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Conformation and Nutritional Evaluation of Gummy Candy Complemented with *Annona muricata*

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ABSTRACT

Candies are the most favoured eats by people of all age group. At present, due to increasing nutritional awareness candies are restricted from consumption as they provide empty calories and also cause dental caries. In order to make the common man enjoy the flavour and savour of candies, it becomes vital to nutritionally enhance the sugar candies by value addition so that the candies are no more in the block list of purchase. As a primitive measure, the study aims to incorporate *Annona muricata*, commonly known as graviola or soursop a fruit which is cultivated in the tropical areas, known for its antioxidant, anti-carcinogenic properties and immune enhancing properties as a major ingredient for the preparation of gummy candy. The mishmash of sour and sweet taste of the fruit and wellness of the whole fruit has immensely contributed for the mouth-watering taste of the gummy candy and nutritional factors as well. This study is outlined with the objective of developing gummy candy by incorporating soursop pulp, puree and extract to the regular ingredients of gummy candy respectively. The developed soursop gummy candies were subjected to sensory analysis and the accepted variation was subjected to nutritional analysis. It was observed that the soursop puree incorporated gummy candy was significantly rich in micronutrients and polyphenols compared to plain gummy candy which provided only calories.

KEY WORDS: ANTI-CARCINOGENIC, GUMMY CANDY, IMMUNE ENHANCEMENT, SOURSOP, VALUE ADDITION

INTRODUCTION

Annona muricata, Soursop fruits possess a strong smell and flavor, because of the high content of Vitamin C, Vitamin A and B complex. Mineral content quite complete couple with amino acids such as lysine, methionine and tryptophan (Rady et al.,2018). The specific bioactive constituents responsible for the major anticancer, antioxidant, anti-inflammatory, antimicrobial, (Sun etal., 2014, Prabhakaran etal.,2016) and other health benefits of soursop include different classes of alkaloids, flavonoids, sterols, and others (Chamcehyu and Rady, 2018).

Soursop acknowledged as a potent immune booster (Sun et al.,2017) and has proven effective against cancer, haemorrhoids, renal disorders, hepatic-biliary disorders, urinary tract infection, osteoporosis and even delays ageing.Ripe soursop fruit with short shelf life, will deteriorate and price of soursop fruit in the market by the farmers is not fetched (Amusa et al.,2003, Abbo et al.,2006). Therefore, the addition of the soursop fruit to gummy or jelly candy not only improve the taste, but also acts as a source of vitamins, minerals and amino acids as well expected to improve the utilization of soursop fruits (Moghadamtousi et.al., 2015, Daddiouaissa and Amid, 2019).

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As the jelly candies prepared incorporating fruits or vegetables along with gelatine and natural sweeteners has the advantage of nutritional value compared with those prepared only from essence and simple sugars. The texture and consistency of gummy candy allows the flexibility, to mold into different shapes, size making the product a highly acceptable one.

The present study is outlined with the objective of developing gummy candy by incorporating soursop pulp, puree and extract to the regular ingredients of gummy candy respectively. The developed soursop gummy candies were subjected to sensory analysis and the accepted variation was subjected to nutritional analysis. It was observed that the soursop puree incorporated gummy candy was significantly rich in micronutrients and polyphenols compared to plain gummy candy which provided only calories.

MATERIAL AND METHODS

All the ingredients required for the preparation of soursop gummy candy viz. soursop fruit, gelatin and jaggery were procured from Salem and Coimbatore, Tamilnadu India. The undamaged, healthy, mature soursop fruits were used for this study. The outer cover and seeds were removed. The flesh was cut in to small pieces and the fresh fruit pulp stored in refrigerator to prepare candy. In a stainless steel pan add soursop flesh and add ½ cup of drinking water and allow it to boil for few minutes. Once it reached room temperature put it into a blender to obtain soursop puree. The flesh was cut in to small pieces and it was put in stainless steel pan. Add drinking water 1½ times of fruit pulp. Boiled fruit sample was filtered through the muslin cloth to get soursop extract. After the preparation of pulp, puree and extract they were posed to physiochemical analysis to determine the suitability of incorporation to prepare gummy candy.

Table 1. Physio-chemical Properties of Soursop Pulp, puree and extract

Physicochemical Analysis	Pulp	Puree	Extract
Titratable acidity (g/100g)	1.02±0.43	0.61±0.02	0.81±0.04
Ascorbic acid (mg/100 g)	20.9±1.84	9.83±0.26	8.72±0.28
Cloud stability (at 660nm) Total	0.94±0.06	0.65±0.00	0.42±0.01
Total Soluble solids (^{0}Brix)	11.00±0.4	8.00±0.00	1.00±0.00
pH	3.70±0.06	3.70±0.04	3.70±0.08
Viscosity (cp)	25.60±0.14	19.20±0.16	8.02±0.22
Fructose, g/100 g	3.60±0.27	3.09±0.22	3.27±0.23
Glucose, g/100 g	2.97±0.24	2.90±0.22	2.87±0.20
Sucrose, g/100g	1.02±0.28	0.99±0.05	0.87±0.02

RESULTS AND DISCUSSION

The results of physio-chemical analysis are presented in table-1.

Titratable acidity deals with measurement of the total acid concentration contained within a food was determined by exhaustive titration of intrinsic acids with a standard base. Titratable acidity is a better predictor of acid's impact on flavor than pH, while Cloud Stability is linked to electrostatic repulsion between these particles, where negatively charged pectins surrounds protein nucleus. The solution viscosity gives an indication of the average degree of polymerization of the cellulose and gives a relative indication of the degradation (decrease in cellulose molecular weight) resulting from the pulping and/or bleaching process. To Measure the sugar content TSS content was used.

