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GELLED CONFECTIONERY PRODUCT SUPPLEMENTED WITH GUARANA (*PAULLINIA CUPANA* KUNTH) POWDER. DEVELOPMENT AND CHARACTERIZATION

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Abstract: The main components of *Paullinia cupana* Kunth which are relevant for food and pharmaceutical industry are procyanidin, caffeic acid and its derivatives. Hence, the enrichment the most consumed foods matrix with phenolic compounds with antioxidant activity revealed by natural plants extract, is a clear and precise way to provide bioactive compounds to consumers. Admitting the fact that food can also be a vehicle that transports substances with a bioactive role in the human body, confectionery products, more precisely a gelled confectionery product, fit perfectly, due to consumption at all ages. This work aims to develop and characterize new functional herbal jelly incorporated with natural ingredients containing guarana powder antioxidants. This preliminary study shows a new functional herbal jelly, fortified with natural ingredients that contain antioxidants from guarana powder.

***Keywords*:** antioxidant activity, caffeine, functional food, guarana jelly, jelly texture, *Paullinia cupana.*

Introduction

Guarana seed (*Paullinia cupana* Kunth) are recognized by the European Medicines Agency, as a home-grown medication fixing can be utilized to alleviate indications of weariness and faintness dependent on dose use (Patrick *et al*., 2019).

Around 200 species are included in the genus Paullinia, comprising the ridge area of tropical and subtropical America (typical Brazilian plant),

being a single exception of the habitat in Africa (the species *Paullinia pinnata* L.) (Schimpl *et al*., 2013). The product berries of guarana is made out of a red shell, introducing inside a seed somewhat covered by a white aril. The part of the plant mostly used by food industry is only the seeds (Santana *et al*., 2018).

The commercial forms under which guarana is presented are the following, according to (Silva *et al*., 2017): roasted guarana, roasted and grounded (powder), guarana stick and guarana drink. The most significant share in the production of guarana is represented by the beverage industries, the syrups being representative, and to a lesser extent it is commercialized in the form of powder. At the same time, in another study, a high percentage (70%) of guarana production in Brazil also goes to the drink industry sector (Marques *et al*., 2016).

Admitting to the high percentage in terms of caffeine (about 6%) group of methylxanthines, or cathechin (significant amounts of phenolic compounds), gallate brazilian guarana plays an important role in natural pharmacological health, medicinal prevention, cosmetics and food industry (Marques *et al*., 2016).

Among the studied implications of guarana extracts in prevention therapy we mention Campos *et al*. (2003) show a decrease in gastric damage induced by indomethacin and ethanol when using a variable dose of guarana acetone extract. The positive sound effect was gastroprotective activity. Another study reveals that the extract from *Paullinia cupana* Kunth has an action on H. pylori, demonstrating the antimicrobial action possessed (Aguiar *et al*., 2020). At the same time, Basile *et al*. (2013) expose the idea that guarana acetone extract has demonstrable antifungal activity. Lunga *et al*. (2015) completes the antimicrobial activity picture of guarana, presenting the fact that the extract of *P. pinnata* L., bacteria and yeasts have been inactivated to a considerable extent. The treatment of obesity, according to (Bortolin *et al*., 2019), is also related to the name of this plant.

Limiting synergic connections between bioactive compounds and other food ingredients during food preparing or depositing is an important concept for healthy food trends. This study has two distinct reasons, namely: reformulating pectin-based products by valorisation the antioxidant properties of guarana, finally leading to an increase in the nutritional value of common jellies, which use mainly artificial colours; the second amendment is the utility of jelly-type products enriched with guarana, as possible food substitutes for coffee, relying on the caffeine action present to *Paullinia cupana* Kunth powder.

Materials and methods

Guarana powder, purchased from Biosano, Piatra Neamț, packed in bags with a capacity of 200 g. It was chosen the ground form of guarana, due to its specification, according to (Santana *et al.*, 2018) which ensures homogeneous incorporation in food, easily potentiates the material with high caffeine content. Crystal white sugar (Agrana, Romania), packed in 50 kg bags; Pectin yellow ribbon 1500M, purchased from ExpertArom, Sibiu, packed in polyethylene bags with a capacity of 25 kg; Citric acid packed in 1 kg bags and natural vanilla flavour, purchased from ExpertArom, Sibiu. The products were obtained in the pilot station of Confectionery Products (Faculty of Food Science and Technology, USAMV Cluj-Napoca) and specific containers, utensils and equipment were used to obtain the jellies.

The evaluation of the total polyphenol content was performed by the Folin Ciocalteu method, the absorbance of the samples being measured at 750 nm (UV-VIS 1700 Shimadzu), according to Mureşan *et al*. (2014).

The antioxidant capacity was determined by evaluating the Free Radical Scavenging effect on 1,1-diphenyl-2-picrylhydrazyl (DPPH). This determination is based on the method proposed by Odriozola-Serrano *et al*. (2008). 100 µl of the methanolic extract of the analyzed samples was mixed with 3.9 ml of DPPH solution (0.025 g/l) and 90 µl of distilled water.

