

CANDIES IN MIXED MASS OF GUAVA AND MANGO TYPE MARIOLA: DEVELOPMENT AND CHARACTERIZATION



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Doce em massa misto de goiaba e manga tipo mariola: desenvolvimento e caracterização

Dulces en masa mixta de guava y mango tipo mariola: desarrollo y caracterización

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RESUMO

Os desperdícios de frutas são minimizados com a elaboração de diferentes tipos de doces. Os doces em massa podem ser enriquecidos nutricionalmente pela mistura de frutas, como goiaba e manga. Assim, objetivou-se desenvolver doces em massa misto de goiaba e manga tipo mariola, bem como avaliar as características físico-químicas e aceitação sensorial. Foram elaborados três doces em massa, diferenciados pelas concentrações de polpa de goiaba e manga. Analisou-se as características físico-químicas, aceitação sensorial, Índice de Aceitabilidade, Aceitabilidade Geral e intenção de compra. Os dados obtidos foram tratados com Análise de Variância, em Delineamento Inteiramente Casualizado, comparando-se as médias pelo teste de Tukey a 5% de significância. Os doces atenderam aos padrões de identidade e qualidade preconizados pela legislação brasileira. Somente os valores de pH não diferiram significativamente, variando entre 3,92 e 3,97. Os doces apresentaram no atributo consistência uma variação dos termos entre “gostei muito” e “gostei muitíssimo”. A formulação com 30% goiaba e 20% manga destacou-se como mais bem aceita. A elaboração de doces de goiaba e manga tipo mariola pode ser viável e são bem aceitos sensorialmente.

Palavras-chave: Aceitação sensorial. Doce de frutas. *Mangifera indica* L. Mariolas. *Psidium guajava* L.

ABSTRACT

Fruit waste is minimized by making different types of candies. The mass in mass can be nutritionally enriched by mixing fruits, such as guava and mango. Thus, the objective was to develop candies in mixed mass of guava and mango type mariola, as well to evaluate the physical-chemical characteristics and sensory acceptance. Three candies in mass were made, differentiated by the concentrations of guava and mango pulp. The physical-chemical characteristics, sensory acceptance, Acceptability Index, General Acceptability and buy intention were analyzed. The data obtained were treated with Analysis of Variance, in a Completely Randomized Design, comparing the means

by the Tukey test at 5% significance. The candies met the standards of identity and quality recommended by Brazilian legislation. Only the pH values did not differ significantly, varying between 3.92 and 3.97. The candies presented a variation of terms in the consistency attribute between "I liked it a lot" and "I liked it a very much". The formulation with 30% guava and 20% mango stood out as the best accepted. The preparation of guava and mango type candies can be feasible and are well-accepted sensorially.

Keywords: Sensory acceptance. Fruit candy. *Mangifera indica* L. Mariolas. *Psidium guajava* L.

RESUMEN

El desperdicio de fruta se minimiza al hacer diferentes tipos de dulces. Los dulces a pasta pueden enriquecerse nutricionalmente al mezclar frutas, como la guayaba y el mango. Por lo tanto, el objetivo era desarrollar dulces mixta en pasta de mariola tipo guayaba y mango, así como evaluar las características físico-químicas y la aceptación sensorial. Se prepararon tres dulces pasta, diferenciados por las concentraciones de pulpa de guayaba y mango. Se analizaron las características físico-químicas, la aceptación sensorial, el Índice de Aceptabilidad, Aceptabilidad General e intención de compra. Los datos obtenidos se trataron con Análisis de varianza, en un diseño completamente al azar, comparando las medias mediante la prueba de Tukey con una significancia del 5%. Los dulces cumplieron con los estándares de identidad y calidad recomendados por la legislación brasileña. Solo los valores de pH no difirieron significativamente, variando entre 3.92 y 3.97. Los dulces presentaron una variación de términos en el atributo de consistencia entre "Me gustó muy" y "Me gustó mucho". La formulación con 30% de guayaba y 20% de mango se destacó como la más aceptada. La preparación de dulce mariola de guayaba y mango puede ser factible y bien aceptada sensorialmente.

