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Phytochemical characterization of extracts of the mesocarp of *Bactris gasipaes* and evaluation of its antioxidant power for pharmaceutical dermal formulations

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Abstract
The *Bactris gasipaes* is a native palm from Central America which its fruit is known as pejibaye, its wood is also used for the manufacture of various utensils, the marrow of its tender stems is edible and it is called palmetto, it is used in the preparation of salads and other dishes. The pejibaye is cultivated in Costa Rica and part of the diet, this due to its high content of starch and mainly by content of antioxidant substances. The objective of the present study is to identify the main phytochemical groups and quantify the main markers in order to associate them with cosmetic or medicinal functions in pharmaceutical products. Materials and Methods: The mature fruits of *Bactris gasipaes* were peeled and separated the seeds of the mesocarp, were dried, milled and subdivisions were made with low, medium and high polarity solvents, then a phytochemical screening was carried out according to the Guidelines for the Quality Control of Products of Natural Origin of the World Health Organization, additionally the antioxidant properties were evaluated, the concentration of total phenols, total carotenoids content, the content and type of saturated and unsaturated fatty acids and the physicochemical properties of the aqueous extract were determined. The study found a low concentration of phenolic compounds such as condensed and non-condensed tannins and the main phytochemical groups such as: carotenoids, terpenes, fats, carbohydrates and alkaloids and the absence of Anthocyanins. The antioxidant power that was 45.56 ± 1.96 µg/mol Trolox Eq/g dry fruit, an EC 50 0.293 mg/Lfor the mesocarp oil, the total phenols found are 0.628 ± 0.12 mg/Gof dry sample (equivalents of Gallic acid), which shows that the main antioxidant components are lipophilic, so they can be useful in formulations such as emollients, anti-aging effect, anti-wrinkle, nourishing and moisturizing for the skin, and as a sunscreen. The mesocarp oil contains unsaturated fats (78.6% ± 1.2 µg/g): oleic, linoleic and Palmitoleic and Palmitic acid, respectively 58.3 ± 1.8, 14.5 ± 1.2, 4.5 ± 0.3 and 20.8 ± 1.4 µg/g. The acidity index is 4.32 ± 0.10 which is beneficial to maintain the cutaneous acid mantle and thus favor the normal flora of the skin, although this property represents a challenge in the formulation of Carbomer-based gels. The aqueous extract is hyperosmotic, 2333 ± 9.54 mOs/kg, and has a high electrical conductivity (1492 ± 5.56 µS/cm) due to the presence of polyelectrolytes and a high concentration of reducing sugars according to the obtained brix degrees (13.45 ± 0.01), finally mesocarp oil at 0.1% w/w shows an absorption of ultraviolet radiation of 25% at wavelengths between 260 nm and 400 nm, which could also be useful for formulating compositions for sun protection.

Keywords: Antioxidant, *Bactris gasipaes*, cosmetic, mesocarp, phytochemical screening

1. Introduction
The *Bactris Gasipaes* is a palm tree, as shown in Figure 1, which produces a fruit commonly known in Costa Rica as pejibaye, is native to Central America, very common in Costa Rican food due to its high content of starch in its fruit, its wood is used for various utensils; and the tender stems which are cut in half to obtain their marrow, it is called palmetto, the latter widely used in salads and other dishes [1].

This plant is found throughout Central America to South America, among its common names are Tembé (Bolivia), Pupunha (Brazil), Chontaduro (Colombia), pejibaye (Costa Rica and Dominican Republic), Chonta (Ecuador), manaco (Guatemala), pibá or pifá (Panama), pijuayo (Peru), pijiguao (Venezuela) or Peewah (Trinidad and Tobago). It is a species that grows on the edges of the primary forest between sea level and 1,200 meters high with average annual rainfall of 2000 to 5000 mm and average annual temperatures of 24 to 28 °C. *Bactris gasipaes* was domesticated by the Indians of South American influence, widely used in the Chibchan culture [1, 2].

Currently in Costa Rica the largest producing area is Tucurrique, Cartago; Guápiles, Limón and the southern zone in Perez Zeledón, where there is even a town called Pejibaye.

In the market you can get three qualities depending on the size of the fruit: pejibaye first, second and third; nevertheless, the fruits of the third seem to come from wild or old cultivated varieties.

Fig 1: *Bactris gasipaes* and its fruits with and without shell [1].

The fruits are red or yellow drupes, very variable in dimensions that grow in clusters of up to several hundred units that can weigh up to 20 kg. Each fruit contains a single seed (sometimes contains two), surrounded by a fibrous endocarp of dark color [3]. The fruits are highly perishable; they can be kept in good condition only about 4 days and under refrigeration up to 8 days. The whole fruit is separated from the bunch and boiled in salted water for 1 hour to 3 hours to remove the oxalate crystals and inhibit the trypsin. The mesocarp oil of the fruit does not contain cholesterol, it has a high proportion of unsaturated fats and oleic acid [1].

Table 1: Nutritional Content of Pericarp of *Bactris gasipaes* in 100 grams of fruit

Characteristic	Value
Energy	185- 196 kilocalories
Humidity	50,5-52,2 g
Dietary fiber	1,0-1,4 g
Proteins	2,6-3,3 g
Grease	4,4-4-6 g
Total carbohydrates	37,6-41,7 g
Ashes	0.8-0.9 g
Calcium	14-23 mg
Magnesium	20 mg
Potassium	196 mg
Match	46-47 mg
Iron	0,7-1,0 mg
Vitamin A	1117-7300 UI
Riboflavin	0,11-0,16mg
Niacin	0,9-1,4 mg
Vitamin C	3,5-20 mg
Vitamin B6	0,06 mg
Folic acid	34 mg

Source: [4].

A more recent report on the composition of carotenoids and tocopherols in the fleshy part after boiling: translipene 20 µg/100 grams, cis-lycopene 63.7 µg/100 g, alpha carotene 423 µg/100 g, trans beta carotene 591 ug/100 grams, cis beta carotene 391 µg/g, and 0.1 mg/100 g, of alpha tocopherol [5,6]. The composition of the pejibaye peel and the seed have also been studied, both are industrial waste of their production. The marketing of canned goods has recently been started, which generates a waste of husks and seeds. The composition of the dried base of *Bactris gasipaes* is as follows: in ethereal extract between 23.35% -24.14%, the percentage of dry matter between 37.8%-42.33%, the ashes vary from 2.1% - 2.3%, lignin between 1.71% -2.46% and the main fatty acids present were: oleic (540.77-557.84 mg/g) and palmitic (253, 15-255.31 mg/g), Palmitoleic acid (66.98-80.68 mg/g) and linoleic acid (84.85-94.7 mg/g [7]. Another study analyzed the composition of four varieties of *Bactris gasipaes*[8],it was concluded that the lipid extract of the mesocarp of *Bactris gasipaes* of the Colombian Pacific reveal a composition of Saturated and unsaturated fatty acids are very similar to those of the varieties analyzed in the Central Amazon of Brazil and those of Costa Rica. In turn, this profile of saturated and unsaturated fatty acids in *Bactris gasipaes* scan be compared with olive oil, palm oil and other commercial oilseeds, due to the high content of oleic acid, but a low content of Lauric and Myristic acid [8].

2. Materials and Methods

The fully mature fruits (stage 3 according to the maturity scale of Ó Acosta-Montoya *et al.*, [9], directly from the farm in the area of Copey de Dota, 2 kg of plant material were obtained.

Reagents: fluorescein, quercetin, ellagic acid, gallic acid, Follin Ciocalteu reagent, DPPH reagent ((2,2-diphenyl-1-picrilhydracil) dihydrochloride), Dragendorff, Prussian blue, Trolox (6-hydroxy-2,5-acid), 7,8-tetramethyl-2-carboxylic acid) are from Sigma Aldrich Chemical Company (St. Louis, MO, USA); (AAPH) Cyanidin-3-O-glucoside from Extrasynthèse (Genay, France); The reactive reagents used are analytical grade and HPLC grade solvents. Equipment: UV-visible spectrophotometer model Evolution 600 brand Thermo Scientific, with integration sphere device, UV spectrophotometer -visible model Genesys 10 s, brand Thermo Scientific, analytical balance model Adventurer scale model 310 brand Ohaus, Osmometer brand Advanced Instruments model 2200, pH-meter brand Hanna Instruments model pH211,Mettler Toledo model Seven easyconductometer, bath constant temperature Brand N-Industries Nury LL630 model, drying oven Brand Thelco. Labconco brand lyophilizer, Fisher Scientific Model 225 centrifuge, Labconco brand rotary evaporator, Oster brand blender model, Rudoph Instrument refracto meter, Brookfield Model DV III ULTRA viscometer, Corning model PC-420 agitator model.

