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Development and Characterization of Innovative Nutraceutical Corn Jam

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Abstract

Many fruit jams are available in the market such as strawberry, pineapple, apricot, and orange but no jam has been reported to be formulated with corn. This prompted the idea of establishing corn based jam. This study was therefore, aimed to produce a new innovative corn jam. Standard methods were applied for sensory analysis and physicochemical (proximate) analysis. Among the various combinations, the newly developed corn jam containing 155g corn and 93g jaggery was found to be better for its nutritional quality and sensory evaluation. All three samples of newly prepared corn jam have been found highly acceptable according to sensory evaluation. The pH, acidity, brix, moisture, ash, protein, fat, fiber, carbohydrates and antioxidant activity of sample selected on the bases of organoleptic properties were found to be 3.5, 0.1%, 68.5 o, 1.74%, 2.22%, 0.21%, 2.0%, 0.01%, 65.99% and 7.89% respectively. On the sensory point of view, all three samples of the presently developed corn based jam were found highly acceptable. Viscosity and consistency analysis showed good quality attributes of corn based jam. The newly developed corn based jam also has the market competent price therefore the product is likely to gain the attraction of consumer and improves the market trends.

Keywords: Corn, Jaggery, Jam, Corn Based Jam

Introduction

To prevent diseases and to improve health, the consumers' demand of functional/nutraceutical food has been increased in a current era. Although urbanization, increase in working population has increased per capita income but also created hectic schedule of working which results in unavailability of time for the consumer to prepare their food at their own. Due to the reason, the consumption of readymade food products has brought in practice. Most of these foods have low nutrients value and high in salt, sugar and fat which make them junk foods (Kaushik, Sachdeva *et al.* 2014). Historically, jams originated as an early effort to preserve fruit for consumption during the off-season. It is an intermediate food product, prepared by boiling fruit pulp with sugar, pectin, acid and other ingredients (preservatives, coloring and flavoring substances) until obtaining a reasonably thick consistency. Many fruit jams are available in the market such as strawberry, pineapple, apricot, orange and many other fruit but no jam has been reported to be formulated with corn (Benmeziane, Djermoune-Arkoub *et al.* 2018). The historical use of pectin was in food and food preparations, such as jam and jellies due to its thickening and jelling properties (Siddiqui, Azhar *et al.* 2015).

The utilization of corn decreased the danger of diseases like, cardiovascular illness type 2 diabetes, weight and a few kinds of cancers too it is related with the improvement of digestive tract health. (Siyuan, Tong *et al.* 2018, Rouf Shah, Prasad *et al.* 2016). Corn has starches, nutrients and minerals and phytochemicals like phenolic acids. The corn grain has endosperm and germ. Nutrients vitamin A, B, E, and Minerals (magnesium, potassium and phosphorus), phenolic acids

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and flavonoids, plant sterols, and different phytochemicals (lignin's and bound phytochemicals) are available in corn grain. phytochemical profile changes with variety of corn (Siyuan, Tong *et al.* 2018).

Jaggery is a product of sugar cane plentiful in minerals like calcium, magnesium, phosphorous, sodium, iron, manganese, zinc, copper and chloride. Jaggery is also a source of vitamin D, vitamin E, vitamin B complex. It is the most nutritious sweetener contains magnesium that strengthens our nervous system, helps to relax our muscles, provides relief from fatigue and takes care of our blood vessels. Along with magnesium, jaggery contains selenium that acts as an antioxidant by scavenging free radicals from human body. Due to its anti-allergy properties, it is considered good for asthama patients (Singh, Solomon *et al.* 2013).

Keeping in view the health benefit of various ingredients, the aim of study is to prepare corn based jam with all natural ingredients without using artificial color or preservatives to enhance shelf life. There are several jam sold in the market and are happily consumed by the consumers and few of them have medicinal properties, but no jam developed by corn has been reported in the literature earlier. Therefore, the introduction of newly developed in the current study in the market will improve the health of consumers as well as the product cycle of the industry. It also has the market competent price therefor the product is likely to gain the attraction of consumer and improves the market trends.

