Effect of passion fruit juice and pectin on characteristics of Purple Yard Long Bean jam

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Abstract. The present study aims at studying the amounts of passion fruit juice (21.1, 23.3 and 25%) and the amounts of pectin (0.5, 1 and 1.5) optimum to produce Purple Yard Long Bean jam (Vigna unguiculata subsp. sesquipedali) cv. Sirindhorn No.1. The results showed that jam with 21.1% of passion fruit juice and 0.5% of pectin had the highest pH value and the lowest Rupture Strength. The water activity value and total soluble solids of 3 formulas jam were not statistically different. Jam with 25% of passion fruit juice and 1.5% of pectin had increasing of L* value and decreasing of a* value. Sensory evaluation showed that the jam with 21.1% of passion fruit juice and 0.5% of pectin gained the highest hedonic score in terms of odor, taste, texture, spreadability and overall preference. Purple Yard Long Bean jam with 21.1% of PJF and 0.5% of pectin had with higher fiber content than in commercial products.

1. Introduction

Sirindhorn No.1 purple yard long bean was a long bean hybrid from the long-stemmed species, green pods and mixed with red long pods. There was a characteristic of the species is the reddish purple pod and the seeds have red and white stripes. Sirindhorn No.1 purple yard long bean is source of antioxidant phenolic compounds, specifically flavonoids.[1] And source of high fiber because dietary fiber is a component of the cell wall in plants which are complex carbohydrates containing cellulose, pectin, hemicellulose, lignin and inulin. Consumption of dietary fiber provides other health benefits and decrease risk of diabetes, obesity, coronary heart disease, lowering of blood glucose and prevention of colon cancer.[2,3]

The Passion fruit (Passiflora edulis var. flavicarpa) containing vitamin C, provitamin A, phenolic compounds, flavonoids such as quercetin catechins, carotenoids can contribute to beneficial human. These compounds present antioxidant capacity.[4] Fruits and vegetables are source of high antioxidant can protect against several human diseases such as cancer hypertension, Alzheimer's cardiovascular diseases and prevention of the evolution of some diseases.[4,5]
Jam is an intermediate moisture food prepared by fruit and vegetables with sugar, acid, pectin other ingredients.[6] Fruits and vegetables contain acidity and pectin content that can improve quality of the texture of jam. However, the amount of pectin and acidity suitable for the gel formation by pectin in the range of 0.5-1% and 2.8-3.2 of pH value.[7] The jam should contain 60-65% of total soluble-solids content and at least 45% fruit.[3]

Therefore, the objective of the present study was to develop Sirindhorn No.1 purple yard long bean jam incorporated with passion fruit juice and study the amount of passion fruit juice and the amount of pectin on jam characteristics.

2. Materials and Methods

2.1 Materials
Sirindhorn No.1 purple yard long bean (Vigna unguiculata subsp. sesquipedalis) in the preparation of jams, were obtained from Ratchaburi Province. Sirindhorn No.1 purple yard long bean were ground using a blender and stored at -20 °C until processing. The passion fruit in the preparation of jams, were purchased from the local market. The passion fruit were washed and opened to remove the pulp with seeds and then it was squeezed until the total juice was removed. The passion fruit juice (PFJ) stored at -20 °C until processing.

2.2 Jam processing
Purple Yard Long Bean jam were prepared using different amounts of passion fruit juice (21.1, 23.3 and 25%) and the amounts of pectin (0.5, 1 and 1.5%) at 45% Purple Yard Long Bean and 55% sugar. After that, they were heated until about 64-65 % brix. The jams were produced in duplicate.

2.3 Chemical and physicochemical analysis
2.3.1 pH and Total soluble solids
The pH was measured using a S220 pH meter (Mettler Toledo, Switzerland). The water activity was measured by a water activity serie 4TE. (AquaLab, United States of America). Total soluble solids determined by Hand refractometer ATC-20E. (ATAGO, Japan).

2.3.2 Proximate analysis
The moisture content, fat, ash, fiber, protein and carbohydrate contents of the purple yard long bean jam were estimated by using standard method of [8].

2.3.3 Color
Color was measured in terms of L*, a*, b* values using a Hunterlab Colorflex Spectrophotometer (CIE Lab Hunter Associates Inc, USA).

2.3.4 Textural analysis
The textural properties of Purple Yard Long Bean jam samples were measured using Texture Analyzer, TA.XT Express Enhanced (Charpa Techcenter Co.,Ltd.). The textural was measured in terms Rupture Strength and Brittleness. A cylindrical probe (cylinder probe p/20) was used to Compression, Pre - test speed : 1 mm/sec, Test speed : 0.50 mm/sec, Post- test speed : 10 mm/sec, Target mode : Distance 8 mm.