2.1 Preparation of extracts and phytochemical screening

The fruits are peeled and separated from the seed of the pulp. The latter was cut into pieces and dried in an oven at 50 °C for 3 hours, then milled, in a manual mill. For each extract, it was liquefied in each of the respective solvents. The aqueous extract was taken 100 grams and liquefied in 400 grams of water, then filtered (phase a). Different extracts were prepared by taking 100 grams of different solvents with 50 g of pulp: ethanol (phase b), acetone (phase c), petroleum ether (phase d) and hexane (phase e). Each one was placed in an independent soxhlet, for 2 hours. Phase e was carried out in

quadruplicate, in order to have enough phase sample to perform other tests, of mesocarp and seed. These extracts or phases were placed in amber-colored flasks at -20 °C.

2.2 Ethanolic and aqueous extracts

The following analyzes were made to the aqueous and ethanolic extract: Gelatine (Tannins), Gelatin-Salt (Tannins), Formaldehyde-HCl (Tannins), Ferric Chloride (Tannins), Mucilages, Shinoda, Pews (Flavonoids), Dragendorff, Mayer, Wagner (Alkaloids), Ninhydrin (Amino Acids), (Steroids) Lieberman-Burchard, (Quinones) Bornträger, (Anthocyanins) Rosenheim, (Saponins) Foam Rosenthaler, Fheling, Molish, Tollens, Benedict (Carbohydrates), (Lactones-Coumarins), Baljet Ferric Hydroxycinnamate, (Cardiotonic Glycosides) Kedde, (Cyanogenic Glycosides) Guinard, Sudan III (Fats), Carr-Price (Carotenes), (Terpenes) Molybdate Ammonium IV, Perchloric Acid, Salkowski, Tortelli-Jaffe.

2.3 Acetone extract

The saturated acetonic extract was added with a saturated NaCl solution and allowed to stand until the phases separated. Once separated, the upper layer was taken, to which 100 mL of acidified methanol was added until a pH of 3 (0.01 molar in HCl) (phase c1), then it was stirred for 15 min at room temperature in a vacuum trap, previously performing. Bubbling the extract with nitrogen for 1 minute and protected from light, filtered using vacuum to recover the solvent with the extract. The extracts were concentrated in a rotavapor at 40 °C, up to 80 mL, the aceto-methanolic extract was taken to a 100 mL graduated balloon and saturated acid methanol was obtained, 20 mL were taken (phase c1) and separated for analysis of tannins, amino acids, and flavonoids, the remaining 80 mL were again placed in a rotary evaporator at 40 °C until dry, three washes with 50 mL of 0.01 molar HCl aqueous solution at 40 °C were carried out, the washed to a 250 mL Erlenmeyer flask, centrifuged for 30 minutes at 10.000 rpm and the supernatant was filtered on a membrane with a pore of 0.45 µm (phase c2), the insoluble or precipitated part is separated, this is then washed with water cold at 5 °C, dry and dissolve in 20 mL of chloroform (phase c.3) Lieberman -Burchard and Bornträger analyzes, of the acid soluble part (phase c.4), is made alkaline until pH 9.0 with 0.1 molar ammonia solution, the alkalinized extract is placed in a separating funnel d. After 250 mL, the alkaline phase is extracted with three 30 mL portions of hexane (phase c.5), the remaining aqueous phase (phase c.6) is saturated with sodium sulfate, the chloroform phase (phase c.5).) is washed with three portions of 5 ml of cold water 5 °C, from phase c.5 10 ml are taken, placed in a rotary evaporator at 40 °C until dry and 2 ml of chloroform are added (phase c.5.1) and performs the Lieberman-Burchard test.

The rest of step c.5 is brought to dryness and 10 mL of HCl is added (phase c.5.2), and the Dragendorff, Mayer and Wagner test is carried out. The aqueous phase (phase c.6) is saturated with anhydrous sodium sulfate, three portions of 50 mL of a mixture of chloroform: ethanol 3:2 by weight are added, placed in a separatory funnel and the aqueous phase is separated (phase c.7) to which the Shinoda and Rosenheim test is carried out. The chloroform: ethanol mixing phase (phase c.8) is washed with saturated aqueous sodium sulfate solution and cooled in an amber flask at -20 °C until analysis for the Shinoda, Rosenheim, Lieberman tests, Burchard, Dragendorff and Mayer.

2.4 Extract in petroleum ether

The ether phase (phase d) was divided into two parts, phase d1 and phase d2, independently evaporated in a rotary evaporator at 40 °C, 100 ml of water acidified to pH 3 was added to phase d1 with 0.1 M HCl. it was stirred for 10 minutes, and simultaneously alkalized water was added in the d2 phase to a pH of 12 with 50% w/w NaOH, the latter was placed in reflux for one hour, the acidified and alkalinized extracts (phase d1 and d2) were added placed independently in a 250 mL separatory funnel, extracted with three 30 mL portions of chloroform, separated the phases, the remaining phases were separated to perform phase d1 and d2 analyzes, phase d3 and d4 were refrigerated in a flask amber at -20 °C. The same analyzes were carried out for the aqueous and ethanolic extracts. The carotenoid test is carried out on the organic phases d3 and d4.

2.5 Hexanic extract

One of the parts extracted in soxhlet of the hexane phase (phase e) was reconstituted in 100 mL of ethanol. From this phase it is possible to separate the ethanolic phase (phase e1) and the hexane phase (e2). Phase e1 was refrigerated in an amber bottle at -20 °C. The same analyzes were carried out for the aqueous and ethanolic extracts. Phase e2 is tested for carotenoids and tocopherols.

A part of the hexane phase is reserved for analysis of fatty acid determination, spectroscopy, and for the carotenoid quantification analysis, this part is placed in a rotary evaporator at 40 °C to dryness, the solid residue is placed in a flask Glass amber with glass stopper and stored at -20 °C. The remaining two parts are reserved for the testing of the micro emulsion formulations, these parts are placed in a rotary evaporator at 40 °C to dryness, the solid residue is placed in an amber glass jar with glass stopper and stored -20 °C.

The Phytochemical Screening and the reagents were carried out according to Solís, Gattuso, & Cáceres, (2003) and World Health Organization [10, 11].

2.6 Moisture determination test

It is made to the freshly cut and peeled mass of the mesocarp and seed.

Weighing 250 grams (in scales of three decimals) of seed and independent mesocarp; in each beaker they were placed for three hours in a tray inside an oven at 50 ° C, dryness, weight is determined after three hours and the weight of dry matter is calculated by difference [10, 11, 12, 13].

Test Determination of weight of fat-soluble fraction for the hexane phase, for the seed and mesocarp independently.

Four empty rotary evaporator balls are weighed, the hexane and ethereal phases are placed independently. In the rotary evaporator, it is dried at 40 ° C, the weight is calculated by the amount of solids of the organic phases and the weight percentage of the phase extracted from the hexane phase and the ethereal phase is calculated [10,11,12,13].

2.7 Determination of Total Phenols for the Acetonic phase of independent seed and mesocarp oil, by the Folin-Ciocalteu Method

2.7.1 Reagents

Folin-Ciocalteu Reagent: In 10 ounces of water, 10 grams of sodium tungstate and 2.5 grams of sodium molybdate were added. Then 5 mL of 85% phosphoric acid w/w and 10 mL of 36% w/w HCl were added, heating this solution to reflux for 10 hours [14, 15].

NaOH solution (0.35 mol/L):1.40 g of NaOH are weighed on a top loading balance and placed in an appropriate plastic container. Add 50 mL of distilled water and stir until dissolved. It is brought to an approximate volume of 100 mL with distilled water

Preparation of samples for analysis by Folin-Ciocalteu: It was carried out in triplicate with the acetonic phase, taking 10 grams of dry sample (fresh seed or mesocarp finely ground less than 0.5 mm in particle size) and leaving them in reflux with 100 mL of acetone for three hours with acetone at 35 °C, then concentrated to 8 mL in a rotary evaporator at 35 °C and placed in a volumetric flask of 10 mL with acetone. The standard solution was gallic acid at a concentration of 500 mg/mL in acetone and distilled water 1:1. The result was expressed as mg of gallic acid equivalents (GAE) per gram of fresh fruit [14, 15].

