

## Development of a Jam Using Bilin Fruit (*Averrhoa bilimbi* L.) and Evaluation of Its Sensory and Physico-chemical Properties

UG Chandrajith\*, RMNA Wijewardana, CR Gunawardane, BMKS Tilakaratne  
Institute of Post Harvest Technology, Jayanthi Mawatha, Anuradhapura, 50000, Sri Lanka

### Abstract

Bilin (*Averrhoa bilimbi* L.) is tropical fruit grow in many countries including Sri Lanka. The fruit has a very short shelf-life up to 4-5 days resulting in higher postharvest loss and is unable to store more than 7-8 days even it is chilled in the field at the time of harvest. Bilin fruits have a limited processing and home scale usage as dried salted nuts and traditional pickles in Sri Lanka. At present, Bilin is not widely used in any other commercial products such as jam or jelly due to lack of knowledge, for even about home scale processing. The objectives of this research were to utilize Bilin fruit for jam product formulation. Fruits in proper maturity condition (length > 3.0 cm and light green colour) were selected for experimentation. Fruit pulp was prepared by blending fruit slices using a food processor. Three different formulations were prepared by changing the pulp to sugar ratio at 1000g: 1000g (T<sub>1</sub>), 1000g: 1100g (T<sub>2</sub>) and 1000g: 1200g (T<sub>3</sub>). According to the sensory evaluation, T<sub>2</sub> was selected as the most accepted jam formulation. T<sub>2</sub> was analyzed for colour (L\*=22.81±0.44, a\*=0.78±0.06, b\*=4.74±0.47), titratable acidity (1.58±0.04%), pH (3.26±0.15), vitamin C (8.15±0.42 mg/100g), total soluble solids (68.20±0.50), moisture content (26.57±1.83) and crude fiber content (1.06±0.08). Bilin jam can be prepared with fruit pulp to sugar ratio of 1000g: 1100 g with acceptable sensory attributes.

**Keywords:** Bilin fruit, Jam, Product development, Sensory evaluation, Physico-chemical analysis

\*Corresponding author: chandrajithug@yahoo.com

### Introduction

Bilin (*Averrhoa bilimbi* L.) is a tropical fruit grow in Indonesia, Malaysia, Bangladesh and Sri Lanka. The fruit has a very short shelf life up to 4-5 days which cause higher postharvest losses. Bilin fruits are unable to store more than 7-8 days even it is chilled in the field at the time of harvest.

Bilin is a one of the underutilized fruits in Sri Lanka which is used to make traditional pickles, added to curries as an acidulant and used as slated dried nuts only. It is not used at the moment for any other commercial products such as jam or jelly due to lack of knowledge for processing. According to the CODEX standard 296, Jam is the product brought to a suitable consistency which made from the whole fruit, pieces of fruit, the unconcentrated and/ or concentrated fruit pulp or fruit puree, of one or more kinds of fruit by mixing with sweetening foodstuffs (Fructose, Brown sugar etc.) with or without the addition of water. Proportions of sugar to fruit are in equal commonly but proportion might get changed based on the type of fruit as well as its ripeness. The objective of this research was to utilize Bilin fruit for jam formulation and with the view of reducing postharvest losses.

### Material and Methods

Bilin fruits were harvested and transported to the fruit processing laboratory of Institute of

Post Harvest Technology. Diseased and damaged fruits were sorted out and the fruits in proper maturity condition (length > 3.0 cm & light green colour) were selected for experimentation. Fruits were thoroughly washed with potable water to remove dust particle and other foreign materials. Edges of the each fruits were trimmed to remove remaining floral parts and sliced in length wise. Fruit pulp was prepared by blending fruit slices using a food processor (Panasonic: MK5076). Three different formulations were prepared by changing the pulp to sugar ratio at 1000g: 1000g (T<sub>1</sub>), 1000g: 1100g (T<sub>2</sub>) and 1000g: 1200g (T<sub>3</sub>).