Descriptores: Aceptación sensorial. Dulces de frutas. *Mangifera indica* L. Mariolas. *Psidium guajava* L.

INTRODUCTION

In Brazil, the fruit growing presents an important social and economic activity. It is estimated that at around 53% of all national fruits production is destined for processing. The Northeast, despite the water limitations, is responsible for 27% of this total, highlighting the cultivation of coconut, guava, papaya, mango, passion fruit, pineapple and melon (ARAÚJO et al., 2014; VIDAL; XIMENES, 2016).

Guava (*Psidium guajava* L.) is a typical fruit of tropical and subtropical regions. Brazil stands out by economical representativeness and intense consumption of *in natura* and processed guava. This fruit has a nutritional intake that is based in exogenous antioxidants, such as vitamin C, carotenoids, phenolic compounds and flavonoids (AMORIM et al., 2015; ARAÚJO et al., 2015; SILVA et al., 2016).

Mango (*Mangifera indica* L.) is a fruit with nutritional quality, that is compound by bioactive, such as vitamin C and carotenoids, responsible by health

promotion (MELO; ARAÚJO, 2011; SOARES; JOSE, 2013). Due to grown of several regions of the world, its economic importance and exportation potential are high (ONIAS et al., 2016).

It is known that fruit candies production can be an agroindustrial activity able to aggregate economical value to *in natura* raw material, besides that to enable the waste minimization during the commercialization. Mixed formulations have prepared with the aim of enriching nutritionally products already exist in the market (VALIM, 2011; MOURA et al., 2014).

In Brazilian legislation, candies in mass can be called cut type candies. More intensely in recent years, the commercialization of mariola type candies has grown (BRASIL, 2005; OLIVEIRA et al., 2018). These candies are elaborate by the cooking of vegetables or edible parts of crumbled vegetables and sugar, pectin, and organic acids to pH setting (BRASIL, 1978; 2005).

Candies mariola type can be classified as simple or mixed, when in the formulation there is only one vegetable specie and when in the formulation there is more one vegetable specie, respectively (OLIVEIRA et al., 2018). However, there weren't found in the literature results in candies in mixed mass type mariola.

Thus, this work aims to develop candies in mixed mass of guava and mango type mariola, as well to evaluate the physical-chemical characteristics and sensory acceptance.

MATERIAL AND METHODS

This study was developed at the Federal Institute of Education, Science and Technology of Rio Grande do Norte, *campus* Pau dos Ferros-RN. Ingredients used were commercial sugar, pectin of high methoxylation content – HMC (Genu® of CP Kelco) and *in natura* fruits (guava and mango), bought in the local businesses of Pau dos Ferros-RN.

Fruits have submitted the steps of maturation stage selection mature, sanitization with the chlorinated solution (100 ppm/10 min), rinsing, peeling, separating the seeds from the mangoes, cutting, grinding in an industrial blender and filtering through nylon sieves to separate the guava seeds. Thus, the Guava Pulps (GP) and Mango Pulps (MP) were prepared.

Through preliminary tests and according to the methodology described by Oliveira Neto et al. (2018), it was defined three formulations of candies in mixed mass of guava and mango type mariola. These candies are different in the concentrations of GP and MP, being M₁ (25% de GP e 25% de MP), M₂ (20% de GP e 30% de MP) e M₃ (30% de GP e 20% de MP). In Table 1 are detailed the formulations.

For the preparation of candies, the solid ingredients were mixed and, then, with the pasty, respectively. The mixture was subjected to the cooking process in stainless steel pots up to a Total Soluble

Solids content (TSS) of 74 °Brix (reading in a manual refractometer), according to the methodology described by the Adolfo Lutz Institute (ALI, 2008).

Table 1. Formulations of candies in mixed mass of guava and mango type mariola.

Ingredients (%)	Formulations		
	M ₁	M ₂	M ₃
Guava Pulp (GP)	25	20	30
Mango Pulp (MP)	25	30	20
Sugar	48	48	48
Pectin of HMC	2	2	2

Subsequently, the candies were added while still hot in polyethylene trays, previously sanitized. When the products reached room temperature, they were cut into small tablets (3 × 5 cm), which were subjected to granulation with crystal sugar. Then, the candies were placed in polyethylene pots with a capacity of 200 mL and stored at room temperature.