The study of the texture parameters and the behaviour of the gelling agent used to make the product were performed using the Brookfield CT3 Texture Analyser. The texture analysis was performed using a cylindrical probe TA44, which has a diameter of 4 mm. The type of test is compression. The starting load of the probe is 5 g. The penetration speed is 1 mm / s.

The profile of the analyses samples is also completed by the determination of the soluble solid content (Abbe Refractometer, model 10,450, USA), titratable acidity (TC) (Official Methods of Analysis of the Association of Official Analytical Chemists – AOAC, 2006), pH (Digimed, model DM 20, Brazil).

Guarana herbal jelly candy preparation

Measure and mix the amounts (A) of sugar and pectin. Measure the amount (A) of guarana powder and water by mixing for appropriate homogenization. Heat the resulting solution to ~ 60°C, then dose the sugar difference (B) and continue boiling. When the solution has reached 75°C, add the glucose syrup (C) previously heated to 60°C. The solution is further heated until the desired dry matter is obtained at 78° Bx by checking with a

refractometer. As soon as it reaches the desired dry matter, add the amount (D) of citric acid solution 50%. The starch forms are prepared in advance by sifting the starch and distributing it evenly in the wood forms. The starch layer in the wood forms must be compacted and its surface must be smoothed in order to be able to imprint the negative on the starch mass. The jelly is poured with metal funnels. The poured jellies are left to gel for about 60 minutes in starch forms at room temperature. After gelation and cooling, the jellies are removed from the starch. The jellies are moistened, and then covered with sugar. The jellies are placed on trays and placed in the oven at 40-45° C for 15 minutes. The jellies will be packed in 167 ml round jars with glass lid and rubber gasket, with a special wire closure (figure 1).

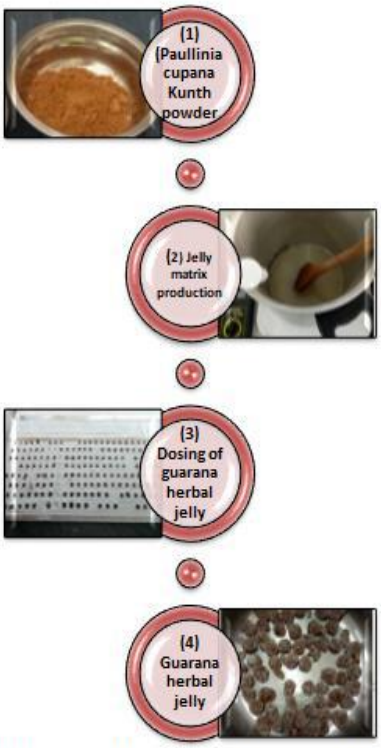


Fig. 1 Technological process of guarana herbal jelly

Table 1 The composition of jelly with addition of guarana herbal powder

		Weight (g)
	Water	336
A	Pectin	19,6
	Sugar	100
	Guarana powder	26,6
B	Sugar	415
C	Glucose syrup 40DE	324
D	Citric acid solution 50%	16,6
	Initial composition	1237,8
	Vapor	~237,8
	Final composition	~1000

Results and discussion

Herbal jelly fortified with guarana powder has a high content of soluble solids, which implies a stable character at room temperature. Similar values of soluble solids were specified by (Cappa *et al.*, 2015), summing

(78.3°Brix) in pectin-added products. Product quality defects regarding the reference value of these soluble solids, in the case of jellies, appear below 73-74° Brix, when the texture becomes soft. The values of the physico-chemical indices of the Guarana powder (GP), control jelly candy (JF), jelly candy with guarana powder (JG) samples are noted in table 2.

The variation of the interactions regarding temperature / pH, include the most studied direction in the transposition in fact of the values regarding the stability of the compounds with antioxidant effect. Regarding the pH of the sample JG an adequate value (3.55) was observed, and the limit values for the stability of the product when molding being 3.0-3.2, other authors even going up to a pH of 3.5 (Moura *et al*., 2019).

Total phenolic compound detention was higher in guarana powder (176.16 mg of gallic acid equivalent/100 g of sample). The results regarding guaraná (*Paullinia cupana*) seeds are conclusive with those found in the literature by Marques *et al*. (2016). These compounds are considered to be chemical markers for the safety of certain foods (especially juices) while also helping to claim the botanical authentication of plants (Silva *et al*., 2017). The profile of total phenols compounds in guarana seed depends largely on the extraction solvent, the maximum values (189 mg GA/g extract), and acquirement in the case of solvent mixtures 35% acetone. Minimum TPC values of guarana were in the case of the unanimously known solvent, water (Majhenič *et al*., 2007).

Table 2.