Bilin pulp was heated and two third of total weight of sugar was added gradually while heating the fruit pulp. Twenty grams of pectin was mixed with the rest of sugar and added into pulp after 15 min while heating. Heating was continued until the total soluble solid (TSS) content of fruit pulp reached to 68.5 °Brix at 105 °C. Hot filling was done into pre-sterilized glass bottles after the TSS of pulp reached to 68.5 °Brix and bottles were sealed with lid. Sensory evaluation was conducted using 30 untrained panelists to evaluate the best formulation out of three treatments such as T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>. Five point hedonic scales was used to evaluate the colour, odour, texture, spreadability, taste and overall acceptability of the three formulations (5- extremely like, 1- extremely dislikes). Sensory evaluation data were analysed using non-

parametric Friedman test with statistical software MINITAB version 14.0.

Most accepted jam formula was analyzed for colour, titratable acidity, pH, vitamin C, total soluble solids, moisture content and crude fiber content. Colour of jam was determined in terms of CIE L\*, a\*, b\* as Hunter colour values with colour difference meter (Konica Minolta TR 400). Acidity of jam was determined by titration with 0.1 N NaOH and phenolphthalein as indicator. Probe of digital pH meter (Hanna: 9157 BN, Witchford, England) was inserted into a beaker containing the 10 g of jam sample to measure pH. 2, 6 - Dichloro Indophenol visual titration method was carried out to determine vitamin C content in the jam sample. Hand Refractometer (HR-5, Kyowa Optical, Tokyo, Japan) was used to measure total soluble solid content. Fiber content was determined according to the AOAC method (2000). Moisture content was measured by oven dry method at 105 °C for 24 hours.

### Results and discussion

Panelist's responses for colour, odour, texture, spreadability, taste and overall acceptability of three jam formulations are presented in Figure 1. Treatment 2 (T<sub>2</sub>) which contained pulp to sugar ratio at 1000g: 1100 g was selected as the best formulation according to panelist's responses for overall acceptability. Treatment 3 (T<sub>3</sub>) had lower score for spreadability, may be due to higher sugar content making the jam hard and lower spreadability. Taste of the Treatment 1 (T<sub>1</sub>) had lower score may be due to sour taste which characteristic for Bilin fruits.

Results of the physico-chemical analysis of most accepted formulation (T<sub>2</sub>) are shown in table 01. Titratable acidity of Bilin jam was slightly lower

than recorded values of wood apple jam according to Vidhya and Narein (2011) but higher than pineapple jam which is 0.18% according to findings of Farooqui *et al.* (2015).

According to the results obtained, pH value of jam has achieved necessary pH level for jam product (3.0-3.3) even though citric acid was not added as an ingredient. Most common cause for reducing of jelling property is insufficient acid concentration of the processed jam which indicated by pH or acidity. Low acidity between 0.3 - 0.8 % and low pH contribute to pectin gelation and increase the stability of the formulated jam but pH must not be low than 3.0 since it could induce deterioration of sensory qualities such as acidic flavor, glucose crystallization, granular texture and exudation phenomenon (Orsi *et al.*, 2012).

Moisture content of Bilin jam was comparable with the findings of Orsi *et al.* (2012) for Sugar apple jam (26.23 %) while Jambolan and Pineapple jams had 29.66 % and 29.74% in moisture, respectively. It is important to note that the moisture content is directly related to the shelf-life of the product and lower moisture content leads to longer shelf-life.

Bilin jam had the total soluble content of 68.20±0.50 °Brix that fulfill the requirement of CODEX standard 296-2009 for jam which notice total soluble solid content shall be between 60 % -65 % or greater. TSS content is an important quality parameter for processing of jam. TSS value lower than 60 °Brix make the gel weak and the value of TSS higher than 70 °Brix cause crystallization of the sugar which make undesirable change in the texture of the jam which was might resulted with T<sub>3</sub> formulation of this experiment. The TSS content between 65 °Brix and 70 °Brix has a good sensory

