Study On Physico-Chemical Properties And Shelf-Life Of Mixed Pineapple And Mango Jam Under Ambient Storage

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Abstract: The main purpose of this research is to reduce fruit losses, to supply wholesome and safe preserved fruits to utilize during the off-season and develop new value-added products. The present research placed it emphasis on preparing mixed fruits jam products (pineapple and mango) retaining its natural flavor, aroma and a longer shelf-life. Their characteristics such as pH, acidity, viscosity, fibre content, ash content, colour, soluble solid (°Brix), organoleptic properties and shelf-life were determined. Effect of concentration of sugar and effect of storage time at ambient temperature on the quality of mixed fruits jam product were investigated to produce the good quality products.The optimum sugar concentration was 30 ºBrix and maximum sensory score 7.7. Sensory evaluation and microbiological changes of the jam was performed to assess consumers' likeness and safety for human consumption.

Keywords: Mixed fruitsJam, Mango, Pineapple, Shelf-life

1. Introduction

Jam is prepared by boiling fruit pulp with sugar, acid, pectin and other ingredients for colouring and flavouring with preservatives to a thick consistency and firmness to the hold the fruit tissues [1-2] .The finished jam should contain more than 65% TSS according to the specification of the Codex Alimentarius Commission. Sugar constitutes more than 40% of total weight and 80% of total solids in jam [3].Fruit jams are commonly used with breads, cookies, cake fillings and others [4]. The mango isconsisting of numerous tropical fruiting trees in the flowering plantfamily Anacardiaceaeand a fleshy stone fruitbelonging to the genus Mangifera. The mango spreads all over the worldandis native to India. It is also the mostcultivated tropicalfruit of the world..Internally, juicy flesh has orange-yellow in color with numerous soft fibrils radiating from the husk (enveloping a single large kidney-shaped seed). Mango fruit is pleasant in flavor, sweet taste and rich in pre-biotic dietary fiber, vitamins, minerals and poly-phenolic flavonoid antioxidant compounds. According to new research study, mango fruit has been found to protect against colon, breast, leukemia and prostate cancers[5].Pineapple or Ananas(Ananascomosus) is native to tropical America. It is now cultivated in tropical countries for its succulent fruit.Pineapple contains mainly water, carbohydrate,vitamin A, C, and carotene. It contains lowamount of protein, fat and fibre. It is also rich indifferent antioxidant, for example flavonoids [6]. It has been reported that, in developing countries, farmers suffer highpostharvest losses of fruits and vegetables mostespecially during harvest time. This would minimize losses, optimizeprofit and provide variety of products before theconsumer. The use of these fruits (pineapple and mango) in jam production is onesuch way of enhancing their utilization [7]. Jams are one of the most popular food products because of their low cost, all year long availability and organoleptic properties [8].Fruit jams provide quick boosts of energy with only half bout of calories and are important in the diet of every agegroup. The presence of fiber and fructosecontent regulates the blood glucose levels by slowing the digestion and enhancing the satiety level. Good jamhas a soft even consistency without distinct pieces of fruit, a bright color, a good fruit flavor and easy to spreadsemi-jel- liked texture without free liquid [9].The jam preparations require the natural pectin present in the fruit itself or commercial pectin as a gelling agent [10]. This study was aimed at keeping in view the nutritional importance of pineapple and mango prolonging their utilizable lifespan by preserving them as jam along with an analysis of organoleptic acceptability.

2. Materials and Methods

2.1 Materials

In this research work, good, sound and matured ripe pineapple(yellow colour), mango (Yinkwè) (yelowcolour), were obtained from Hmawbi Township, Yangon Region. Food additives such as sugar, salt, citric acid, sodium carboxymethyl cellulose, pectin and commercial grade of preservative (potassium sorbate, potassium metabisulfite and sodium benzoate) were purchased from local markets.

2.2 Methods of Preparation for Pineapple-Mango Jam

A good, sound, ripe pineapple of yellow colour and mango were thoroughly washed with water. The washed pineapple and mango were then cored and sliced. Pineapple slices were placed in juice extractor and mango were cut into $1cm^3$ cube. (100)g ofextracted pineapple and (100)g cubic mango were placed in the stainless steel pan and then 30% of sugar, 0.5% salt and 0.5% pectin were added into it. The mixture was heated under controlled temperature at 80˚C and stirred thoroughly. Heating was continued to obtain the desired soluble solid content range 50-67 °Brix of pineapple-mango jam. And then, 0.1% of potassium sorbate were added and thoroughly agitated. Finally the firm pineapple-mango jam

was carefully poured into the sterilized glass bottle and sealed with sterilized cap.