The physical-chemical characteristics of the candies were evaluated, in triplicate, regarding the parameters: water content (drying in an oven, at 105 °C/ 24 h); pH (direct reading in pHmeter); Total Titratable Acidity - TTA (titration with 0.1 N NaOH); TSS; Total Reducing Sugars - TRS, Non-Reducing Sugars - NRS, Total Sugars - TS (Lane-eynon method); and *Ratio*, through the TSS/TTA relationship (ALI, 2008). The water activity (A_w) of the candies was evaluated using digital equipment (Aqualab®, model Labstart).

The sensory analysis of the candies in mixed mass of guava and mango type mariola was carried out with 50 untrained evaluators. The sensorial acceptance of the attributes color, appearance, aroma, consistency, flavor, sweetness and overall impression was evaluated, using a hedonic scale of nine points, being 1 - extremely disliked, 2 - disliked a lot, 3 - dislodged moderately, 4 - dislocated slightly, 5 - neither liked nor disliked, 6 - I liked it slightly, 7 - I liked it moderately, 8 - I liked it a lot and 9 - I liked it a very much (DUTCOSKY, 2013).

The Acceptability Index (AI) and the General Acceptability were calculated, according to Gularte (2009). The buy intention was analyzed using a five-point hedonic scale, being 1 - would certainly not buy the product, 2 - probably would not buy the product, 3 - maybe bought/ maybe didn't buy, 4 - would probably buy the product 5 - would certainly buy the product (DUTCOSKY, 2013).

The data obtained in the physical-chemical and sensory analyzes were analyzed with the aid of the *software Assistat* version 7.7 beta (SILVA; AZEVEDO, 2016). An Analysis of Variance (ANOVA) was applied, in a Completely Randomized Design (CRD), comparing the means by the *Tukey* test at 5% significance level ($p < 0.05$).

RESULTS AND DISCUSSION

Table 2 presents the results of the physical-chemical analysis of the candies in mixed mass of guava and mango type mariola.

Table 2. Physical-chemical analysis of the candies in mixed mass of guava and mango type mariola.

Parameters	Candies in mixed mass type mariola			SMD
	M ₁	M ₂	M ₃	
	Water content (%)	22.88 ^a	17.52 ^b	
A _w	0.67 ^a	0.61 ^b	0.61 ^b	0.01
pH	3.92 ^a	3.97 ^a	3.93 ^a	0.06
TTA (%)	0.58 ^a	0.46 ^b	0.29 ^c	0.08
TSS (°Brix)	74.00 ^b	77.00 ^a	74.00 ^b	0.01
Ratio	128.47 ^c	169.10 ^b	256.88 ^a	3.81
TRS (%)	13.36 ^c	14.53 ^b	15.75 ^a	0.76
NRS (%)	37.65 ^b	48.27 ^a	37.50 ^b	1.41
TS (%)	53.00 ^c	65.34 ^a	55.22 ^b	1.66

Guava Pulps (GP), Mango Pulps (MP), M₁ (25% GP and 25% MP), M₂ (20% GP and 30% MP) and M₃ (30% GP and 20% MP). Water activity (A_w), Total Titratable Acidity (TTA), Total Soluble Solids (TSS), Total Reducing Sugars (TRS), Non-Reducing Sugars (NRS), Total Sugars (TS) and Significant Mean Deviation (SMD). Significant Average Deviation (SAD). Means followed in line by the same letter do not differ significantly by *Tukey* test at 5% significance.

Results show high water content to M₁, with a significant difference ($p < 0.05$) if compared to the other formulations. Most of the values are probably related to the composition of the raw material used. Relating the A_w, M₁ showed the highest value, with

0.67. There wasn't a significant difference ($p < 0.05$) between M₂ and M₃. Low values of A_w in the products can limit the microorganism's multiplications and biochemistry reactions.

The pH values were statistically equal ($p < 0.05$), from 3.92 (M₁) to 3.97 (M₂). Hence, different concentrations of GP and MP didn't modify this parameter. According to Moura et al. (2014), when candies pH is more than 4.5, pathogenic bacteria are favored, for example, the *Clostridium botulinum*. In this study, Moura et al. (2014) found similar pH values, among 3.79 and 4.16, when they studied creamy guava candy.