Materials and Method:

Chemicals and Glassware

Analytical grade chemicals were used for analysis. All glassware was pre-rinsed with 10% HCl followed by deionized water.

Ingredients

The raw material of jam includes corn, jaggery, lemon, pectin and honey were purchased from a local market in Karachi city while food grade pectin were purchased from a departmental store in Karachi.

Preparation and Formulation of Corn based Jam

Corn kernel were separated from a cob by hand and boiled in a steel pan to prepare a puree. Juicer blender is used to grind corn kernel after that grinded corn is now strained through a strainer to get a puree.

Table 1: Formulation of Corn based Jam

S.No	Ingredients (g)	Sample1	Sample2	Sample3
1.	Corn pulp	155	155	155
2.	Jaggery	83	93	103
3.	Citric acid	5.1	5.1	5.1
4.	Honey	5	5	5
5.	Pectin	5.1	5.1	5.1

Organoleptic Evaluation

Standard 9-point hedonic scale procedure was used to carry out the sensory (organoleptic) evaluation of the finally produced corn jam (Amerine, Pangborn *et al.* 1965). The mean score of each quality parameter such as overall acceptability, colour, texture, flavor and taste was recorded which was analysed by 20 trained/and semi trained panelist.

Proximate Analysis

Proximate analysis of the final product such as moisture, pH, total soluble solids, acidity, viscosity, fiber, minerals, fat, consistency, colour antioxidant and phytochemical analysis were carried out according to the standard methods of AOAC (Williams 1984).

Statistical Analysis

Standard deviation was estimated by using one-way analysis of variance ANOVA. Calibration curves and linear regression curve showed r^2 values above 0.97 indicating good linearity(Williams 1984).

Results and Discussion

Standardization of Corn based Jam

The sensory analysts recommended the sample2 showed an acceptability score above average (Table-2). Corn based jam samples produced by various combination had almost the same taste, texture and mouth feel, but sample2 has shown the highest acceptability score.

Table 2: Standardization of Milk Chocolate Recipe

Parameters	Sample1	Sample2	Sample3
Corn (g)	**83**	**93**	**103**
Organoleptic acceptability score*	7.7 ± 0.88	7.95 ± 0.65	7.79 ± 0.96
Remarks	Not Selected	**Selected**	Not Selected

The sensory score of fresh corn based jam has been summarized in Table 3. The color of sample2 of final product was observed to be 8.3. This might be due to bronze colour formation by jaggery. The scores for texture, flavour and taste for sample2 were found to be 7.66, 7.83 and 8.3 respectively. All three freshly prepared sample of corn based jam, were found to be acceptable. The composition and better sensory scores might have made all of the product acceptable.

Table 3: Sensory score of fresh Corn based Jam

Parameters	Sample1	Sample2	Sample3
Taste	7.66 ± 1.03	8.3 ± 0.81	7.83 ± 0.98
Colour	7.66 ± 1.50	8 ±1.26	7.3 ±1.211
Flavour	8 ± 1.09	7.83 ±1.16	8 ±1.26
Texture	7.5 ± 1.04	7.66 ± 0.81	8 ± 1.09
Organoleptic acceptability score*	7.7 ± 0.88	7.95 ± 0.65	7.79 ± 0.96

Proximate Analysis of Corn based Jam

Proximate analysis of corn based jam have been summarized in Table-4. The results indicate that physico-chemical properties of corn based jam such as pH, ascorbic acid, acidity and overall acceptability were affected significantly by changing the ingredients. Antioxidant activity as DPPH was observed to be higher in sample3 of freshly prepared corn based jam. Antioxidants present in jaggery affect the amount of antioxidant. It has been reported in the literature that the total phenolic content is an indicator to determine the hydrophilic activity of antioxidants. The more the phenols present in the product, the higher antioxidant activity will be(Priecina and Karlina 2013).