This was measured using a refractometer, and is referred to as the degrees Brix. The results depicted that all the criterions were similar in all three formulations viz. pulp, puree and extract except TSS values in extract, which was less may be because of processing method that was used. It was also observed that the values obtained were complimentary for the formulation of gummy candy. Hence, it was decided to prepare three formulations of soursop gummy candy (SGC) by using pulp, puree and extract as well. The soursop gummy candy was prepared by using soursop pulp, puree, extract. The ingredients required for the formulation is listed in Table 2.

Table 2. Composition of Ingredients for Formulation of Soursop Gummy Candy

Ingredients	Sample		
	F-1(Pulp)	F-2(Puree)	F-3(Extract)
Soursop pulp (g/100 g)	50	-	-
Soursop puree (g/100 g)	-	50	-
Soursop extract (ml/100 g)	-	-	50
Jaggery (g/100 g)	50	50	50
Gelatin(g/100 g)	2	2	2
Water(ml)	50	50	50

The steps in preparation of soursop gummy candy were as follows: Hot water was added to gelatin and was rested for 10 minutes. Water was boiled and to it was added portioned amount of jaggery to prepare syrup. Once the syrup reached one – thread stage, other ingredients were added except soursop preparation and stired well. After this soursop pulp/puree/extract was added and stirred for 2 mins without any lumps, in different ampoules. It was moulded into required shapes and refrigerated overnight, being ready to serve.

The different formulations of gummy candies prepared from soursop pulp, puree and extract were subjected to organoleptic evaluation to assess the maximum acceptability of the products. The quality attributes in terms of colour, appearance, flavor, texture, taste and over all acceptability were evaluated by untrained judges using score card with 5 point Hedonic scale.

Figure 1: Mean Organoleptic Scores of Different Formulations of Soursop Gummy Candies

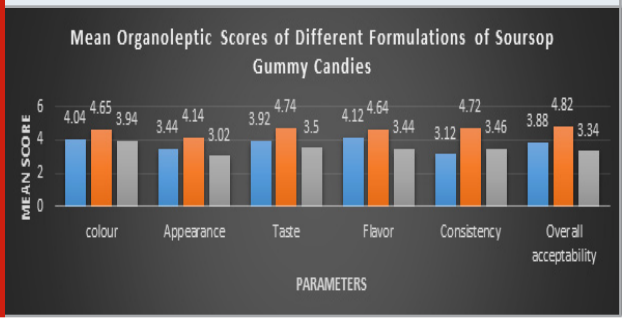

Figure 1 depicts that the overall acceptability, and other parameters of assessment like colour, appearance, taste, flavour and consistency was on the higher side for the gummy candy prepared from soursop puree. Hence, the accepted formulation was subjected to nutrient evaluation.

It is evident from the above table that the gummy candy prepared from soursop puree is superior in nutritional aspects in all means. The energy and carbohydrate values are more in SGC which may be attributed to combined calories and carbohydrates obtained from SF and jaggery. The protein available from gelatine and soursop has increased the protein content in SGC. The presence of fibre in candies is astounding and solely the inclusion of soursop fruit has proved the possibility (Qazi et al.,2018).

Fibre has sufficient supporting factors to improve the gut health, provide satiety and prevent obesity. The presence of B complex vitamins aid to boost metabolism. Vitamin C present in SGC (20.2mg/ 100gms) is a welcoming parameter to promote the production and use of SGC. Minerals like calcium, magnesium and iron known to play a vital role in boosting immunity is present in sufficient quantity in SGC. The presence of phytonutrients like alkaloids, flavonoids and polyphenols was also observed after qualitative estimation of phytochemicals in SGC.

Table 3. Comparison of Nutritive Value of *Annona muricata* Fruit, Plain Gummy Candy and Soursop Gummy Candy (Puree)

Nutrients	Nutritive Value of Soursop Fruit (SF)	Nutritive Value of Plain Gummy Candy (PGC)	Nutritive Value of Soursop Gummy Candy (Puree) (SGC)
Energy (kcal)	66	262	302.4
Protein(g/100g)	1	0.2	1.03
Fat (g/100g)	0.3	0	0.32
Cho (g/100g)	16.84	70	73.85
Fibre (g/100g)	3.3	0.1	3.11
Niacin(mg/100g)	0.9	0.01	0.3
Riboflavin(mg)	0.05	0	0.01
Thiamin(mg/100g)	0.07	0	0.03
Ascorbic acid (mg/100g)	20.6	2.2	20.23
Calcium(mg)	14	10	71.36
Potassium(mg)	60	54	63.76
Sodium(mg)	14	30	231.87
Magnesium(mg)	21	5	25
Iron(mg)	0.6	0.1	3

CONCLUSION

The gummy candy prepared using soursop puree will be ready to lend a hand for patients with cancer undergoing chemotherapy, as they experience nausea and throat or mouth dryness for which slurping of soursop gummy candies will prove effective. Also, renal patients for whom water intake is restricted, soursop gummy candy consumption may relieve thirst, along with the nutritional wellness of soursop. It is recommended that more awareness and promotion is required, regarding the pervasiveness and importance of soursop as it is rarely used as a whole fruit or processed. The food industries can also be encouraged to use soursop fruit in various recipes or menus, as a means of value addition. More supplementation studies are required to study the complete health potential of soursop.

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