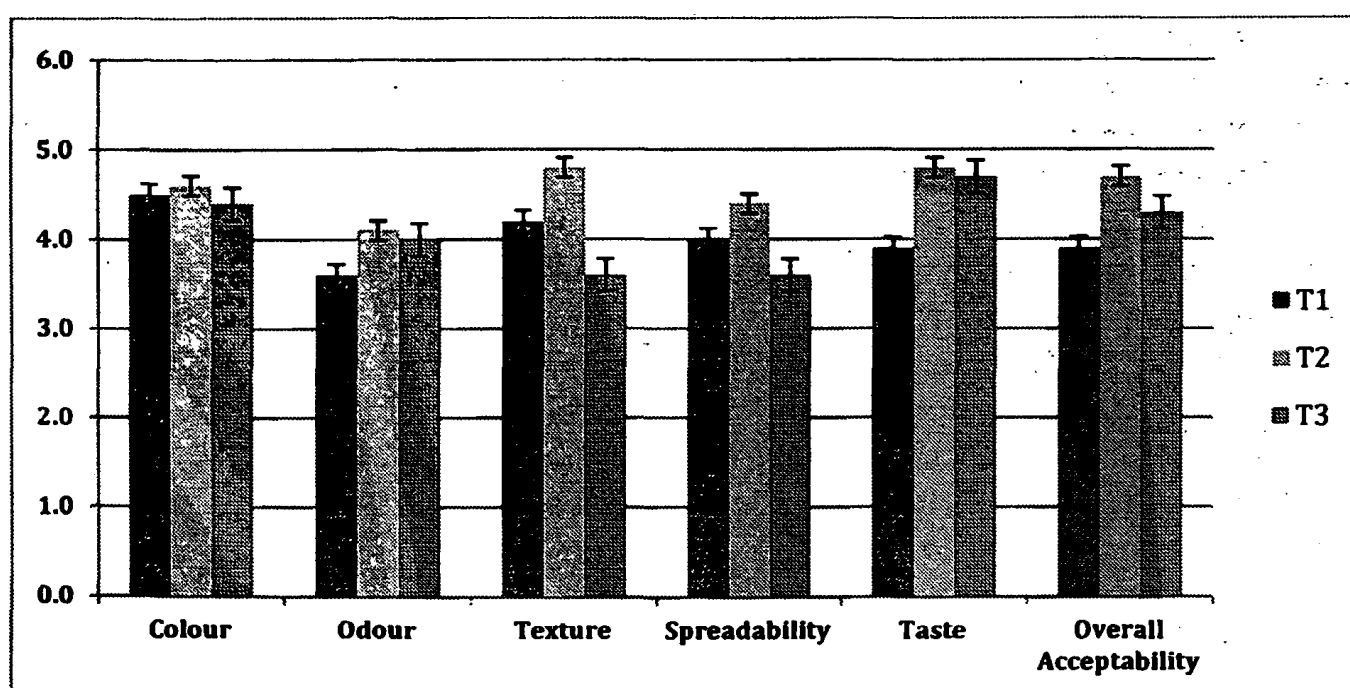


Figure 1: Mean scores for sensory attributes of three Bilin jam formulations

**Table 01:** Physico – chemical properties of selected Bilin jam formulation (T<sub>2</sub>)

Parameter		Value
Titratable Acidity (%)		1.58±0.04
pH		3.26±0.15
Moisture content (%)		26.57±1.83
Total Soluble Solids (°Brix)		68.20±0.50
Ascorbic acid (mg/100g)		8.15±0.42
Fiber (%)		1.06±0.08
Colour	L*	22.81±0.44
	a*	0.78±0.06
	b*	4.74±0.47

Standard deviation for three replicate (n=3) determinations

acceptance according several findings. Ascorbic acid content of Bilin jam was 8.15±0.42 mg/100g which is a lower value than Pineapple jam (13.1mg/100g). Ascorbic acid content of fruit pieces, marmalades and jam are much lower than those of the juices and squashes of same fruit. This may due to prolonged heating time in their production process (Sansui *et al.*, 2008). Fiber content of the Bilin jam is 1.06±0.08 % while bean jam with apple had 0.90 % according to findings of Guine *et al.* (2015). Crude fiber is the material left after making digestion of the food which composed with cellulose, lignin, and some minerals. The USDA national nutrient database for standard reference refers a value of 1.1g/10 g fiber for jam in general (Guine *et al.*, 2015). Colour of Bilin jam was 22.81±0.44 for L\* (lightness), 0.78±0.06 for a\* (redness: + greenness) and 4.74±0.47 for b\* (yellowness: + blueness) indicating the jam colour close to yellow green.

### Conclusion

Bilin jam can be prepared with fruit pulp to sugar ratio of 1000g: 1100 g with acceptable sensory attributes.

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