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Development and quality evaluation of instant pudding mixture fortified with powder of custard apple *(Annona muricata* L.*)*

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Abstract: Desserts are courses that are traditionally served at the end of a meal in many communities around the world. They are normally made up of sweet and smooth ingredients. It is rich in sugar and fat. The aim of this project was to take advantage of natural flavor and sweetness as well as to replace artificial flavors. This study was carried out to develop an instant pudding mixture fortified with custard apple powder and to evaluate the quality characteristics of the product. The mature and ripen custard apples were harvested from the cultivations of local farmers. Fruits were cleaned, peeled, and seeded before being sliced into thin slices of 5 mm thickness and sun-dried until the pieces were fairly brittle. The dry chips were ground, then sieved through a 250 m sieve before being packaged in airtight containers. The custard apple powder was produced and incorporated in to pudding mixture formulations in different proportions (10 to 25%). The pudding mixture was characterized by physicochemical and sensory evaluation. The sensory analysis revealed that the pudding fortified with 20% custard apple powder was highly accepted in terms of color, texture, taste, and overall acceptability when compared to other treatments. A blend of 20% custard apple flour and 80% milk was successful in the development of composite pudding with improved nutritional and organoleptic properties. The findings of this study can be used to generate a high acceptability and nutritionally rich pudding combination made from custard apple powder.

Keywords; Custard apple, Fortification, Pudding mixture, Quality characteristics

Introduction

Custard apple *(Annona muricata* L.*)*, is an important edible fruit available in tropical, subtropical and arid zones around the world with 100 species. This fruit contains moisture (70.5%), carbohydrates (23.5%), proteins (1.6%), fat (0.4%), mineral matter (0.9%), iron (1.0%), calcium (0.2%), phosphorus (0.04%) and energy value 104 Kcal/100g of the edible portion ([1]. *Annona muricata* can be used in ice cream, desserts, beverages, and other dishes. Custard apples are typically served as a dessert due to the fraction of glucose and fructose (80-90%) [1].

Fortification is the process of adding nutrients or non-nutrients to edible products to prevent nutrient intake shortfalls and deficiencies, to balance the diet, restore nutrients lost in processing, or supplement a consumer's diet [2]. Now a days, people are accustomed to an unhealthy diet due to their busy lifestyles. Because of that, they have a lack of opportunities to consume inexpensive and nutritionally enriched fruits that are easily available in the home gardens. Annona is a very tasty fruit which is easily available. Besides, the flavor is unpleasant for some people. In this study, we used the approach of substituting natural flavors for desserts. The aim is to create an instant pudding combination that resembled commercially available instant puddings in terms of nutritional quality, taste, texture, and appearance.

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Methodology and experimental design

Development of custard apple powder

Well matured custard apples *(Annona muricata* L.*)* were purchased from the local farmers, which were washed, peeled and seeds were removed. Then, fruits were cut into thin slices around 5 mm thickness. The custard apple slices were oven-dried (60°C in 48 hours) on nonstick pans until brittle, then kept in airtight containers until found necessary. Finally, dry chips were ground into flour with an electric blender and passed through with a sieve (250 µm) to achieve uniformly sized flour. The flour was then sealed in an airtight container and maintained at room temperature (25°C-30°C) until the analyses were performed.

Experimental plan

Table 1: Experimental plan

Main ingredients	Treatment 01	Treatment 02	Treatment 03	Treatment 04	Treatment 05
Custard apple powder	0%	10%	15%	20%	25%
Milk powder	100%	90%	85%	80%	75%

Development of Instant pudding mixture

The pudding mixture was prepared according to the 100 g formulation (contain different proportions of custard apple and milk powder), 60 g of sugar, 5 g of starch, 10 g of gelatin. For the preparation of pudding dessert for quality evaluations and sensory evaluation, 500ml hot water was added for 100g of pudding mixture. The mixture was stirred and kept until it become to room temperature(27^0C). The mixture was spread in pudding mold and kept it in the refrigerator for one hour [3].

Nutritional analysis of Annona flour based instant pudding mixture

The nutritional quality of the food was assessed using AOAC (2000) approved standards. The quantitative descriptive sensory analysis was performed with 20 untrained panelists for sensory evaluation. The samples were assessed using a 9-point hedonic scale for color, flavor, aroma, appearance, texture, and overall acceptance. The findings of the sensorial acceptability design and other physiochemical parameters were statistically evaluated using the Analysis of Variance (ANOVA) and Tukey test at the 5% level of significance to compare the means using the SPSS 25.

Results & Discussion

Physical parameters of Annona flour based instant pudding mixture

The physical characteristics analysis of the pudding samples is shown in Table 2. There were significant changes in water absorption capacity (WAC) of pudding mixture when the quantity of custard apple powder was raised from 10% to 20% ($p<0.05$).

Table 2: Physical properties of pudding mixture

Treatment	Water Absorption Capacity
T1	3.27 ± 0.04^{a}
T2	3.31 ± 0.07^{a}
T3	3.57 ± 0.02^{b}
T4	3.67 ± 0.03^{b}
T5	4.21 ± 0.06^{c}

The values are means of four replicates ± standard error.

