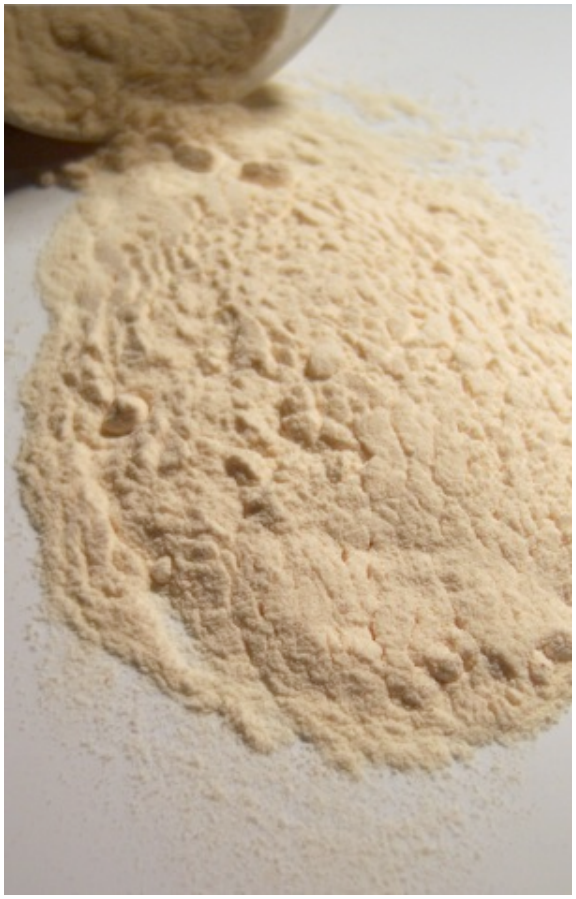
Baobab *(A. Digitata L.)* **Dried Fruit Pulp**
DATA SHEET



COMMERCIAL NAME:	Baobab Fruit Pulp 100% Native Dried.
CODE :	**PBA**
EXTRACTION:	Mechanical separation from seed
USED PART OF THE PLANT :	Fruit.
INCI/CTFA:	Adansonia digitata (Fruit).
CAS N° :	91745-12-9.
EINECS/ELINS N°	294-680-8.
R.E.A.C.H.:	Natural Product.
BOTANICAL FAMILY :	Bombacaeae.
DOSAGE SUGGESTED:	5-10 g / A day / per person
ESTABLISHED and STORING:	See 16p Security Data Sheet.
PACKAGING:	9 Kg - HDPE Bag / Plastic Bucket
PRESERVING AGENTS	None
SHELF LIFE:	36 Months
CROP TIME:	1 Time a year, December/April
PROVENANCE:	Senegal

SAFETY:

No evidence of side effects or toxicity related to baobab fruit pulp ingestion.
The product "Baobab Dried Fruit Pulp", has been approved as NOVEL FOOD by European Council (C-2008-3046 - 27 June 2008).
Product Produced by BFCS has been approved as Novel Food in July 2009

PROPERTIES:

High nutritional value.
Supplement of dietary soluble (prebiotic) and insoluble fibers.
Antioxidant.

NUTRITIONAL APPLICATION:

- After instant dilution in water, yoghurt or juices for refreshing an nourishing Drinks with high fibres and nutrients
- Tablets

FOOD FORMULATIONS:

- Fortified yoghurt with prebiotic fibers
- Bread, Cakes, Bars and Biscuits
- Ice-creams
- Smoothies
- Health/Functional foods

MAIN NUTRIENTS COMPOSITION:

Amino acids and essential fatty acids
Minerals: Calcium, Phosphorus, Iron, Potassium, Sodium, Magnesium, Zinc, Manganese
Vitamins: Vit. C, Vit A, Vit B1-B2-B6,Vit PP

Carbohydrates: glucose, fructose, saccarose, maltose, soluble polysaccharides, starch.
Dietary soluble and insoluble fibers.