2.7.2 Preparation of the calibration curve.

Gallic acid mother solution (500.0 mg/L):50 mg of gallic acid, which has previously been dried in the oven at 105-110 °C for 2 hours, is weighed accurately and placed in a graduated balloon of 100.0 mL. Add 50 mL of distilled water and stir until dissolved. It is carried to the capacity mark with distilled water [14, 15].

From the stock solution, 0.1, 0.25, 0.50, 1.00, 2.00 and 4.00 mL volumes were taken and placed in 50.0 mL volumetric balloons and brought to volume with acetone: water 1:1 [14, 15].

2.7.3 Calibration curve and reading of the Acetonic samples

In a 10 mL test tube, 1 mL of each standard or sample, 1 mL of the Folin-Ciocalteu reagent and 2 mL of the 0.35 mol/L NaOH solution are mixed. It is stirred for 5 seconds and kept in the dark for 3 minutes. It is stirred for 5 seconds and the absorbance at 765 nm is measured using 1:1 acetone: water as target.

2.8 Determination of Antioxidant Power for Seed and Mesocarp Independently of *Bactris gasipaes* DPPH Assay.

2.8.1 Antioxidant power determination

2.8.1.1 Hexanic extract

DPPH assay (2,2-diphenyl-1-picrylhydracil): The DPPH solution, which was prepared at a concentration of 0.1 mM in methanol, was made immediately before use and protected from light to prevent its degradation, the standard solution was prepared with BHA 10 mg/mL in acetone. The test procedure was as follows:

Butyl-Hydroxy-Anisole (BHA) stock solution (500.0 mg/L): Accurately weigh 100 mg of BHA, and place in a 10.0 mL graduated balloon. Add 5 mL of acetone and stir until dissolved. It is carried to the capacity mark with distilled water. This solution should be protected from light and refrigerated at 10 °C.

BHA Pattern Curve (0.4 mg/mL-1.2 mg/L): Aliquots of 0.40, 0.60, 0.8, 1.00 and 1.20 mL of the BHA stock are taken and placed in 10.0 mL graduated balloons. They are taken to the capacity mark with acetone.

Curve Shows seed oil and mesocarp oil from *Bactris gasipaes* (0.4 mg/mL-1.2 mg/L).

100 mg of seed oil or mesocarp acid from *Bactris gasipaes* are accurately weighed in separate containers and placed in a 10.0 mL graduated balloon. Add 5 mL of acetone and stir until dissolved. They are taken to the capacity mark with acetone. They are centrifuged and the supernatant liquid is taken. They are quantified by means of the prepared calibration curve of gallic acid according to the previous section. Dissolution of DPPH Accurately weigh 4-5 mg of DPPH and place in a 100-mL amber graduated balloon. Add 50 mL of methanol and stir for 10 minutes to dissolve. It is brought to the gauging mark with methanol. This solution must be prepared and used the same day. Reading of the standard curve and samples in a 10 mL test tube, 3.9 mL of the DPPH solution and 100 µL of each standard or sample are mixed. It is stirred for 5 seconds and kept in the dark for 30 minutes. It is stirred for 5 seconds and the absorbance is measured at 517 nm using water as a target.The radical elimination activity was reported as ECS0 (average effective concentration needed to reduce 50% of the DPPH radical) [9, 16].The percentage of inhibition must be calculated using the equation:

$$\% \text{ Inhibition} = (1 - (\text{Sample Absorbance} / \text{DPPH Absorbance})) \text{ X } 100$$

Percent inhibition versus pattern or sample concentration is plotted.

The C50 was calculated by using the% inhibition equation by the following calculation

$$C50 = (50-B)/A$$

Where B is the intercept of the percent inhibition vs. concentration curve and A is the slope of the percent inhibition versus concentration curve [17].

ORAC trial the analysis should be performed at room temperature and the samples should be protected from light and stored at 4 ºC after preparation [14].

2.8.2 Preparation of reagents

Sodium Phosphate Buffer/10 Mm Biphosphate: 0.276 grams of Na2HPO4.12H2O and 0.035grams of NaH2PO4.2H2O were weighed, brought to volume in a 100 mL volumetric flask.

Fluorescein 1µM: a solution of fluorescein was initially prepared at 1mM, for this we must weigh 3.76 mg of fluorescein and bring it to volume with the phosphate buffer in a 10 mL volumetric balloon (if necessary, warm to a temperature not higher than 50 °C). Then make the dilution at 1 µM.

AAPH solution (250 mM 2, 2'-azobis (2-amidino-propane): 678 mg were weighed and brought to volume with phosphate buffer in a 10 mL volumetric balloon [9, 13, 18, 19].

Calibration curve: Trolox 5 mg were exactly weighed and taken to a 10 mL volumetric flask, completely solubilized in the phosphate buffer solution and removed. A solution is obtained at 2000 µM. Dilutions were made for the Trolox curve by taking 5, 12.5, 25, 50, 75 and 100 µL of the above solution and bringing to volume of 1 mL with distilled water. 150 µL of fluorescein, 25 µL of the respective dilution of trolox were added in sequence to each well. In parallel, a test blank was prepared containing: 150 µL of fluorescein and 25 µL of phosphate buffer solution. Pre-incubated for 30 min at 37 °C. Added 25 µl of 250 mM AAPH solution to each well. Fluorescence intensity was measured every 2 min for 2 hours with excitation and emission wavelengths of 485 and 520 nm, respectively.

2.8.3 Measurement of samples

Preparation of solid samples: prepare the samples taking into account that for samples with a high fat content, it must be degreased by making the previous saponification. Another

option is to make a 1 in 100 dilutions in methanol with 50% w/w NaOH with reflux for 30 minutes, and extract with ether, dry the extract and reconstitute with ethanol. A 5 mL aliquot is filtered through a nylon membrane (0.45 µm), stored at 4 °C and protected from light. Dilutions in water of 1:10 and/or 1:100 are made.

Preparation of liquid sample: sample 10 mL were centrifuged at 3000 rpm/15 min to remove solid waste. A 5 mL aliquot was filtered through a nylon membrane (0.45 µm), stored at 4 °C and protected from light. Dilutes of 1:10 and/or 1: 100 were made in water.

Sodium Phosphate / Biphosphate Buffering Solution 10 mM.

Fluorescein 1 µM: A 1 mM fluorescein solution is initially prepared. For this, 3.76 mg fluorescein should be weighed and filled with the Phosphate Buffering solution in a 10 mL volumetric flask (if necessary, heat to a temperature not greater than 50 °C). Then make the dilution at 1 µM.

Solution of AAPH (2, 2'-azobis (2-amidino-propane) 250 mM: 678 mg was weighed and brought to volume with phosphate buffer solution in a 10 mL volumetric balloon [9, 13, 18, 19].

Specific Gravity Determination: for aqueous extract only, it was determined following the usual procedure described in Berrocal, *et al*., [20].

pH Determination: for aqueous extract only, it was determined following the usual procedure described in Berrocal, *et al*., [20]. Conductivity Determination: for aqueous extract only, it was determined following the usual procedure described in Berrocal, *et al* [20].

2.8.4 Determination of Indices for fats and oils according to the us pharmacopoeia

The test was performed only on the hexanic extracts of pejibaye seed and mesocarp.

The indices that will be determined are acidity that indicates the amount in grams or milligrams of free fatty acids per gram of sample [20].

Preparation of the sample: If the sample is liquid and has a turbid or sediment appearance, it is placed inside a heater beaker until it reaches a temperature of 50 °C; if it becomes transparent to proceed with the trial, it is filtered and proceeded with the trial [21].

If the sample is solid or semi-solid, it is placed inside a heater beaker until it reaches a temperature between 40 °C to 60 °C; if it becomes transparent to proceed with the trial, it is filtered and proceeded with the trial [21].

2.8.4.1 Acidity index

One gram of sample is weighed in methanol or (1/1 ethanol/diethyl ether mixture) 30 mL, three aliquots of 5 mL are taken, titrated with 0.1 molar Potassium Hydroxide, the indicator is phenolphthalein. A blank is made with methanol or (1/1 ethanol/dithylether mixture). The amount of mg of free fatty acids is calculated, subtracting the volume consumed by the target from that consumed by the sample and multiplying it by molecular weight [21].