The TTA values showed a significant difference ($p < 0.05$) between each other. M₁ formulation presented higher acidity (0.58%) than others. In this study, could be seen that the greater the amount of GP the lower the total acidity of the products, probably due to the higher concentration of organic acids in this fruit.

It could be seen the variation from 74.00 (M₁ and M₃) to 77.00 °Brix (M₂) for TSS values, there weren't significant difference ($p < 0.05$) between M₁ and M₃. The Normative Resolution n° 9 of 1978, recommends that the TSS values for candies in mass should be greater than 65 °Brix (BRASIL, 1978). Hence, all candies produced obtained results by followed per under legislation.

The *Ratio* level is the relation between TSS/TTA, and this can indicate the sweetness sensation of products. It was observed significant difference ($p < 0.05$) among candies, being that M₁ formulation showed the lowest value (128.47) and M₃ formulation the highest value (256.88). So, different concentrations of GP can influence this parameter, so that the higher GP quantity higher the *Ratio* products. Santana Neto et al. (2014) obtained higher *Ratio* results, among 291.41 and 400.14, when they studied banana candies in mass.

In the sugar levels occurred significant difference ($p < 0.05$) among candies for all parameters, except for M_1 and M_3 for NRS. The values varied from 13.36 (M_1) to 15.75% (M_3), and it could see the GP influence. By following per under Dias et al. (2011), sucrose inversion to reducing sugars is desirable in the proportion greater than 30%, aimed at crystallization prevention because of the increase the sucrose solubility during the storage. In this work, candies in mixed mass of guava and mango type mariola M_2 (20% of GP and 30% of MP) showed a higher level of TA than other formulations. Oliveira Neto et al. (2018) got higher TA levels when they studied banana candies in mass (77.99%), reducing the sugar levels with banana pell addition.

In Table 3 are results got the acceptance of sensory attributes and Acceptability Indexes (AI) of the candies in mixed mass of guava and mango type mariola.

Table 3. Sensory attributes acceptance and Acceptability Indexes of the candies in mixed mass of guava and mango type mariola.

Attributes	Candies in mixed mass type mariola			SMD
	M_1	M_2	M_3	
Color	7.88 ^a	8.18 ^a	8.34 ^a	0.48
AI (%)	87.55	90.88	92.66	
Appearance	7.86 ^b	8.14 ^{ab}	8.36 ^a	0.49
AI (%)	87.33	90.44	92.88	
Aroma	7.76 ^a	8.16 ^a	8.08 ^a	0.47
AI (%)	86.22	90.66	89.77	
Consistency	8.04 ^a	8.16 ^a	8.12 ^a	0.53
AI (%)	89.33	90.66	90.22	
Taste	7.74 ^a	8.22 ^a	8.12 ^a	0.60
AI (%)	86.00	91.33	90.22	
Sweetness	7.96 ^a	8.14 ^a	7.92 ^a	0.59
AI (%)	88.44	90.44	88.00	
Overall Impression	7.94 ^a	8.18 ^a	8.34 ^a	0.47
AI (%)	88.22	90.88	92.66	

Guava Pulps (GP), Mango Pulps (MP), M_1 (25% GP and 25% MP), M_2 (20% GP and 30% MP) and M_3 (30% GP and 20% MP). Acceptability Index (AI) and Significant Mean Deviation (SMD). Means followed on the line by the same letter do not differ significantly by *Tukey* test at 5% significance.