Table 4: Proximate Analysis of Corn based Jam

Parameters	Sample1	Sample 2	Sample 3
pH	3.6 ± 0.05	3.5 ± 0.05	3.7 ± 0.7
Acidity(%)	0.07 ± 0.002	0.1 ± 0.001	0.7 ± 0.05
Brix (°)	67	68.5	71
Moisture (%)	1.74% ± 0.00	1.74% ± 0.00	1.84% ± 0.01
Fiber (%)	0.01 % ± 0.00	0.01 % ± 0.00	0.01 % ± 0.00
Ash (%)	1.8% ±0.01	2.22% ±0.00	2.78% ±0.01
Protein (%)	0.18 ±0.06	0.21 ±0.09	0.17 ±0.06
Fat (%)	2 ±0.01	2 ±0.01	3 ±0.01
Carbohydrates (%)	57.85 ± 0.4	65.99 ± 0.10	64.62 ± 0.3
Antioxidants DPPH (%)	10.22 ± 0.05	7.89 ± 0.04	11.32 ± 0.05

The presence of various active secondary plant metabolites as revealed by the phytochemical screening (Table 5) supports the resourcefulness of the plant and can justify medicinal properties of corn based jam. For example, flavonoids are known to be synthesized by plants in response to microbial infection. Tannins have antibacterial and antiseptic properties whereas triterpenes and steroids have analgesic and anti-inflammatory effects (Priecina and Karlina 2013).

Table 5: Phytochemical screening of Corn based Jam (Sample2)

Phytochemical substances	Tests	Results
Alkaloids Test	Mayer's	+
	Wagner's	+
Cardiac Glycosides Test	Modified Borntrager's	+++
Saponins Test	Froth test	-
	Foam test	-
Triterpenes Test	Salkowski'sTest	++
Steroids Test	LibermannBurchard's test	-
Resins Test	Acetone-water Test	+++
Phenols Test	Ferric Chloride Test	++
Tannins Test	Gelatin Test	++
Flavonoids Test	Alkaline Reagent Test	++
	Lead acetate Test	++

+++: appreciable amount, ++: moderate amount, +: trace amount, - : absence

Colour Analysis

For newly prepared jam samples, 'L' scale values indicated that sample3 was found to be a bit lighter than other two samples (Table 6). 'L' scale exposes the lightness and darkness of the sample, 0-50 the darkness and 51-100 the lightness of sample. Values of 'a' scale of all three samples were same showing a –ve number which indicates that the hue is on the green color. Lastly, 'b' values were also –ve number in all 3 samples which shows that the hue is on blue color.

Table 6: Colour Indices of Newly Developed Corn based Jam

Colour Measurement	Sample 1	Sample 2	Sample 3
Redness (a*)	-2.23	-2.14	-2.18
Yellowness (b*)	-4.03	-3.72	-3.83
Lightness (L*)	63.29	63.61	63.51

Viscosity of Corn based Jam

Value of viscosity of corn based jam showed that the sample containing high amount of jaggery showed highest value of viscosity (Figure-1).