Physical chemical characterization of guarana jelly candies

	GP	**JF**	**JG**
Solubile solid (Brix)	-	77±0.49	79%±0.60
Acidity index (g citric acid/100g)	0.133±0.39	0.231±0.33	0.185±0.31
pH	5.5[c]	3.44±0.03	3.55±0.04
Ash (%)	2,48±0.12	0,17±0.15	0,28±0.11
Total phenolic content [a]	176.16±0.008	14.32±0.007	115.85±0.009
Antioxidant capacity [b]	93.98±0.11	4.01±0.14	15.37±0.15

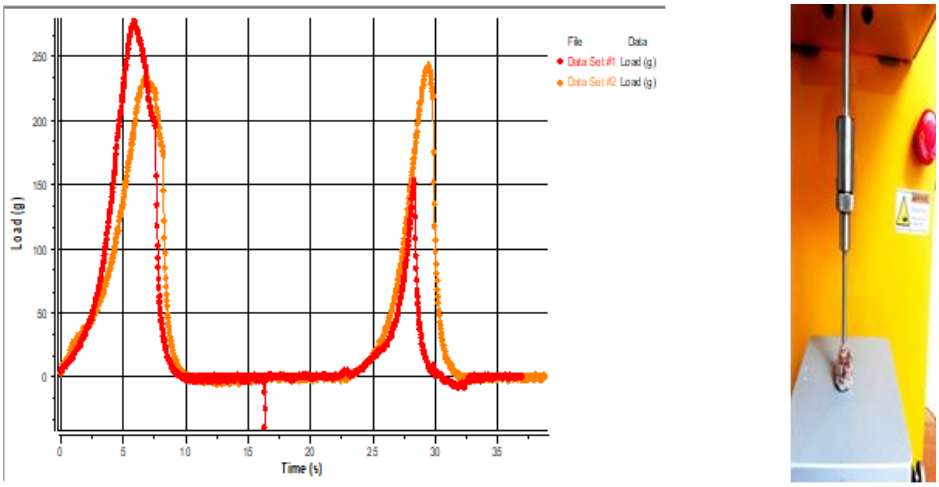
GP – Guarana powder, JF – control jelly candy, JG – jelly candy with guarana powder

[a] mg of gallic acid equivalent/100 g of sample
[b] µmol of Trolox equivalent/g of sample
[c] aqueous solution 8%

The opportune method in the retention of polyphenols in guarana is the introduction in the food matrix of microparticles generated by dripping-extrusion, which ensures over 90% remanence of bioactive compounds (Moura *et al.*, 2019).

Regarding antioxidant capacity, JG registers a significant share of the total action developed by guarana powder itself. However, we can say that during the manufacturing process of jelly candy with guarana powder the antioxidant action decreases; the literature also specifies the remanence halving the antioxidant capacity.

With respect to texture results: the first peak in the curve represents the first compression cycle and we can see that for the guarana jelly a compression load of 242.5 grams was required, which means that these jellies have a lower hardness than the simple jelly (control sample), which needs a compression load of 274.5 grams.



a. b.

Figure 2. (a) Analysis of the textural profile for the jelly samples obtained in the pilot station Legend # 1 - JF – Control Jelly; # 2– JG -jelly candy with guarana powder; (b) Brookfield CT3 Texture Analyser set-up

The ratio of the areas of the two compression cycles represents the cohesiveness of the samples, i.e. the strength of the internal bonds in the products, which is higher in guarana jelly (0.43) than in simple jelly (0.2). The index of elasticity of the samples is the ratio between the height that the product recovers after the first compression cycle and the target distance of

the first compression cycle, with values between 1 (elastic) and 0 (plastic). In the case of samples, guarana jelly has a higher elasticity index (0.71), almost returning to its original shape, than plain jelly (0.62). The present results (figure 2) are similar, the difference being in cohesiveness, chewiness and gumminess, which in guarana jelly have higher values than in the control sample. The results of texture profile are consistent with the literature, but the temperature is what dictates the textural stability of the pectin jelly product. The practicality of the product arises from the addition of pectin, which implies its polar character.

It should also be noted that due to the high caffeine content of guarana seeds, reported in the literature (up to 6%), jelly with guarana powder is a product that provides energy, leading to a potential decrease in oxidative stress due to antioxidants presence (Patrick *et al*., 2019).

Conclusions

The addition of guarana powder not only maximized the functionality of the product by increasing the antioxidant activity and implicitly of the polyphenols, in the final product, but also improved the colour products.

Guarana powder aqueous solution 8% (the amount used to make jellies), has a pH of 5.5 which reduces the amount of citric acid needed for gelling. Consumption of 50 g of jelly provides a sufficient amount of caffeine to provide energy and ensure the active principles due to guarana. Due to the caffeine content, the product is not recommended for children, the values of caffeine far exceeding those present in *Coffea arabica* L.

Further studies to increase the content of bioactive compounds in *Paullinia cupana* Kunth, can be tested by high frequency pulsatile electromagnetic fields and ultrasound, according to the study proposed by Onac *et al*. (2016).

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