2.3.5 Anthocyanins analysis
Analysis of anthocyanins was measured by acidified ethanol (1% solution of HCl in ethanol 95%) was added to 10 g homogenized jam. The extract was kept room temperature, and filtered the whatman filter paper number 1. The extracts were estimated using the pH-differential method [8] using hydrochloric acid / potassium chloride buffer (0.025M, pH 1.0) and sodium acetate buffer (0.4 M, pH 4.5) and the absorbance was measured at 510 nm and 700 nm on a UV–vis spectrophotometer (specord 250 plus, Jena, Germany). The concentration of anthocyanins in the extract was calculated and expressed as cyanidin-3-O-glucoside equivalent per g of jam according to Eq. (1)
\[
\text{TA (mg/L)} = \frac{A \times MW \times DF \times 10^3}{\text{Ma} \times L}
\]  
(1)

\[A = (A_{510} - A_{700}) \text{ pH 1} - (A_{510} - A_{700}) \text{ pH 4.5}; \text{Mw = molecular weight (449.2 g/mol); DF= dilution factor; Ma = extinction coefficient 26,900 L/(cm*mol) L= path length (1 cm).}
\]

2.4 Sensory evaluation

The sensory evaluation of Purple Yard Long Bean jam were evaluated color, taste, odor, spreadability, and overall acceptability following the nine-point hedonic scale test (9= like extremely, 8 = like very much, 7 = like moderately, 6= like slightly, 5= neither like nor dislike, 4 = dislike slightly, 3 = dislike moderately, 2 = dislike very much, 1 = dislike extremely) by an untrained panel 30 subjects. Served at room temperature within 30 ml cups with three-digit randomized codes and bread pieces and spoons were provided to the panelists.

2.5 Statistical analysis

The study of Chemical and physicochemical analysis in completely randomized design (CRD) and the sensory analysis in randomized complete block design (RCBD). Statistical analysis was carried out using SPSS software (SPSS, Chicago, Ill., U.S.A.). Treatments were compared using analysis of variance (ANOVA) followed by Duncan’s New Multiple Range Test (DMRT) was used to determine significant differences among results, and statistical significance was accepted at 95 %, with probability (P≤0.05).

3. Results and discussion

3.1 Chemical and physicochemical analysis

The results of studying the production of Purple Yard Long Bean jam by varying the amount of passion fruit juice at 21.1, 23.3 and 25% and the amount of pectin at 0.5, 1 and 1.5%. The results as shown in Table 1. It was found that increasing the amount of passion fruit juice the pH trended to decrease. Purple Yard Long Bean jam formula 3 (25:1.5) has the lowest pH (P≤0.05). The pH value affects the gel formation of the jam the appropriate pH value for the gel formation of the jam was 3.2 however the gel increases of hardness as the pH decreases. Acidity was an important, influence pectin gelation, texture of jams.[9] Yard Long Bean jam had water activity (a\textsubscript{w}) values range between 0.58±0.00-0.64±0.02. Which was in the lower range than the microbial growth, the yeast begins to grow when the food is a\textsubscript{w} in the range of 0.70-0.80. Mold can growth as a\textsubscript{w} value was high than 0.70 and the bacteria can growth when the a\textsubscript{w} value was high than 0.80. Yard Long Bean jam had total soluble solids in the range 64.40±0.70-65.50±0.70 % brix. Jam and all formulas are not statistically different. [10] Reported that the total soluble solids of the product should be in the range of 60-65 % brix and the product should contain at least 45% fruit.

| Formulas jam (% PFJ:Pectin) | pH     | a\textsubscript{w}   | Total soluble solids (% brix) |
|-----------------------------|--------|-----------------------|-------------------------------|
| 1 (21.1: 0.5)               | 3.22±0.01\textsuperscript{a} | 0.61±0.01\textsuperscript{a} | 65.50±0.70\textsuperscript{a} |
| 2 (23.3: 1)                 | 3.21±0.00\textsuperscript{a} | 0.64±0.02\textsuperscript{a} | 65.50±0.70\textsuperscript{a} |
| 3 (25: 1.5)                 | 3.18±0.00\textsuperscript{a} | 0.58±0.00\textsuperscript{a} | 64.40±0.70\textsuperscript{a} |

a,b,c…in each the column with different letters were significantly different at (P≤0.05).