There was an increase in the WAC of pudding with the increase in custard apple powder up to 25%. The treatment with 25% custard apple powder had the highest mean and treatment with 10% had lowest mean of water absorption capacity. The result showed that an increase in the level of custard apple powder resulted in a linear increase in water absorption capacity of pudding mixture.

Physicochemical analysis of Annona flour based instant pudding mixture

The physicochemical analysis of instant pudding mixture made from custard apple flour and milk powder blends are shown in Table 3.

Table 3: Physio-chemical properties of pudding mixture

Treatment	Moisture	Ash	pH	Acidity	Fat	Energy
T1	5.34 ± 0.138^{a}	0.05 ± 0.001^{a}	5.57 ± 0.02^{b}	0.13 ± 0.01^{a}	0.24 ± 0.01^{a}	18.69 ± 0.03^{c}
T2	5.17 ± 0.097^{a}	0.05 ± 0.003^{a}	5.28 ± 0.09^{ab}	0.12 ± 0.01^{a}	0.23 ± 0.02^{a}	18.38 ± 0.02^{b}
T3	5.46 ± 0.052^{ab}	0.04 ± 0.001^{a}	5.47 ± 0.12^{ab}	0.15 ± 0.02^{a}	0.27 ± 0.02^{ab}	18.05 ± 0.04^{a}
T4	5.24 ± 0.052^{a}	0.05 ± 0.004^{a}	5.62 ± 0.09^{b}	0.14 ± 0.01^{a}	0.24 ± 0.0^{a}	18.09 ± 0.03^{a}
T5	5.80 ± 0.047^{b}	0.05 ± 0.001^{a}	5.20 ± 0.04^{a}	0.13 ± 0.01^{a}	0.30 ± 0.01^{b}	19.16 ± 0.04^{d}

The values are means of four replicates ± standard error.

The results showed that there were variations in the physicochemical properties of fortified pudding mixtures and there were no significant differences *($p>0.05$)* observed among the treatments in terms of ash, and acidity. The moisture content of cookies was increased from 5.17-5.80% with the incremental addition of custard apple powder from 10 to 25%. This could be due to the higher water absorption capacity of custard apple flour. However, changes in the energy content among the pudding samples may have resulted from the difference in the level of nutrition contents of milk and custard apple powder.

Sensory Analysis of Annona flour based instant pudding mixture

The organoleptic analysis of the pudding mixtures showed that there were significant differences observed *($p< 0.05$)* between the treatments in terms of color, mouth feel, taste and overall acceptability and there were no significant differences *($p>0.05$)* among the treatments in terms of texture and odor as the level of custard apple powder increased from 10 to 25% (Table 4). The diverse orientations of score patterns might be attributed to panelists' differing rates of preference and acceptable values, as well as the quality of finished pudding produced.

Table 4: Sensory evolution of instant pudding mixture

Treatment	Color	Mouth feel	Texture	Taste	Odor	Over roll acceptability
T1	7.1 ± 0.3^{ab}	6.6 ± 0.4^{ab}	6.4 ± 0.4^{a}	6.5 ± 0.4^{a}	6.5 ± 0.4^{a}	6.6 ± 0.3^{a}
T2	6.2 ± 0.4^{ab}	6.5 ± 0.3^{a}	6.6 ± 0.3^{a}	6.5 ± 0.3^{a}	6.5 ± 0.3^{a}	6.5 ± 0.3^{a}
T3	6.6 ± 0.5^{a}	6.5 ± 0.4^{a}	6.6 ± 0.3^{a}	6.8 ± 0.4^{ab}	6.6 ± 0.3^{a}	6.6 ± 0.3^{a}
T4	8.3 ± 0.2^{b}	8.0 ± 0.3^{b}	7.3 ± 0.0^{a}	7.9 ± 0.3^{b}	7.3 ± 0.4^{a}	7.9 ± 0.2^{b}
T5	7.0 ± 0.4^{a}	6.9 ± 0.4^{a}	6.5 ± 0.4^{a}	6.5 ± 0.4^{ab}	6.7 ± 0.3^{a}	6.7 ± 0.3^{a}

The values are means of 20 replicates ± standard error.

The color of the pudding mixtures changed from light green to normal green color. The darker color may be due to increase the amount of custard apple flour of mixture. The T4 containing 20% of custard apple had the highest mean value for taste, texture, mouth feel and odor. The overall acceptability, which is an essential metric in organoleptic estimate, includes several implications. For overall acceptance, the fortified pudding from treatment T4 with 20% custard apple flour had the greatest mean value compared to the other custard apple flour fortified pudding mixes.

Conclusion

As a conclusion, this study will be a new concept for incorporating healthy desserts with custard apple powder to increase the value of dessert. Custard apple powder was successfully developed from *Annona muricata* fruit and the instant pudding mixture was successfully formulated. The pudding mixture made out with 20% custard apple powder were highly acceptable in nutritional and organoleptic qualities compared to other tested combinations.

Reference

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