2.3.Methods of Analysis

Physico-chemical properties of fish seasoning powder such as moisture content, ash content, protein content, fiber content, fat content, and carbohydrate content (AOAC-Method, 2000) [11] were determined.The microorganisms were determined by Aerobic Plant Counts by petrifilm method (AOAC-990.12)and Yeast &Mould by FDA-BAM(Foodand Drug Administration-Bacteriological Analytical Manual) (Online Manual April 2001) method, respectively.

2.3.1.Determination of Moisture Content

3 g of sample was weighed in a petri dish and dried for 4 hours at 110°C in hot air oven and it was cooled in desiccators and weighed. The process of heating, cooling and weighing was repeated. Moisture content was calculated as follows: [11]

$$\text{Moisture} \quad (\%) = \frac{W_1 - W_2}{W_1}$$

Where, W_1= weight (g) of sample before drying,
W_2= weight (g) of sample after drying

2.3.2.Determination of Ash Content

Accurately weighed 1 g of sample was introduced into the porcelain crucible. The crucible and sample were carefully ignited over hot plate and heated until the sample was thoroughly charred. Then, it was placed in the muffle furnace at 550°C for 5 hours until residue was free from carbon. The crucible and ash were then cooled in the desiccator and weighed. The weighing, heating in the furnace and cooling were repeated until the constant weight was obtained. The ash content of sample was calculated as follows: [11]

$$\text{Ash} \ (\%) = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

2.3.3.Determination of Protein Content

2 g of sample was transferred to a digestion flask followed by the addition of 3g of catalyst mixture (K_2SO_4:$CuSO_4$:SeO_2in100:20:2.5) and 20 ml of concentrated sulfuric acid. The content was then digested till transparent liquid was obtained. The volume of digested material was made up to 100 ml with distilled water. Carry out a blank digestion without the sample and make the digested to 100ml. Measured aliquor of digested material was distilled with excess of 40% NaOH solution and the liberated ammonia was collected in 20 ml of 2% boric acid solution containing 2-3 drops of mixed indicator (10 ml of 0.1 percent bromocresol green+ 2 ml of 0.1 percent methyl red indicator in 95 percent alcohol). The entrapped ammonia was titrated against 0.01 N of hydrochloric acid. A reagent blank was similarly digested and distilled. Nitrogen content in the sample was calculated as follows and a factor of 6.25 was used to convert nitrogen to protein [10].

$$N_2\,(\%) = \frac{\text{Sample titre} - \text{Blank titre} \times \text{Normality of HCl} \times 14}{\text{vol. made of digest} \times 100} \Big/ \frac{}{\text{Aliquot of the digest taken} \times \text{Weight of sample} \times 1000}$$

Protein content = % Nitrogen × 6.25

2.3.4. Determination of Crude Fiber Content

2 g of sample was weighed into 500 ml of beaker and 200 ml of boiling 0.255 N of sulfuric acid (1.25 percent w/v) was added. The mixture was boiled for 30 min keeping the volume constant by the addition of hot water at frequent intervals (a glass rod stirred in the beaker helps smooth boiling). At the end of this period, the mixture was filtered through a muslin cloth and the residue washed with hot water till free from acid. The material was then transferred to the same beaker and 200 ml of boiling 0.313 N of NaOH (1.25 percent w/v) was added. After boiling for 30 min., the mixture was filtered to a crucible, dried overnight at 80-100°C and weighed (W_2). The crucible was kept at in a muffle furnace at 550°C for 3 hours. Then it was cooled in desiccators and weighed again (W_3). The difference in residue weights and ash represents the weight of crude fiber [11].

$$\text{Crude fiber content} \ (\%) = \frac{(W_2 - W_3)}{W_1} \times 100$$

where, W_1= Weight of sample, (g), W_2= Weight of insoluble matter, (g) and W_3= Weight of ash, (g).