2.8.4.2 Saponification index test

Weigh one gram of oil or fat, dissolve in a 100 mL graduated balloon with alkaline methanolic solution of potassium hydroxide 2 M, bring it to capacity. Take three aliquots of 5 mL and titrate them with 0.1 molar HCl, the indicator is phenolphthalein. A blank is made with methanol. The amount of mg of free fatty acids is calculated, subtracting the volume consumed by the target from that consumed by the sample and multiplying it by molecular weight [21].

2.8.4.3 Peroxide index

It is the quantity of mill equivalents of oxygen per kilogram of oil or fat [21].

Test: Reactive acetic acid solution and chloroform. Mix three volumes of glacial acetic acid with two volumes of chloroform. Saturated solution of potassium iodide, freshly prepared, 0.1 N solution of sodium thiosulfate, duly standardized, starch solution. Dissolve 1 gram of soluble starch in cold distilled water (forming a paste), add 100 mL of water at 90 °C, rapidly stir the solution and cool [21].

2.8.4.3.1 Saturated solution of potassium iodide

It was prepared with potassium iodide and recently boiled distilled water. It was necessary to ensure that the solution remained saturated, which is confirmed by the presence of undissolved crystals. Store in the dark and protected from light. Check to 30 mL of the solution of acetic acid and chloroform add 0.5 mL of the solution of potassium iodide and two drops of the starch solution, if a blue color is formed that requires more than one drop of solution 0.1 N of sodium thiosulfate to disappear; the potassium iodide solution is discarded, and a new solution is prepared [21].

One gram of the sample is placed in an Erlenmeyer flask and 10 mL of acetic acid/chloroform solution is added, dissolving with stirring, upon solubilization the content is added 0.5 mL of saturated potassium iodide solution. Using the 0.01 N solution of sodium thiosulfate, titrate gradually and with constant agitation the contents in the Erlenmeyer flask, until the yellow color has almost disappeared, then add 0.5 mL of the indicator solution of starch and continue the titration close from the end point, constantly stirring to release all the iodine from the chloroform layers. Add the sodium potassium sulfate solution drop by drop, until the blue color disappears completely [21].

A blank was made with all the reagents without the sample and following the same procedure.

The peroxide index is calculated using the following equation:

$$I = (v * N / m) * 1000 \quad (6)$$

Being

/ = Index of peroxide in mEq. of O_2 per kilogram of the product.

v = Volume of the sodium thiosulfate solution used in the titration of the sample, in mL corrected from the blank).

N = Normality of the sodium thiosulfate solution.

m = Mass of the sample analyzed, in grams [21].

2.8.4.4 Iodine Index

Weigh approximately 0.2 mg of sample, so that the volume of Wijs solution that is added has an excess of 100 to 150% with respect to the amount of iodine that is absorbed by the sample. The mass of the sample that allows to fulfill the condition established in 8.1 can be calculated, approximately, by means of the following equation:

$$m = 26 / i$$

Being:

m = sample mass for the determination, in grams.

i = iodine index expected to be found, in cg/g.

Transfer the weighed amount of the sample to a 500 mL Erlenmeyer flask (or weigh the sample directly into the flask) and add 20 mL of carbon tetrachloride. Then, using a graduated pipette, add 25 mL of Wijs solution, cover the flask

and shake it to obtain an intimate mixture of its content.
Store the balloon in a dark place for 1 hour at a temperature of 25 °C.
Add 20 mL of potassium iodide solution and 100 mL of freshly boiled and cooled distilled water, titrate the free iodine with the 0.1 N solution of sodium thiosulfate (with constant and vigorous agitation), until the yellow color has almost missing; add 1 mL to 2 mL of starch indicator solution and continue the titration until the blue color disappears completely [21].
Near the end point of the reaction, the iodimetric balloon should be capped and agitated vigorously so that any remnants of iodine present in the carbon tetrachloride layer are transferred to the aqueous solution of potassium iodide [21].
Two blank tests should be performed for each determination using all reagents and following the same procedure but without adding the sample.
The iodine value is calculated by the following equation:

$$i = 12.69 (V-Vi) N / m$$

Being:
i = iodine index of the sample, in cg/g.
V = arithmetic mean of the volumes of sodium thiosulfate solution used in the titration of the tests, in milliliters.
Vi = volume of sodium thiosulfate solution used in the titration of the sample, in milliliters.
N = normality of the sodium thiosulfate solution.
m = mass of the sample analyzed, in grams.
Reagents
Wijs solution

2.8.4.5 Carbon tetrachloride
15% solution of potassium iodide. Dissolve 150 g of potassium iodide (Kl) in 400 mL of distilled water and dilute the solution to 1 L.
0.1 N solution of sodium thiosulfate, duly standardized.
Indicator solution of starch. Form a homogeneous paste with 1 g of soluble starch and cold distilled water, add 100 cm3 of boiling water, stir quickly the solution and cool it. 125 mg of salicylic acid can be added as a preservative. In case the solution should be stored for a relatively long period of time, it should be stored in a refrigerator at a temperature of 4 °C to 10 °C [21].

2.8.4.6 Refractive index
The refractive index of the oil samples is measured in triplicate at 25 °C in a refractor meter, the average and its standard deviation are determined. It must be verified that the refract meter has been calibrated previously [21].
Determination of fatty acids of seed oil and mesocarp hexane phase. 0.5 grams of sample was weighed and trans-esterified using methanol and boron trifluoride. The fatty acids were determined in the dry oil phase in hexane. Fatty acid identification was performed by gas chromatography, using a Variam chromatograph model 3700, model 9176, a stainless steel column 1/8 by 6 inches long, packed with Silar, flame ionization detector (FID) and nitrogen as carrier gas. The temperature of the detector and injector was 220 °C and 190 °C of the 190 °C column. The identification of the methyl esters was carried out by comparing the retention times of the experimental material with the fatty acid standards; and they were expressed as percentage of methyl esters (result of the division of the area of each fatty acid between the total area) [22].

2.8.4.7 Ultraviolet-visible spectroscopy
The test was performed only on the extracts in seed hexane and peach palm mesocarp.
Phenols absorb in the ultraviolet region. In the case of flavonoid-type phenols, 2 characteristic absorption bands are present, the aromatic ring band A with a maximum absorption in the range 240-285 nm (benzoyl band) and another band of the B ring with maximum absorption in the range 300-550 nm (Cinnamoyl band).
Each of the extracts phase a, b, c, d and e was dissolved 1 in 100 in the extraction medium and the absorbance was measured in a UV-visible spectrophotometer from 200 nm to 800 nm with a resolution of 1 nm [20, 21].

2.8.4.8 Quantification of total carotenoids by UV-visible spectroscopy
The test was performed only on the Hexanic extracts of pejibaye seed and mesocarp.
The determination of total carotenoids was carried out in the following way, using the previous procedure of Jatunov [23]. 100 grams of fresh fruits were peeled, seeds and mesocarp were separated, which were cut into pieces and ground in a manual grinder and placed in a tray at 72 °C in a convection oven, subsequently ground again the sample in a food processor, 5 grams of mesocarp, and 5 grams of seed were each independently placed in an Erlenmeyer flask with 50 mL of 5% KOH solution in methanol under nitrogen for 24 hours at room temperature environment and protected from light. Carotenoids are extracted by adding 150 mL of pure acetonal and stirring for 15 minutes. The extract is concentrated to 50 mL in a rotary evaporator at 40 °C, the sample is placed in a separatory funnel and 30 mL portions of a mixture of ethyl ether/hexane 1:1 are added until the color of the aqueous phase disappears (lower), the colored upper phase is collected. The extracts were dried on a rotary evaporator at 40 °C and placed in a 50 mL graduated balloon and taken with hexane up to the calibration mark, placed in an amber container protected from light and under a nitrogen atmosphere at -20 °C. 5 mL of the solution was taken and measured at 450 nm. Hexane is used as a target.

$$\text{Carotenoids } \left(\mu g/g\right) = \frac{\text{Absortion} \times \text{volume (mL)} \times 10^6}{A^{1\%}_{1\,cm} \times 100 \times \text{sample weight (g)}}$$

Where absorption is the absorbance of the sample, volume of the balloon 50 mL A1% 1 cm is the coefficient of absorptivity in this case for total carotenoids is used 2500 100mL/g cm. Performed in triplicate [23, 24].
For the content of carotenoids in fat, we must weigh 0.1 gram either of seed or mesocarp separately in a beaker and then add 10 mL of acetone and measure at 450 nm [24].

