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Increasing the Economic Value of Nutritionally Rich Watermelon Rind by Preparing Edible Value-added Products

S. Gayathri Devi[1]* and C. Prabhavathy[2]

[1]Associate Professor, Government Arts and Science College for Women, Barugur – 635104, Tamil Nadu, India; sgayathridevi74@gmail.com
[2]Guest Lecturer, Government Arts and Science College for Women, Barugur – 635104, Tamil Nadu, India

Abstract

Watermelon (*Citrulluslanatus*) which originated in Africa is widely cultivated throughout the world including India. This fruit is known for its nutritional value and is relished by many people. Only the pulp of this fruit is used commercially and the rind which is also rich in so many nutrients is considered agricultural waste. To add economic value to nutritionally rich agricultural waste i.e., watermelon rind, three edible value-added products of watermelon rind were prepared and evaluated by comparing them with their controls. They were found to be better than the controls in appearance, taste, flavour, texture, colour and overall acceptability. The cost of their preparation was also economical when compared with their controls. Hence, farmers and self-help group women may be trained to prepare and market these products so that watermelon rind which is considered agricultural waste can be used commercially.

Keywords: Halwa, Jam, Self-help Group Women, Tutti Fruity, Value-added Products, Watermelon

1. Introduction

Watermelon (*Citrulluslanatus*), known for its hydration function and health benefits, possesses unique organoleptic properties[1]. The National Institute of Industrial Research has stated that watermelon is cultivated in many states of India including Tamil Nadu[2]. It is rich in lycopene and citrulline. Citrulline content is more in watermelon rind than flesh[3]. Citrulline present in this fruit reduces the body fat after converting it into arginine which blocks the activity of Tissue Nonspecific Alkaline Phosphatase (TNAP) and prevents the accumulation of fat[4].

Watermelon consists of skin, rind, flesh and seeds. The edible rind makes up approximately 40% of the total watermelon mass but is often discarded as waste which causes environmental issues[5]. Watermelon rind is a rich source of fatty acids, minerals, phenolic compounds and dietary fibres. It also contains soluble carbohydrates, carotenoids, alkaloids, saponin and phytates[6]. Recovering valuable components from neglected food parts and introducing them again into the food chain, economically and sustainably is gaining importance nowadays. Minimizing food losses and waste, reduction of environmental impact, maximizing agricultural profit and improving food sustainability on a commercial scale can be achieved by conversion of this high-value agro waste into innovative bioactive functional food[7].

Hence the objective of the present study was to increase the economic value of agro-based waste – Watermelon Rind (WMR) by developing value-added products and evaluating their acceptability.

*Author for correspondence

2. Methodology

Mostly WMR was used in powdered form and incorporated as flour in bakery products. But its use in the fresh form was rarely found in the literature. Hence it was planned to prepare three value-added products namely tutti fruity, jam and halwa where fresh WMR can be used without further processing. Organoleptic evaluation of these products was done by comparing them with controls prepared using raw papaya, mixed fruit pulp and ash gourd respectively.

2.1 Material Selection

Watermelon rinds were collected from local fruit sellers. They were peeled, washed and cleaned for further use. The ingredients used for the preparation of tutti fruity, jam and halwa namely sugar, food colours and citric acid as well as the ingredients required for the preparation of control such as raw papaya, apple, banana, ripe papaya, mango and ash gourd were purchased from the local market.

2.2 Preparation of Value-added Products of WMR

2.2.1 Preparation of Tutti Fruity[8]

Ingredients	Quantity
Mature unripe papaya/WMR	100 g
Sugar	75 g
Citric acid	1 g
Essence colour	a drop

Method

- Harvest mature, sound raw papaya, make incisions and drain the papain extract.
- Wash the fruit well, peel, remove the seeds and cut it into small pieces.
- Soak in 2% brine containing 1% calcium chloride for 30 minutes.
- Drain, wash the papaya pieces and add equal quantities of sugar and boil for 5 minutes.
- Let soak at room temperature for 4 hours, and mix the required essence, coloring and citric acid.
- Add more sugar to the above mixture and boil up to a sugar concentration of 70° Brix.
- Drain the candied papaya pieces, spread them on a tray and shade dry.
- Pack in polyethene bags, seal and store.

2.2.2 Preparation of Jam[9]

FSSAI specifications for jam production

Content	Concentration
Fruit Pulp/WMR	45%
TSS (Total soluble solids)	65%
Citric acid	5 g

Method

- Select a ripe fruit, peel and pulping is done using mixie.
- Addition of sugar, and citric acid to the pulp and cooked to jam consistency.
- Poured in sterilized bottles.

2.2.3 Preparation of Halwa[10]

Ingredients	Quantity
Ash gourd/WMR	100 g
Sugar	70 g
Ghee	10 g
Cashew nuts	5 g
Cardamom powder	1 g

Method

- Cleaning and grating ash gourd
- Cooking the ash gourd till water is absorbed
- Addition of sugar and cooking until the dissolved sugar is absorbed
- Addition of ghee and cooking till the ghee leaves the sides
- Addition of fried cashew nuts and cardamom powder and mixing
- Cooling and storing

2.3 Sensory Evaluation

The sensory attributes such as appearance, flavour, texture, colour, taste and overall acceptability of the products prepared using WMR were compared with that of the controls by a panel of 25 semi-trained people using scores from 1 to 5 (1 for the lowest and 5 for the highest).

