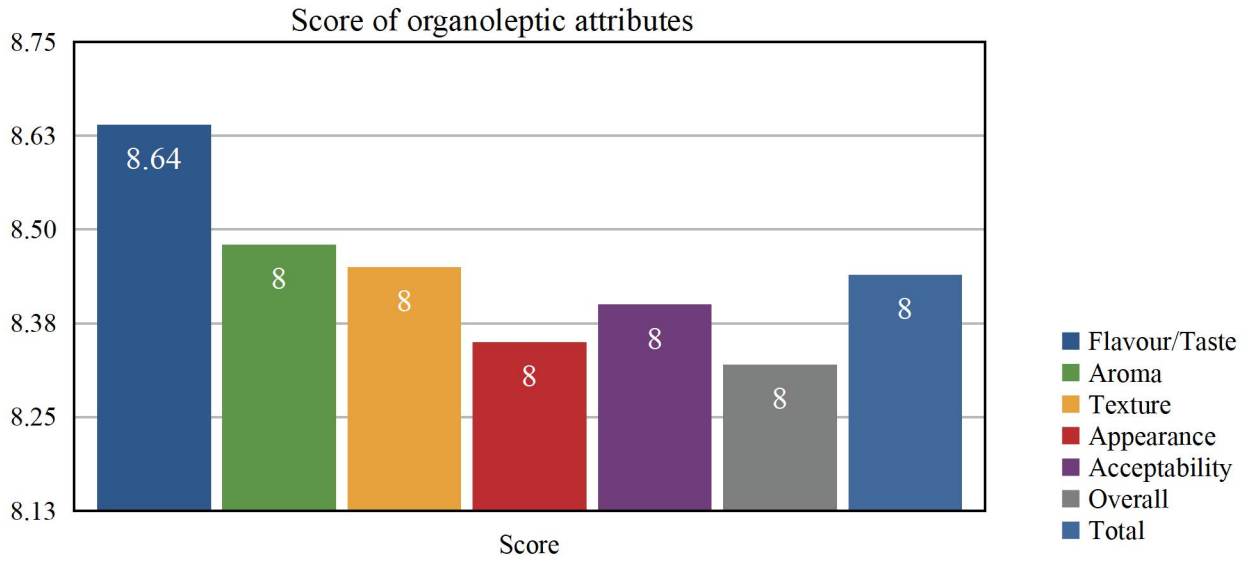

Fig 2: Graph of organoleptic evaluation

4. Conclusion:

The increasing demand for fruits and vegetables has led to a rise in novel technologies for their preservation, including jam processing. Watermelon rind jam presents a unique and creative approach to utilizing a typically discarded part of the fruit. This sustainable practice not only reduces food waste but also offers various health benefits due to the rich bioactive compounds and nutrients found in the rind. Watermelon rind jam was successfully prepared with important parameters studied. So, the value added watermelon rind jam is of good quality as they are under the United States Code of Federal Regulations (CFR), the TSS and all requirement for jam is as exact as they mentioned. The jam was found more richer in bioactive components and other nutrient properties which helps in the fulfillment of the daily requirement of nutrition as per RDA. The acceptability is based on result in TSS, consistency, pH and other requirements. The organoleptic evaluation of the valued added watermelon rind jam product shows that it may have higher acceptability in the market or by the people. The flavour was more acceptable in all parameters of organoleptic evaluation. Then the aroma got good score. And texture was also scored a good value whereas the appearance does not have higher value because the colour that was added in preparation of jam was Brilliantblue FCF (INS No. 133) and it turned out to be green due to interaction with acid present in watermelon rind but overall it comes under the acceptable novel product.

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