3. Results

Table 2: *Bactris gasipaes* Phytochemical screening of aqueous, ethanolic, petroleum ether and hexane extracts of mesocarp of pejibaye

Test	Compounds	Phase a	Phase b	Phase d1	Phase d2	Phase d3	Phase d4	Phase e1	Phase e2	Phase e3	Phase e4
Gelatin	Tannins	+	-	-	-	NA	NA	+	+	NA	NA
Gelatin-Salt	Tannins	+	-	-	-	NA	NA	+	+	NA	NA
$FeCl_3$	Tannins (Gallic and Catechinic)	-	-	-	-	NA	NA	-	-	NA	NA
Formaldehyde-HCl	Condensed Tannins	-	-	-	-	NA	NA	-	-	NA	NA
Dragendorff	Alkaloids	-	-	-	+	+	+	+	+	+	+
Mayer	Alkaloids	+	+	+	+	+	+	+	+	+	+
Wagner	Alkaloids	+	+	+	+	-	-	-	-	-	-
Cooling	Mucilages	-	-	-	-	NA	NA	-	-	NA	NA
Ninhydrin	Amino acids	-	-	-	-	-	-	-	-	-	-
Lieberman-Burchard	Steroids Terpenes	-	-	-	-	NA	NA	´+	-	+	+
Salkowski	Terpenes	-	-	-	-	NA	NA	-	-	-	-
Tortelli –Jaffe	Terpenes	-	-	+	+	NA	NA	+	-	-	-
Ammonium Molybdate IV	Terpenes	+	+	+	+	NA	NA	+	+	+	+
Perchloric acid	Terpenes	-	-	-	-	NA	NA	-	-	-	-
Shinoda	Flavonoids	-	-	-	-	NA	NA	-	-	-	-
Pews	Flavonoids	-	-	-	-	NA	NA	+	+	-	-
Bornträger	Quinones	-	-	-	-	NA	NA	-	-	-	-
Rosenheim	Anthocyanins	-	-	-	-	NA	NA	-	-	-	-
Foam	Saponins	-	-	-	-	NA	NA	-	-	-	-
Rosenthaler	Saponins Steroids	+	-	-	-	NA	NA	-	-	-	-
Fheling	Carbohydrates	+	+	+	+	NA	NA	-	-	NA	NA
Molish	Carbohydrates	+	+	+	+	NA	NA	+	+	NA	NA
Benedict	Carbohydrates	+	+	+	+	NA	NA	+	+	NA	NA
Tollens	Carbohydrates	+	+	+	+	NA	NA	+	+	NA	NA
Baljet	Lactones Coumarines	-	-	-	-	NA	NA	+	+	NA	NA
Ferric Hydroxamate	Sesquiterpenes Lactones Esters	-	-	-	-	NA	NA	+	+	NA	NA
Kedde	Cardiotonic glycosides	-	-	-	-	NA	NA	-	-	NA	NA
Guignard	Cyanogenic glycosides	-	-	-	-	NA	NA	-	-	NA	NA
Sudan	Fat	+	+	NA	NA	+	+	+	NA	+	+
Carr -Price	Carotenes	+	+	NA	NA	+	+	+	NA	+	+
Emmerie-Engel,	Tocopherols	+	+	NA	NA	+	+	+	NA	+	+

Nomenclature; NA: not applicable, - Negative test + Positive test.

Table 3: *Bactris gasipaes* Phytochemical acetone extract of mesocarp screening results phytochemical acetone extract of Mesocarp from *Bactris gasipaes.*

Test	Compounds	Phase C1	Phase C3	Phase C5.1	Phase C5.2	Phase C7	Phase C8
Ninhydrin	Amino acids	-	NA	NA	NA	NA	NA
Shinoda	Flavonoids	-	NA	NA	NA	-	-
Gelatin	Tannins	+	NA	NA	NA	NA	NA
Gelatine-Salt	Tannins	+	NA	NA	NA	NA	NA
$FeCl_3$	Tannins	-	NA	NA	NA	NA	NA
Bornträger	Quinones	-	+	NA	NA	NA	+
Lieberman-Burchard	Steroids Terpenes	+	+	-	NA	NA	+
Dragendorff	Alkaloids	+	NA	NA	+	NA	+
Mayer	Alkaloids	+	NA	NA	+	NA	+
Wagner	Alkaloids	+	NA	NA	+	NA	+
Rosenheim	Alkaloids	+	NA	NA	+	+	+
Pews	Flavonoids	+	NA	NA	NA	NA	+

Nomenclature; NA: not applicable, - Negative test + Positive test.

Table 4: Quantification of humidity percentage and ethereal and hexane mesocarp extracts and *Bactris gasipaes* seeds

Sample	Mesocarp % Humidity	Mesocarp % Ethereal	Mesocarp % Hexane
1	50,43	6,15	7,45
2	45,56	7,34	6,35
3	54,34	6,73	6,59
Mean	50,11	6,74	6.78
Standard deviation	4,40	0,60	0,58

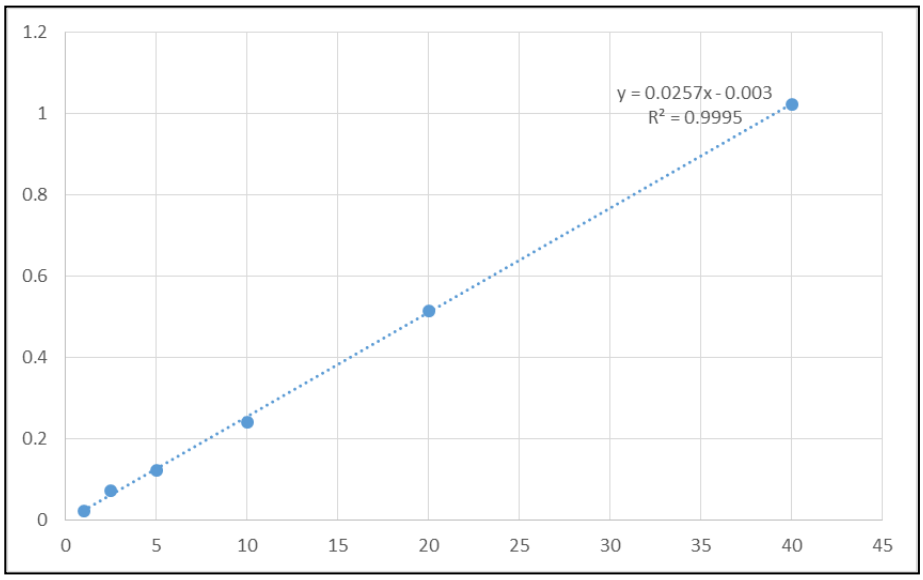

Fig 2: Calibration curve for the quantification of total phenols by Folin-Ciocalteu in *Bactris gasipaes*

Table 5: Quantification of total phenols in *Bactris gasipaes* by the Folin-Ciocalteu method

Sample	Mesocarp/g	Amount gallic acid equivalents/ mg g^{-1} equivalents topisalic.
1	10,01	0,625
2	10,02	0,617
3	10,01	0,641
Mean	10,01	0,628
Standard deviation	0.005	0,012

Table 6: Data Analysis of DPPH BHA and mesocarp oil *Bactris gasipaes*

Concentration mg/mL	Absorbance BHA	% Inhibition	Absorbance Mesocarp Oil	% Inhibition Mesocarp Oil
0,000	1,454	0	1,452	0
0,400	0,814	44.02	0,689	5255
0,600	0,753	48.21	0,623	57,09
0,800	0,689	52.61	0,539	62,87
1,000	0,597	58.94	0,457	68,52
1,200	0,523	64.03	0,413	71,56
	C50 0.659 mg/mL	50	C50 0.293 mg/mL	50