2.3.5. Determination of Fat Content

Accurately weighed 5 g of sample was introduced inside the thimble and a piece of cotton was placed at the open and of the thimble. The thimble containing the sample was kept inside Soxhlet apparatus fixed with round bottom flask (500 ml) containing petroleum ether (B.P 40-60°C) 250 ml. The extraction flask was heated on the heating mantle for 14 hours at the boiling point of petroleum ether. After the extraction was completed, the ether dissolving oil was transferred into the beaker. Then, the ether was removed by evaporation. Fat content was calculated as follows: [11]

$$\text{Fat} \ (\%) = \frac{\text{Fat weight}}{\text{Sample weight}} \times 100$$

2.3.6. Determination of Carbohydrate Content

Carbohydrate value of the sample was determined by using the following formula:

Carbohydrate(%)=100 – (moisture+ash+protein+fiber +fat)

2.3.7. Determination of Vitamin C.

Ascorbic acid was determined by the 2,6dichlorophenol indophenol titration procedure [11]. Ascorbic acid was extracted using an acetic acid and metaphosphoric acid solution. The extracts were transferred with distilled water into a 50 ml volumetric flask and made up to the mark with more water and filtered rapidly. The filtrate was run from a burette into a test tube containing one drop of dilute acetic acid and 1ml of the dye, 2,6dichlorophenol indophenol solution. The volume of extract required to decolorize the dye was noted. The titration was repeated using standard ascorbic acid solution (1 mg pure vitamin per 100 ml).
Ascorbic acid per 100g of jam or pulp is calculated as:

$$\%\ \text{Ascorbic acid} = w \times \frac{100}{100}$$

w= volume of dye

2.3.8 Sensory Evaluation

The organoleptic properties namely color, flavor and aroma were determined on the basic of 9 point Hedonic scale by 10 panelists. For sensory evaluation, the organoleptic properties of product were determined on the basis of 9 point Hedonic scale-rating, where 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 a panel of 20 semi-trained judges.

2.3.9 Statistical Analysis

All measurements were made in triplicate for each sample, analyzed and tabulated statistically and expressed as percentage; mean scores, standard error of mean, critical difference, t-test and one-way analysis of variance (ANOVA) by using statistical software SPSS version 20. To indicate statistically significant difference P ≤0.05 values were considered.

3. Results and Discussion

Jam is product of sugar and pectin contained fruits. It has characteristics of texture, colour and taste. It should be capable of storage for reasonable period after opening of bottle without risk of spoilage.The physical and chemical characteristics of raw pineapple and mango (yin kwè) are shown in Table (3.1). The effect of sugar concentration on pineapple-mango (yin kwè) jamswas indicated in Table (3.2).From these results, it was evident that the sample using 30% of sugar concentration was more suitable due to higher sensory score of overall acceptability than others. Table (3.3) show that the effect of storage time on acidity, pH,soluble solid content and vitamin C content of pineapple-mango jam. Acidity of mixed fruits jam was increased during 3 months storage. There was no change in the acidity after 3 months. Increase in acidity of mixed fruits jam was observed due to ascorbic acid degradation. The total soluble solid for pineapple-mango jam range from 59.00-60.00% and there is no significant difference in the TSS value of pineapple-mango jam for the period of 6 months. The result of evaluation shows that the qualities of pineapple-mango jam was maintained for period of 6 months for which the study was covered. The retention of qualities may be due to the positive role of sugar in maintaining the chemical composition of jam products over a period of time as reported by [12]. One of the important factors to obtain optimum gel condition of jam is pH. From Table (3.3), pH of pineapple-mangomixed fruits jam was decreased during3 months storage. The pH values of pineapple-mango mixed fruits jam was stable after that storage time. During storage intervals, value of pH decrease due to increase in acidity. This may be due to formation of acidic compounds.The pH of preserved products plays a dual role by acting as flavor promotion and also as preservatives [13]. Acidity contents of pineapple-mango mixed fruits jam was increased during 3 months storage. There was no change in the acidity after 3 months. Increase in acidity of mixed fruits jam was observed due to ascorbic acid degradation. The mean vitamin C content for pineapple-mango jam ranged between 5.6-7.3 mg/100g. There was no significant difference in the mean vitamin C content of watermelon jam from 0th to 3months day but a significant reduction at the end of 3 months storage. The decrease in ascorbic acid was observed by [14] in the study of storage of papaya chutney. This loss was likely due to oxidation or exposure to atmospheric oxygen during the preparation [15]. Table (3.4) shows the results of sensory evaluation of pineapple-mango jam for 3 months storage time. Sensory evaluation was conducted on the jam at with respect to colour, taste, aroma and overall acceptability. There is no significant difference in mean score in the sensory properties of pineapple-mango jam up to 3 months under the room temperature storage. A gradual decrease in the sensory evaluation mean score was also reported by [16] during the storage evaluation of amia jam. It was found to be high compared to 5.3 point and 6.8 point for jam made from dry light red roselle calyx stored at cold temperature and jam made from 1:1 African star apple and tamarind respectively[17][18]. Table (3.5) represents the result of microbial load evaluation. Microbial load of the jam was within the Microbiological limits for Jams, Jellies and MarmaladesKenya standards[19].The presence of the low pH of the juice could be one the factors that account for keeping the microbial load in check within acceptable level the period of three months under which the study was conducted.