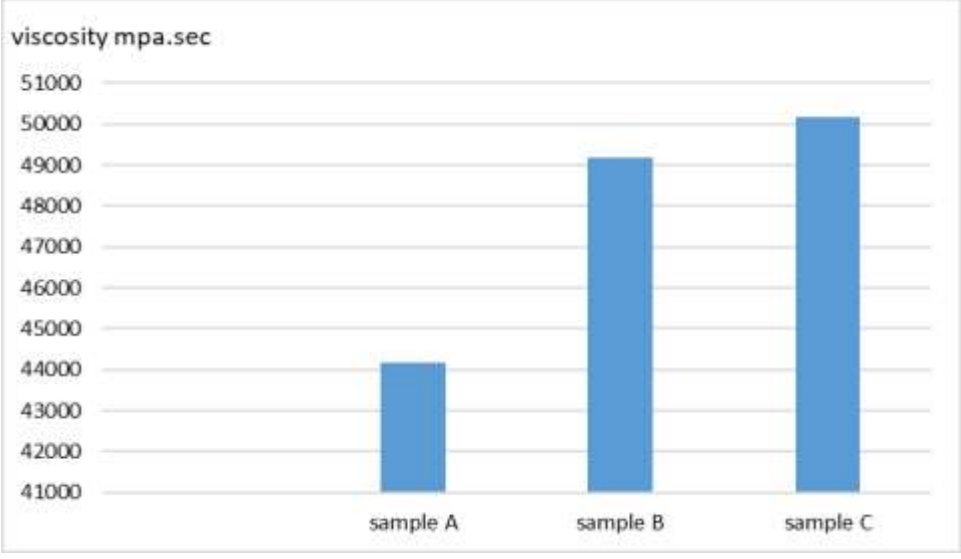

Figure 1: Viscosity Analysis of Fresh Corn based Jam

Consistency

Consistency of corn based jam showed that the sample containing high amount of jaggery has the lowest value of viscosity (Figure-2).

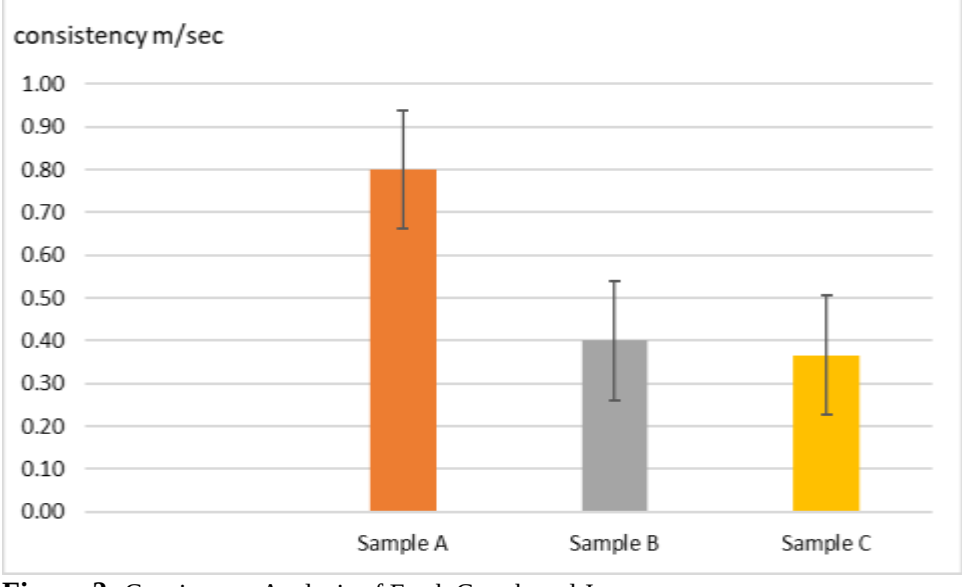

Figure 2: Consistency Analysis of Fresh Corn based Jam

Phenol content (folin-ciocalteu)

Sample 3 had the highest amount of phenol compared to other two samples (Figure-3). Sample 1 had lowest amount of phenol content compared to other two

samples. It is due to the highest amount of jaggery present in sample3, hence high amount of phenolic compounds.