2.4 Cost Comparison

The cost for the preparation of WMR products was compared with the cost for the preparation of controls by calculating the total cost of the ingredients used.

2.5 Data Analysis

All the data collected were compiled and analyzed using mean, standard deviation and 't' tests using MS excel-10.

3. Results and Discussion

The value-added products were compared with their control products using sensory evaluation. The scores obtained are presented in Table 1.

3.1 Comparison of Control Tutti Fruity with WMR Tutti Fruity

The mean score obtained by the WMR tutti fruity was higher than the scores obtained by the control for appearance, flavour, texture and colour without any significant difference. The mean score obtained for a taste of WMR tutti fruity was slightly less but not significant. The overall acceptance score obtained by WMR Tutti fruity was more than the overall acceptance score obtained by the control but without any statistical significance (Figure 1).

3.2 Comparison of Control Mixed Fruit Jam with WMR Jam

When the mean scores obtained for the sensory attributes of the control mixed fruit jam were compared with that of WMR jam, it was noticed that WMR jam had scored more than the control in all the sensory attributes (Table 1). The overall acceptability score of the WMR jam was also significantly higher than that of the control ($p \leq 0.01$) (Figure 1).

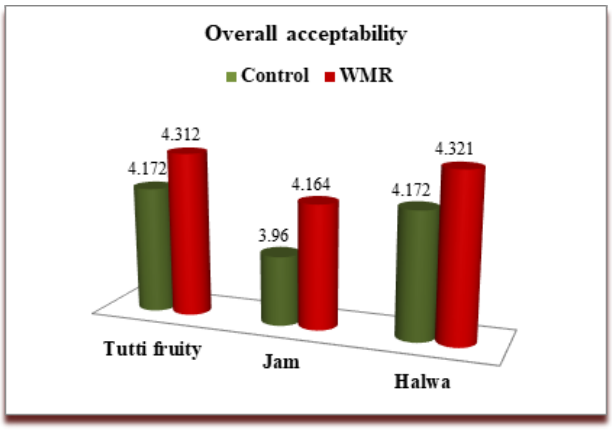

Figure 1. Overall acceptability of the control and WMR value-added products.

3.3 Comparison of Control Ash Gourd Halwa with WMR Halwa

The sensory evaluation of these products showed that the halwa prepared with WMR had secured higher scores for appearance, flavour, taste, texture and colour than the ash gourd halwa (Table 1). The overall acceptability score of WMR halwa was significantly higher than the

Table 1. Mean scores obtained by control and WMR value-added products

Sensory attributes	Mean scores obtained					
	Tutti fruity		Jam		Halwa	
	Control	WMR	Control	WMR	Control	WMR
Appearance	4.104±0.759	4.52±0.653	4.12±0.711	4.24±0.723	4.08±0.79	4.328±0.657
Flavor	4.11±0.812	4.16±0.8	4.08±0.748	4.12±0.971	4.24±0.708	4.34±0.669
Texture	4.146±0.866	4.4±0.64	3.96±0.87	4.24±0.845	4.21±0.808	4.32±0.64
Taste	4.22±0.8	4.04±0.789	3.92±0.744	4.08±0.812	4.28±0.825	4.34±0.622
Color	4.28±0.737	4.44±0.583	3.72±0.775	4.14±0.723	4.05±0.692	4.28±0.613
Overall acceptability	4.17±0.076	4.31±0.202	3.96±0.157	4.16±0.072	4.17±0.101	4.32±0.024
't-test	0.11		0.01*		0.01*	

Note: '*' statistically significant at 1% level

overall acceptability score of ash gourd halwa ($p \leq 0.01$) (Figure 1).

3.4 Cost of the Value-added Products Prepared using WMR

The costs of the value-added products prepared were calculated based on the cost of the raw materials used for their preparation. The same was compared with that of their respective controls. It was noticed that the value-added products were economical when compared with their controls since the main ingredient used i.e., WMR could be procured from the fruit sellers free of cost as it was considered as waste material by the fruit sellers.

4. Conclusion and Recommendation

This study was conducted to find out a fruitful use for watermelon rind which is normally considered agricultural waste. The main ingredients used for the preparation of some of the famous and highly used products namely tutti fruity, jam and halwa were substituted by WMR and the sensory attributes and the cost of the new products were analyzed. The results clearly showed that all the value-added products prepared were matching well with their respective controls in all the sensory attributes and costs of the products. So watermelon rind can be used as a suitable substitute for the main ingredients used in the control food products. These value-added products prepared using WMR also reap the health benefits cost-effectively hidden in them. This will not only help to reduce the biowaste but also will increase the commercial value of the biowaste i.e., the watermelon rind. These value-added products are simple, easy to prepare, cost-effective and liked by all. Hence, they have the potential to get more commercial value in the market. So special training may be organized for farmers and women in self-help groups for the production and marketing of these value-added products to improve their economic status.

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