Color, aroma, consistency, taste, sweetness, and overall impression results didn't show the significant difference ($p < 0.05$) among candies. The average of all attributes, with consistency exception,

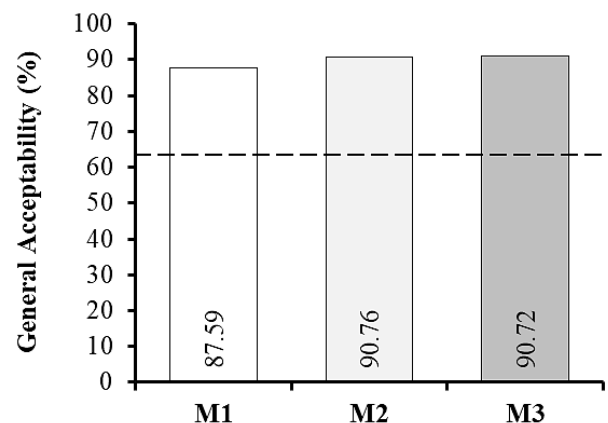
was between "I liked it moderately" and "I liked it a very much", using the hedonic terms, with AI greater than 85%. By following Gularte (2009), the product is considered to accept if it has $AI \geq 70\%$.

Regarding the concerning the appearance attribute, there wasn't significant difference ($p < 0.05$) among M_2 and other formulations. In this attribute, the average varied from "I liked it moderately" and "I liked it a very much", with results greater for M_3 , with 30% of GP and 20% of MP. Godoy et al. (2014) found less sensory acceptance for appearance (between 5.0 and 5.7), studying cut type banana candy.

The candies presented the average consistency of notes in hedonic terms, varying between "I liked it a lot" and "I liked it a lot". This attribute can be associated with TSS of formulations, important for the gel formation, and reaching the correct candies point. Consistency's AI was between 89.33 (M_1) and 90.66% (M_2) which is considered a positive value to marketing tests, by following per under Gularte (2009). The greatest AI was seen in the attributes color, appearance, and overall impression, mainly in the M_3 formulation, that has the greatest GP concentration.

General Acceptability Indexes are presented in Figure 1 of the candies in mixed mass of guava and mango type mariola.

Figure 1. General Acceptability of the candies in mixed mass of guava and mango type mariola.



About to with concerning General Acceptability was found values greatest than 70%. It is known, by following per under Gularte (2009), the AI minimum of 70% is considered for the product will be accepted relating its sensory properties.

The M₃ got General Acceptability of 90.92% highlighting if compared with the other formulations. Campos et al. (2015) found superior results the 70% when studied candies in mass of passion fruit and guava (from 83.80 to 86.00%), Kato et al. (2013) also found superior results the 70% being it 84.30% of General Acceptability, when studied pumpkin candy with coconut.

In Table 4 are results got the buy intention of the candies in mixed mass of guava and mango type mariola.

Table 4. Buy intention of the candies in mixed mass of guava and mango type mariola.

Candies in mixed mass type mariola	Buy intention	SMD
M ₁	4,12 ^b	
M ₂	4,34 ^{ab}	0,36
M ₃	4,54 ^a	

Guava Pulps (GP), Mango Pulps (MP), M₁ (25% GP and 25% MP), M₂ (20% GP and 30% MP) and M₃ (30% GP and 20% MP). Significant Mean Deviation (SMD). Means followed in line by the same letter do not differ significantly by *Tukey* test at 5% significance.

In the intention buy the candies, a variation of the hedonic terms was found between “would probably buy the product” and “would certainly buy the product”. There were no significant differences ($p < 0.05$) between candy M₂ and the others, with a higher average for the M₃ formulation (4.54). It is possible due to the higher overall AI (Figure 1), *Ratio* content (Table 2), and GP concentration.

Guava candy (*goiabada*) is more commonly found in commerce, so it probably has a higher consumption by consumers. Diógenes-Júnior et al. (2019), when evaluating soursop dough candy, obtained an average variation of the hedonic terms between “maybe bought/ maybe didn't buy” and “would certainly buy the product”.

CONCLUSION

The candies in mixed mass of guava and mango type mariola met the standards of identity and quality recommended by Brazilian legislation, with low levels of water activity, which tend to limit changes during storage. The different concentrations of guava and mango pulp were significant factors, mainly for the values of total acidity and *Ratio*.

In the sensorial acceptance of the candies, high Acceptability Indexes and buy intention were observed, highlighting the most accepted formulation, with 30% guava pulp and 20% mango pulp. Therefore, the elaboration of mixed masses of guava and mango type mariola can be viable and well accepted, with different sensory attributes and nutritional value.

All authors have declared that there is no potential conflict of interest regarding this article.

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