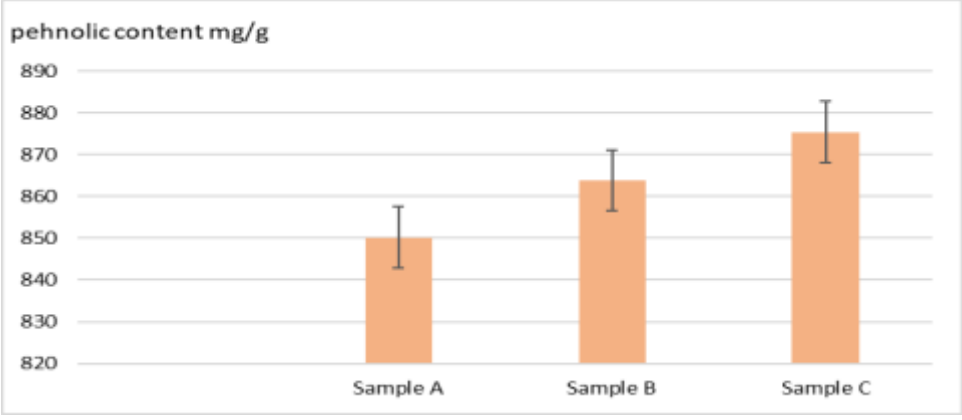

Figure 3: Phenolic Content of Corn based Jam

DPPH assay (anti-oxidants)

Sample 3 was found to contain the highest amount of anti-oxidants as compared to other two samples (Figure-4). It is due to the highest amount of jaggery present in sample3, hence high amount of phenolic compounds.

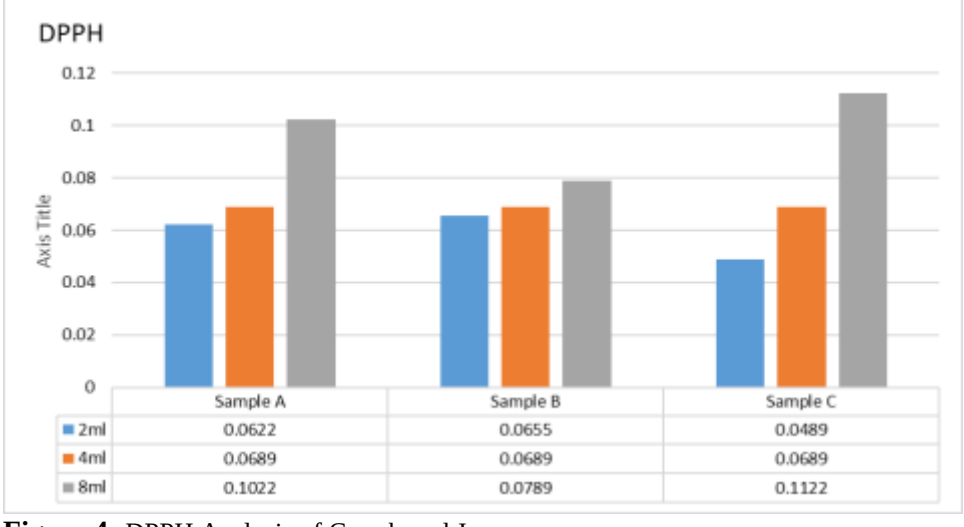

Figure 4: DPPH Analysis of Corn based Jam

Conclusion

This study was therefore, aimed to produce a new innovative corn jam. Standard methods were applied for sensory analysis and physicochemical (proximate) analysis. Among the various combinations, the newly developed corn jam containing 155g corn and 93g jaggery was found to be better for its nutritional quality and sensory evaluation. All three samples of newly prepared corn jam have been found highly acceptable according to sensory evaluation. The pH, acidity, brix, moisture, ash, protein, fat, fiber, carbohydrates and antioxidant activity of sample selected on the bases of organoleptic properties were found to be 3.5, 0.1%, 68.5 °, 1.74%, 2.22%, 0.21%, 2.0%, 0.01%, 65.99% and 7.89%

respectively. On the sensory point of view, all three samples of the presently developed corn based jam were found highly acceptable. Viscosity and consistency analysis showed good quality attributes of corn based jam. The newly developed corn based jam also has the market competent price therefore the product is likely to gain the attraction of consumer and improves the market trends.

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