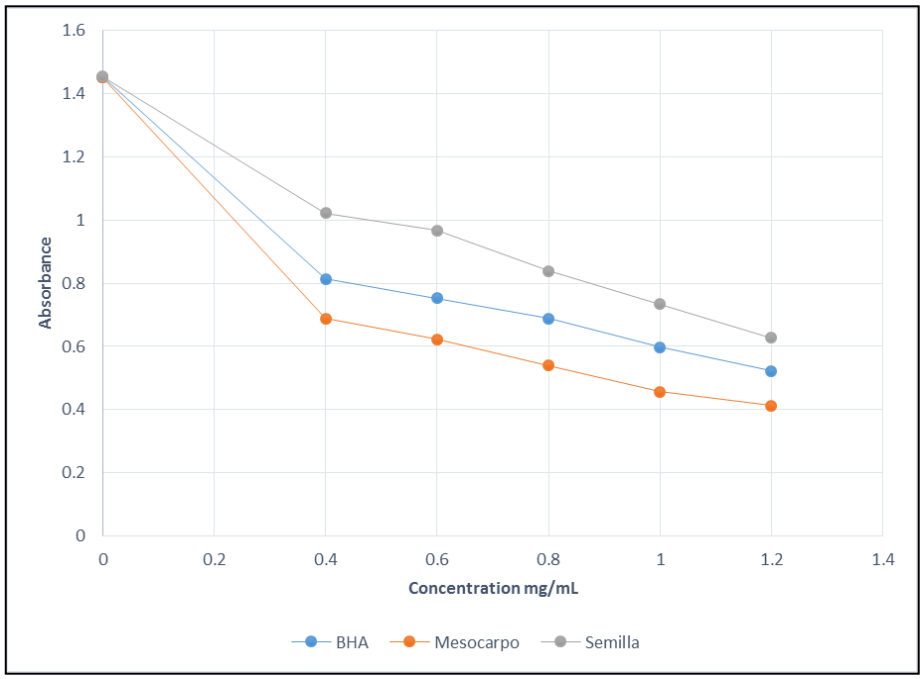

Fig 3: Curve absorbance vs concentration of Radical DPPH for BHA: seed oil and mesocarp oil from *Bactris gasipaes*

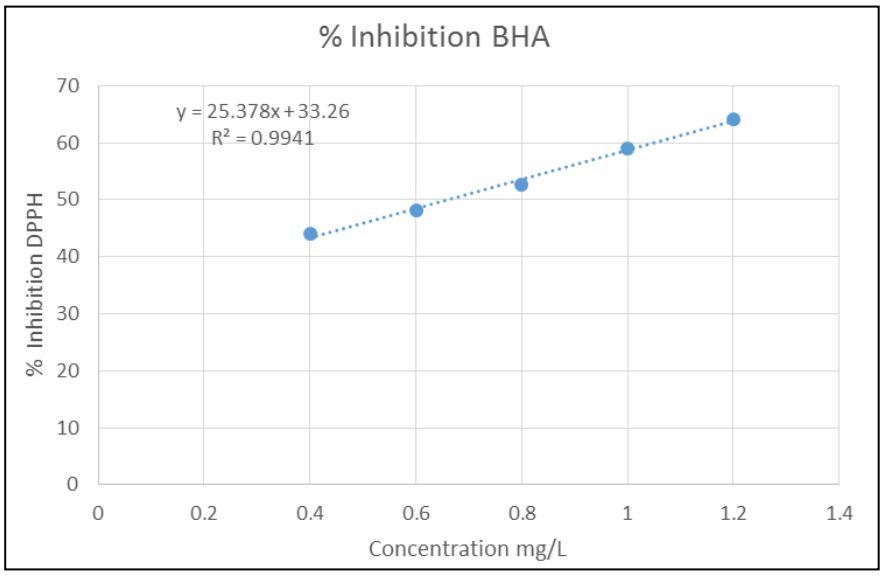

Fig 4: Percent Inhibition curve by DPPH quantification in acetonic solution BHA.

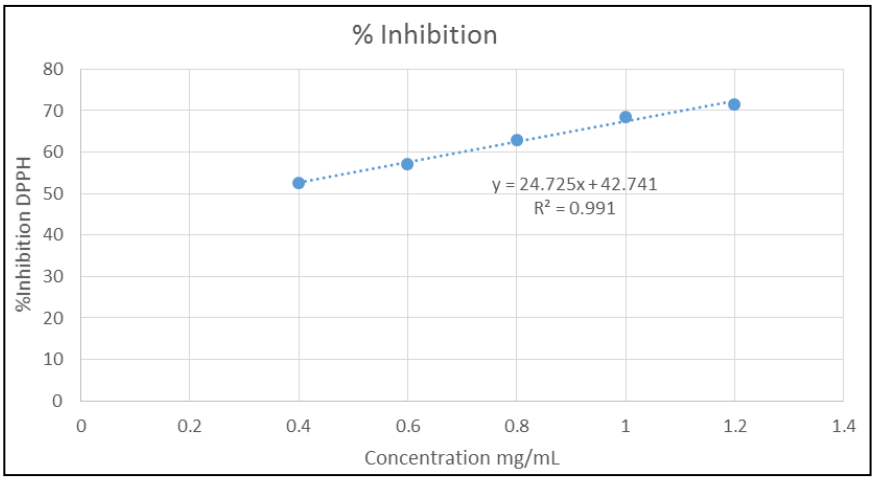

Fig 5: Percent Inhibition curve quantification by DPPH in mesocarp oil of *Bactris gasipaes*

Table 7: Quantification of H-ORAC antioxidant power of mesocarp of *Bactris gasipaes*

Sample	Dry fruit Trolox equivalent /µg mol^{-1} g^{-1}
1	45, 42
2	43, 71
3	47, 60
Mean	45. 56
Standard deviation	1, 96

Table 8: Physicochemical Properties Aqueous Extract Pejibaye Mesocarp *Bactris gasipaes*

Sample	pH 25 °C	Specific gravity 25 °C	Brix Grade	Conductivity 25 °C / µScm^{-1}	Osmolarity 25 °C / m$OsKg^{-1}$
1	6,10	1,0014	13,45	1497	2324
2	6.08	1,0023	13,46	1486	2332
3	6,10	1,0019	13,45	1493	2343
Mean	6,09	1,0018	13.45	1492	2333
Standard deviation	0,01	0,0040	0.01	5,56	9,54

Table 9: Determination of Pharmacopoeia Indexes mesocarp of Pejibaye *Bactris gasipaes*

Sample	Acidity Index	Saponification Index ng KOH	Iodine Indexcg I/g	Index of Peroxides mEq/Kg	Refractive Index
1	4,40	215,0	84,90	7,76	1,6614
2	4,35	217,0	84,40	7,89	1,6620
3	4,20	220,0	84,70	7,80	1,6616
Mean	4,32	217,3	84,6	7,82	1,6616
Standard deviation	0,10	2,5	0,25	0,65	0,0030

Table 10: Composition of fat oils in mesocarp and see of *Bactris gasipaes*

Substance	Mesocarp
% Solids	34 ± 1,5
% Fat in dry weight	17 ± 1,4
Caprylic	-
Capric	-
Lauric	-
Myristic	-
Palmitic	20.8 ±.1,4
Palmitoleic	4, 5 ± 0,3
Stearic	0, 6 ± 0,4
Oleic	58, 3 ±1,8
Linoleic	14. 5 ± 1,2
Linolenic	1, 3 ± 0,3
Total saturated	21, 4 ± 1,2
Total unsaturated	78, 6 ± 1,2

Table 11: Determination of totals carotenoids in oil of *Bactris gasipaes*

Sample	Carotenoids/mesocarp ug g^{-1}
1	147, 784
2	147, 012
3	147, 584
Mean	147,460
Standard Deviation	0,400

Table 12: Determination of total carotenoids in dry matter of *Bactris gasipaes*

Sample	Carotenoids/mesocarp ug g^{-1}
1	195.896
2	195.736
3	196.824
Mean	196.792
Standard Deviation	1.0413

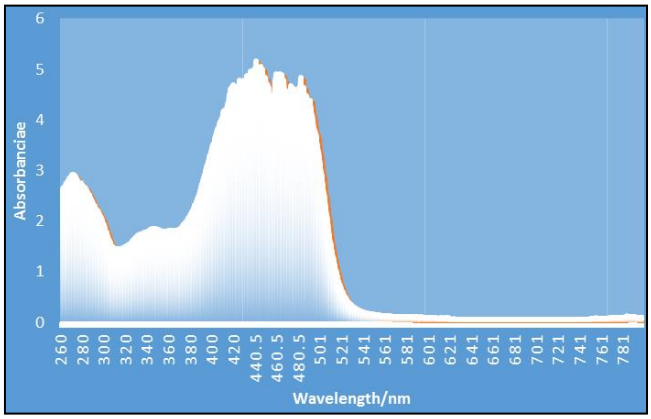

Fig 6: *Bactris gasipaes* ethanolic extract 0.1% w/w UV-visible absortion spectrum