Table (3.1) *Physical and Chemical Characteristics of Raw Pineapple and Mango*

Sr. No	Characteristics	Pineapple	Mango (Yin kwè)
1	Soluble Solids Content (°Brix)	7.9±0.1	12±0.1
2	Water Content (%w/w)	83.2±0.2	77.3±0.1
3	Ash Content (%w/w)	3.4±0.2	5.4±0.1
4	Fibre Content (%w/w)	5.6±0.1	2.6±0.1
5	Acidity (%v/w)	1.7±0.2	0.16±0.3
6	pH	4.6±0.02	4.7±0.03
7	Vitamin C (mg)	10.6±0.2	13.9±0.3

Table (3.2) *Effect of Sugar Concentration on Characteristics and Sensory Scoresof Pineapple-mango Jam*

No.	Sugar (%w/w)	Soluble Solid Content (˚Brix)	Overall Acceptability
1	10	56	4.8
2	20	58	5.2
3*	30	60	7.7
4	40	63	5.9
5	50	66	5.7

Effect of Storage Time on Acidity, pH, Soluble Solid Content and Vitamin C Content of Pineapple-mango Jam

Storage Time (Days)	Acidity (%v/w)	pH	Soluble Solid Content (°Brix)	Vitamin C
Initial	0.17	4.52	60	7.3
15	0.19	4.5	59	6.9
30	0.2	4.45	58	5.6
45	0.21	4.4	58	5.6
60	0.21	4.4	58	5.6
75	0.21	4.4	58	5.6
90	0.21	4.4	58	5.6

Table (3.4) *Effect of Storage Timeon Sensory Evaluation of Pineapple-mango Jam*

Storage Time (Days)	Colour	Taste	Aroma	Overall Acceptability
Initial	7.5	7.9	7.7	7.7
15	7.5	7.9	7.7	7.7
30	7.4	7.7	7.6	7.7
45	7.4	7.6	7.5	7.57
60	7.3	7.5	7.6	7.47
75	7.3	7.5	7.6	7.47
90	7.2	7.3	7.3	7.27

Table (3.5) *Physical and Chemical Characteristics of Prepared Pineapple-mango Jam*

Sr. No	Characteristics	Pineapple-mango Jam
1	Soluble Solid Content (°Brix)	60±0.1
2	Moisture Content (%w/w)	21.8±0.3
3	Sugar Content (%w/w)	50±0.5
4	Ash Content (%w/w)	1.6±0.3
5	Fibre Content (%w/w)	0.89±0.4
6	Acidity (%v/w)	0.17±0.2
7	pH	4.52±0.1
8	Vitamin C (mg)	7.3±0.5
9	Colour	3.7 Red, 52 Yellow

Table (3.6) *Microbiological Analysis of Mixed Pineapple-mango Fruits Jam*

Sr No	Characteristic	Pineapple-mango Jam				Standard Limits* (KENYA STANDARD)[28
		Fresh	1 month storage	2 months storage	3 months storage	
1.	Total Plate Counts (TPC) (cfu/g)	20	22	23	25	50
2.	Escherichia coli(cfu/g)	ND	ND	ND	ND	Absent
3.	Yeast and Mould (cfu/g)	ND	ND	ND	ND	Absent

4. Conclusion

The study shows that good quality pineapple-mango mixed fruits jam could be prepared and stored at ambient temperature for 90 days with minimal decrease in quality. The study also presents an opportunity of setting –up small scale fruit based jam industry in Myanmar. However, maintenance of proper hygienic condition is required during processing and storage.

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