Table 2 showed that the increase the amount of passion fruit juice in Purple Yard Long Bean jam increased the L* value and the a* value was decreased. [9] Similarly reported that the added to fibers
increasing of pomegranate peel powders the L* value increased from 38.97 to 43.49 and a* value decreased from 13.13 to 10.62. In addition its to affect on L* and a* value were increasing proportions of fruits. Jam with higher amount of fruit were a* value decreased which could be due to destruction of the anthocyanins during processing [11].

### Table 2. Color of Purple Yard Long Bean jam

| Formulas jam (% PFJ:Pectin) | L*          | a*          | b*          |
|-----------------------------|-------------|-------------|-------------|
| 1 (21.1: 0.5)               | 21.45±0.62a | 19.80±0.49b | 19.49±0.28a |
| 2 (23.3: 1)                 | 25.75±0.86b | 20.32±0.59a | 19.56±0.73a |
| 3 (25: 1.5)                 | 29.39±0.57a | 18.35±0.48b | 18.14±0.71a |

a,b,c…in each the column with different letters were significantly different at (P≤0.05).

Rupture Strength and Brittleness value of Purple Yard Long Bean jam as shown in Table 3 the results showed that rupture strength was increased with increased pectin and PFJ concentration from 21.1- 35 and 0.5-1.5% respectively. [9] Similarly reported that an increase in pectin concentration from 0.2% to 1.2% the firmness of jams fruits increased. [12] Similarly reported that the hardness of mango jam increased with pectin concentration. Pectin and sugar were responsible for gel formation in fruit jam due to the number of junction zones with pectin concentration result in number of the elasticity active polymeric chains of gel pectin structure stronger. [9,12] Brittleness of the Purple Yard Long Bean jam, all formulas are not statistically different.

### Table 3. Rupture Strength and Brittleness value of Purple Yard Long Bean jam

| Formulas jam (% PFJ:Pectin) | Rupture Strength (g) | Brittleness (mm) |
|-----------------------------|----------------------|------------------|
| 1 (21.1: 0.5)               | 407.63±40.23a        | 16.81±0.38a      |
| 2 (23.3: 1)                 | 684.07±4.57b         | 16.99±0.11a      |
| 3 (25: 1.5)                 | 992.91±53.40a        | 17.96±0.80a      |

a,b,c…in each the column with different letters were significantly different at (P≤0.05).

### 3.2 Sensory evaluation

The sensory evaluation of Purple Yard Long Bean jam were evaluated color, taste, odor, spreadability and overall acceptability following the nine-point hedonic scale test are reported in Figure 1. The scores of sensory attributes in color of the Purple Yard Long Bean jam, all formulas are not statistically different. Jam formulas 1 with 21.1% of PJF and 0.5% of pectin gained the highest hedonic score in terms of odor, taste, texture, spreadability and overall preference (P≤0.05). These results also indicates that Purple Yard Long Bean jam formulated 1 it could be concluded that acceptable and produce good quality. Therefore, 21.1% of PJF and 0.5% of pectin were chosen and used in next steps for proximate and anthocyanins analysis.

### 3.3 Proximate and anthocyanins analysis

Figure 2. shows the values of protein, moisture, fat, ash, fiber, carbohydrate and anthocyanins content of Purple Yard Long Bean jam the results shown that Purple Yard Long Bean jam with 21.1% of PJF and 0.5% of pectin had protein, moisture, fat, fiber, ash, carbohydrate content at 1.38±0.28, 29.34±0.03, 0.08 ± 0.02, 25.18±1.01, 0.47±0.00, 43.54 ±1.06 respectively. [3] Similarly reported that jams produced from tomato pomace with increased amount of dietary fiber, proximate composition of low calorie. Purple Yard Long Bean jam had total anthocyanins (TA) content 3.48±0.08 mg/L.[13] reported that the anthocyanins were the most abundant flavonoid compounds these are highly unstable
pigments and processing can greatly influence their content in the final product. Purple Yard Long Bean jam had with higher fiber content and lower value aw than in commercial products.

**Figure 1.** Sensory evaluation of Purple Yard Long Bean jam.
formulas 1 (PFJ 21.1 : Pictin 0.5) ; formulas 2 (PFJ 23.3 : Pictin 1);
formulas 3 (PFJ 25 : Pictin 1.5)

**Figure 2.** Proximate and anthocyanins content of Purple Yard Long Bean jam

4. Conclusions
In this study of the amount of passion fruit juice and the amount of pectin optimum to produce Purple Yard Long Bean jam showed that the passion fruit juice (PFJ) and pectin had effect on pH value, L*, a* Rupture Strength and score of odor. The formula that most panellists was that better accepted was 21.1% of PJF and 0.5% of pectin. Purple Yard Long Bean jam had with higher fiber content than in commercial products and aw value lower with to a longer shelf life.
5. References

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