4. Discussion

The fruits of *Bactris gasipaes*, see figure have been studied for their food properties, their mesocarp is characterized by its high content of starch, but also contains a high content of carotenoids, which makes it a very interesting and abundant source of these compounds, however not have been studied from the medicinal or cosmetic point of view, also has a high oil content which makes it even more interesting as a source of raw material for dermocosmetic products, especially carotenoids have been used in high protection sunscreen formulations absorption that presents in the range of ultraviolet radiation, the current study was carried out a fractionation with pure solvents of different polarities by means of a process of drying and extraction by reflux, in Table 4 shows the percentage of humidity obtained is on average 50,11 % ± 4,40, in table 4 the fatty content extracted by means of ether and by means of hex is shown, which corresponds to 6.74% ± 0.60, and 6.78% ± 0.58, fractionation allows to obtain with greater certainty the phytochemical groups contained in the mesocarp samples, in addition to associating them with cosmetic applications or medicinal

In the different polar fractions were found compounds commonly associated with dermocosmetic and therapeutic effects, being a food consumed regularly in the form of flour, cooking, sweets, it can be deduced a very low level of acute toxicity, of ripe fruits, in the aqueous extract According to the data in Table 2, the presence of tannins, alkaloids, terpenes, saponins, carbohydrates, carotenoids, tocopherols is shown, some of which have already been reported in the literature [25]. The results were confirmed by tests to the ethanol and acetonic extract, no positive data were found for flavonoids, anthocyanins, cyanogenic glycosides, cardiotonic glycosides, these last two are associated with the toxicity of the fruits that contain them, in addition Table 3, where the results of the acetonic extract are described, the alkaloids and tannins were not previously reported in the literature, the data in tables 2 and 3 show confirm the content of tocopherols and carotenoids.

The screening of phytochemical groups in Tables 2 and 3 show highly antioxidant components such as tocopherols, carotenoids, and tannins, the latter in their form are related to an astringent, protein precipitating and bacteriostatic effect, in addition to a high content of reducing sugars that they are a source of humectation of the skin so that it helps the passage of the water through the stratum corneum [26]. Data on the content of other compounds such as flavonoids and terpenes may not be as evident or be at low concentrations since they only appear in acetone extracts.

The composition of the non-polar fractions (chloroform, hexane and ethereal) of the mesocarp of fruits of *Bactris gasipaes*have not been reported in the literature. Terpenes, flavonoids, alkaloids, and steroids were found in the screening. The absence of compounds was also found normally associated with toxicity such as coumarins, cyanogenic glycosides, or cardiotonic glycosides [27], the terpenoid compounds are of high and low polarity, so it is common to find them in both polar and non-polar fractions, in addition in the acetonic extract Table 3 found compounds of alkaloid type which are usually related to very varied therapeutic and cosmetic actions [27], in all fractions were found fatty compounds, tocopherols and carotenoids associated with sun protection products [28].

The aqueous extract of the mesocarp of *Bactris gasipaes*was characterized in table 1 to know its physicochemical properties which are not described in the majority in the literature, these properties are important to understand the compatibility of these types of extract with the excipients for manufacturing of different formulations, as already explained the mesocarp contains at least 50% moisture and in the hydrophilic phases have been a series of components such as tannins, saponins, alkaloids, tocopherols and carotenoids as shown in Table 2 and in the Table 3, the summary of the physicochemical properties described in Table 8, the pH 25 °C was 4.32 ± 0.10, which states that the extract is acidic but does not contain acids such as citroco or that they have pKa of 3.5 or less Gravity Specifies 25 °C 1.0018 ± 0.0040 very similar to that of water, nevertheless superior which indicates the presence of soluble compounds Brix Grades 13.45 ± 0.01

which shows the presence of soluble sugars and other substances in a relatively high concentration, Conductivity 1492 ± 5.56 µS/cm 25 °C, this high conductivity indicates the presence of many electrolytes or polyelectrolytes in solution, also shows a very high Osmolarity 2333 ± 9,54 mOs/kg 25 °C, this makes the hyperosmolar extract mainly due to starch hydrolyzation and the high content of electrolytes, the molarity data must be important when studying the stability especially in creams or emulsions of another type and in the decomposition of the fragrance.

The antioxidant effect associated with the presence of tocopherols and especially carotenoids in the mesocarp is reported in the literature [23]. This antioxidant effect is commonly measured in equivalent Trolox units known as H-ORAC in the table 7 was found an average of 45.56 ± 1.96 µg/mol Trolox Equivalent/g dry fruit, this high antioxidant capacity is associated with multiple dermocosmetic effects, for example an anti-aging effect, a protection against ultraviolet radiations, an anti-wrinkle effect, besides the protective effect against ultraviolet radiation is also associated with the prevention of skin cancer, regenerative effects of damaged tissue, and an antimicrobial effect [28].

Furthermore, the antioxidant effect is also associated with the presence of phenolic compounds and the Follin Ciocalteau test determines the concentration of total phenols was found in the analyzed sample 0.628 ± 0.012 mg/gram of dry sample of gallic acid equivalents see figure 2 and table 5 which shows a low concentration of these compounds, which is reflected in that some tests for tannins in Table 2 and Table 3 are not shown for all hydrophilic fractions nor for all the tests of the same category, since they vary the sensitivity, also shows a lesser antioxidant power than other extracts for example of fruits like blackberry *Rubusadenotrichus* [29] so the antioxidant action can be reserved for the most lipophilic components, as the carotenoids and tocopherols.

Table 9 shows the pharmacopoeial indices for the identification of oils and fats that verify the physical characteristics of the behavior of a translucent liquid Yellow of low viscosity at 25 °C Acidity index 4.32 ± 0.10, Saponification Index 217, 3 ± 2.5 mg KOH/g, Iodine Index 84.6 ± 0.25 cg I/g, Peroxides Index 7.82 ± 0.85 mEq/kg, Refractive Index 1.6616 ± 0.0030, which shows that the mesocarp oil is highly unsaturated, and possesses fatty acids of medium to low molecular weight.

Another way to measure the antiradical effect is by means of the test called DPPH which studies the percentage of inhibition of the free radical 2,2-diphenyl-1-picrilhidrazil, this test studies a mechanism of oxidation different from H-ORAC, so they can be defined as complementary, there are various oxidation mechanisms, in this case figures 3, 4 and 5 shows the inhibitory antiradical effect, with the pattern of butylated hydroxyanisole (BHA), BHA is a recognized antioxidant used in emulsions and oils for its amphiphilic characteristics which Table 6 and Figure 3 shows a lower EC50 equivalent to 0.293 mg/L of oil compared to an EC50 0.659 mg/L of BHA, as shown in Table 5, this shows that the oil does similar physicochemically to tocoferols and carotenoids of mesocarp shows three times more antioxidant activity than BHA itself, carotenoids are associated with an anti-wrinkle effect, and as a sunscreen [30].

The principal components described in mesocarp literature is the content of fats, sugars derived from starch and the presence of carotenoids [25], which give a yellow to orange color to the oil from this source, Table 10 shows the composition of mesocarp oil which is mainly formed by unsaturated fats 78.6% ± 1.2 oleic acid, linoleic and palmitoleic, respectively and 21.4% ± 1.2 mainly palmitic, the fat content in dry matter of mesocarp is approximately 17%, these results coincide with previous studies carried out on the characterization of mesocarp oil, [22], mesocarp oil is a viscous liquid of color yellow to orange, due to the content of oleic acid can also be a good emollient and have a use as a food oil, or cosmetic, the high content of carotenoids in the oil phase Table 11 147,460 ± 0,400 carotenoid s µg/g mesocarp and dry matter Table 12 196.792 ± 1.0413 carotenoids µg/g mesocarp allows to establish a high antioxidant power.

Acid pH is an important factor to consider in aqueous extracts as well as high electrolyte content and high osmolarity. This is important since the formulation of carbomer gels can be affected in their viscosity and stability due to the presence of electrolytes in solution [31], so it is important to assess whether to this is added the acid pH of the extract that can also precipitate the carbomer gel [32].

As shown in figure 6 the mesocarp oil of *Bactris gasipaes*at 0.1% w/w show an absorption in the field of UVB radiation at 260 nm at 320 nm and UVA at 320 nm at 400 nm at approximately 25% of the radiation, received, which can be associated with a low to medium photoprotection effect, however this can be increased proportionally to the content of ultraviolet radiation absorbing compounds, mainly anthocyanins and tannins.

5. Conclusions

The result of the studies carried out for the mesocarp of the mature fruits of *Bactris gasipaes*, shows a high antioxidant power due to an H-ORAC 45.56 ± 1.96 µg mol Trolox Equivalent/g dry fruit, and an EC 50 0.293 mg/L for the oil, this effect is associated with the presence of amphiphilic or lipophilic compounds such as tocopherols and carotenoids, the total phenols 0.628 ± 0.012 mg/gram of dry sample of gallic acid equivalents, verify the qualitative results of the phytochemical screening and They also show a low presence of antioxidant phenolic compounds despite having an aqueous concentration close to 50% in the mesocarp, terpenoid compounds, alkaloids, saponins, carbohydrates, fats were also found, which makes the mesocarp of the *Bactris gasipaes* fruit an excellent Active for formulations, antioxidants, anti-aging, anti-wrinkle, nourishing for the skin and moisturizers, and emollient, in addition its oil also has expensive suitable materials to be raw material in emulsions and ointments and other cosmetic forms that use light oils and with high antioxidant power, the mesocarp oil which is mainly formed by unsaturated fats 78.6% ± 1.2 oleic, linoleic and palmitoleic acid, respectively, and 21.4% ± 1.2, mainly palmitic, also the pH acid pH, 32 ± 0.10 is beneficial to maintain the cutaneous acid mantle and with this favor the normal flora of the skin, but it can be a problem For the formulation of carbomer-based gels, the aqueous extract is also hyperosmotic (2333 ± 9.54 mOs/kg) and has a high electrical conductivity (1492 ± 5.56 µS/cm) due to the presence of polyelectrolytes and a high concentration of reducing sugars according to the obtained brix degrees (13.45 ° ± 0.01), finely the mesocarp oil at 0.1% w/w shows an absorption of ultraviolet radiation of 25% in the wavelengths of between 260 nm to 400 nm, which could also be useful for formulating compositions for sun protection.

6. References

1. Mora J, Weber J, Clement C. Peach palm. *Bactris gasipaes* Kunth. Promoting the conservation and use of

underutilized and neglected crops. Edn 20, Institute of Plant Genetics and Crop Plant Research, Gatersleben International Plant Genetic Resources Institute, Rome, 1997, 7-24.
2. Hernández JA, Mora J, Rocha O. Diversidad genética y relaciones de parentesco de las poblaciones silvestres y cultivadas de pejibaye (*Bactris gasipaes*, Palmae), utilizando marcadores microsatelitales. Revista de Biología Tropical. 2008; 56(1):217-245.
3. Bermejo JE, León J. Cultivos marginados: otra perspectiva de 1492. Colección FAO: Producción y protección vegetal, Edn 26, Roma, 1992, 18.
4. Camacho E. El Pejibaye (Guilielma Gasipaes (B.K.) L.H Bailey). Instituto Interamericano de Ciencias Agrícolasde la OEA. Centro Tropical de Enseñanza e Investigación, Turrialba, 1972, 1-16.
5. Furtado JD, Siles X, Campos H. Carotenoid concentrations in vegetables and fruits common to the Costa Rican diet. International Journal of Food Sciences and Nutrition. 2004; 55(2):101-13.
6. Basto GJ, Wanderlei C, Gomes A, Guimarães HT, Hidalgo DW, Oliveira RL *et al*. Physicochemical properties and carotenoid content of extruded and non-extruded corn and peach palm (*Bactris gasipaes*, Kunth). LWT-Food Science and Technology. 2016; 69:312-318.
7. Márquez LM. Evaluación nutricional de la cascara de chontaduro (*Bactris gasipaes*) como alternativa en la alimentación animal. Universidad Tecnológica de Pereira, Pereira, 2014, 24-27.
8. Restrepo J, Vinasco LE, Estupiñán JA. Estudio comparativo del contenido de ácidos grasos en 4 variedades de chontaduro (*Bactris gasipaes*) de la región del Pacífico Colombiano. Revista de Ciencias Universidad del Valle. 2013; 16:123-129.
9. Acosta O, Vaillant F, Cozzano S, Mertz C, Pérez AM, Castro MV. Phenolic content and antioxidant capacity of tropical highland blackberry (*Rubus adenotrichus* Schltdl.) during three edible maturity stages. Food Chemistry. 2010; 119(4):1497-1501.
10. Solís PN, Gattuso N, Cáceres S. Manual de caracterización y análisis de drogas vegetales y productos fitoterapéuticos. Proyecto Desarrollo de Tecnología de Cultivo de Plantas Medicinales y Producción de Fitoterápicos Organización de los Estados Americanos, 2005, 132.
11. World Health Organization. WHO guidelines for assessing quality of herbal medicines with reference to contaminants and residues. World Health Organization, Geneva, 2007, 89-105.
12. World Health Organization. Quality control methods for medicinal plant materials. World Health Organization, Geneva, 1998.
13. Tiwari BK, Brunton NP, Brennan CS. Handbook of Plant Food Phytochemicals: Sources, Stability and Extraction. Edn 1, Wiley-Blackwell, 2013.
14. Rojano B, Zapata CI, Cortes FB. Estabilidad de antocianinas y valores de capacidad de absorbancia de radicales oxígeno (ORAC) de extractos acuosos de corozo (*Bactris guineensis*). Revista Cubana de Plantas Medicinales. 2012; 7(3):244-255.
15. Espinosa FA, Martinez J, Martinez HA. Extraction of bioactive compounds from peach palm pulp (*Bactris gasipaes*) using supercritical CO_2. The Journal of Supercritical Fluids. 2014; 93:2-6.
16. Martínez NS, Arévalo K, Verde MJ, Oranday ARMC, Treviño J. Germinación *in vitro* e inducción de calloen *Rubus adenotrichus* Schltdl. Polibotánica. 2013; 23:99-107.
17. Radice M, Viafara D, Neill D, Asanza M, Sacchetti G, Guerrini A *et al*. Chemical Chemical Characterization and Antioxidant Activity of Amazonian (Ecuador) *Caryoden dronorinocense* Karst. and *Bactris gasipaes* Kunth Seed Oils. Journal of Oleo Science. 2014; 63(12):1243–1250
18. Gancel A, Feneuil A, Acosta O, Vaillant F. Impact of industrial processing and storage on major polyphenols and the antioxidant capacity of tropical highland blackberry (*Rubus adenotrichus*). Food Research International. 2011; 44(7):2243-2251.
19. Thangaraj P. Pharmacological Assays of Plant Based Natural Products. Springer, 2016.
20. Berrocal L, Fonseca L, Vargas R, Madrigal G. Manual de Prácticas de Laboratorio, Fisicoquímica Farmacéutica II. Editorial Universidad de Costa Rica, San José, 2012.
21. Convención de la Farmacopea de los Estados Unidos de América. Farmacopea de los Estados Unidos de América. Edn 38, United States Pharmacopeial Convention, Washington D.C, 2016.
22. Hammond E, Pan W, Mora J. Fatty acid composition and glyceride structure of the mesocarp and kernel oils of the pejibaye palm (*Bactris gasipaes* HBK). Revista de Biología Tropical, 1982, 91-93.
23. Jatunov S, Quesada S, Díaz C, Murillo E. Carotenoid composition and antioxidant activity of the raw and boiled fruit mesocarp of six varieties of Bactris gasipaes. Archivos latinoamericanos de nutrición. 2010; 60(1):99-104.
24. Rodríguez DB. Guide to Carotenoid Analysis in Foods. International Life Sciences Institute, Washington D.C, 2001, 23-39.
25. Pizzani PB. Composición fitoquímica y nutricional de harina de pijiguao (*Bactris gassipaes* Kunth en H.B.K). Zootecnia Tropical. 2008; 26(3):235-238.
26. Bronaugh RL, Maibach HI. Percutaneous Absorption: Drugs, Cosmetics, Mechanisms, Methods. Edn CRC Press, Boca Ratón. 2005; 3(97):81.
27. Evans W, Trease GE. Tratado de Farmacognosia. Edn 12, Nueva Editorial Interamericana, México, 1986.
28. Iwata H, Shimada K. Formulas, Ingredients and Production of Cosmetics. Technology of Skin- and Hair-Care Products in Japan, 2013.
29. Montoya O, Vaillant F, Cozzano S, Mertz C, Perez A. Phenolic content and antioxidant capacity of tropical Highland blackberry (*Rubus adenotrichus* Schltdl.) during three edible maturity stages. Food Chemistry 2019; 119(4):1497-1501.
30. Baumann L. Cosmetic dermatology. Edn 2, McGraw-Hill Medical, New York, 2009.
31. Wilkinson JB, Moore RJ. Cosmetologia de Harry. Ediciones Díaz de Santos, Madrid, 1990, 514.
32. Baki G, Alexander K. Introduction to Cosmetic Formulation and Technology. John Wiley & Sons, Hoboken, 2015, 189.