INTRODUCTION

The Baobab tree *Adansonia digitata* is a member of the Bombacaceae family which consists of around 20 genera and around 180 species (Heywood, 1993) including closely related species such as *Adansonia gregori* and *Adanosnia madagascariensis* (Shukla *et al*., 2001). Also known as the "upside down tree", on pollination by fruit bats, it produces large green or brownish fruits which are capsules and characteristically indehiscent. The capsules contain a soft whitish powdery pulp and kidney-shaped seeds (Sidibe & Williams 2002).
The baobab is widely distributed through the savannas and drier regions of Africa but it is also common in America, India, Sri Lanka, Malaysia, China, Jamaica and Holland.
All Baobab fruit used in production by BFCS is from Senegal. At present due to infrastructure, and quality guarantees, all fruit used by BFCS is harvested and supplied by the same location.

The literature has reported the isolation of a number of compounds from *Adansonia digitata*. These compounds have been found in a various parts of the plant including the seeds, roots, leaves, bark, and the fruits. In particular different important compounds, like triterpenoids beta-sitosterol, beta-amyrin palmitate, alpha-amyrin palmitate and ursolic acids, have been found in the fruit by Al-Qawari et al (2003). A report by Airan and Desai (1954) highlighted the presence of organic acids in the fruit pulp. These included citric, tartaric, malic, succinic, and ascorbic acid. Nour et al (1980) confirmed the observations of Airan and Desai when they determined that the pulp contained ascorbic acid, tartaric acid, mainly water soluble pectins, and the elements of iron and calcium.

Production Process
The closed Baobab fruits are directly collected in Senegal's driest regions, under supervision of expert qualified professionals.
BFCS focuses its activity on species that are abundant and that can be collected with minimal environmental impact. Consequently, the fruits and/or seeds are the main parts of the plant that are collected rather than the roots or the bark of a particular species.
BFCS use a simple, exclusively mechanical, process to obtain the fruit pulp. First the fruit is harvested, the hard outer shell of the fruit is cracked and the contents removed. The seeds are then separated from fibrous material and mesocarp. This is screened to remove further unwanted fibrous and flaky material, leaving a fine mesocarp powder, in Italian made stainless steel machineries, than is stored in clean food grade aluminium packaging. To maintain the high level of nutrients present in the pulp, BFCS work-up fruits immediately after opening. Only two hours occur from opening to final packaging.

Product preparation:
The Baobab fruit has a hard shell (epicarp) with a velvety covering. Inside the shell is the seed (pericarp and seed) which are hard and dark coloured, and is surrounded by dry, light/cream coloured fruit pulp (mesocarp) forming lumps. Dry, slightly darker fibrous material is also contained within the fruit. The fruit pulp/mesocarp is what is consumed traditionally. The production process to attain the proposed product specification is simple and exclusively mechanical.
The processing steps are:

- Harvesting of fruits
- Cracking the hard outer shell and removing the content
- Mechanical separation of the seed, fibrous material and mesocarp
- Mesh / screen separation of unwanted fibrous and flaky material from fine, clean mesocarp powder (the baobab fruit pulp powder)
- Storage in clean food-grade packaging

NUTRITIONAL SPECIFICATION

100 g of Baobab fruit pulp contain 75.6 % of total carbohydrates, 2.3 % of proteins and a very low content of lipids (0.27% of total lipids).[7,i]
Baobab fruit is known for its high content of ascorbic acid (Vitamin C); in particular, 100 grams of pulp contain up to 300 mg of vitamin C, approximately six times more than the ascorbic acid content of one orange.[11]
Ascorbic acid is extremely important as nutritional element and as supplement, it is the factor able to cure the variety of clinical symptoms known as scurvy, a syndrome occurring in humans whose diet is deficient in fresh fruit and vegetables. Vitamin C protects the organism against free radicals, because it is the most effective antioxidant in hydrophilic compartments; moreover, it participates to several metabolic processes, as collagen biosynthesis in connective tissue, as neurotransmitter and in the steroidal hormones synthesis. It also increases the calcium absorption and iron bioavailability,[ii] and it is related to the prevention of many degenerative diseases (cataract formation, cardiovascular risks, arteriosclerosis).[iii,iv]

The Recommended Daily Allowance (RDA) for ascorbic acid is 75 mg for women and 90 mg for men;[v] if we consider that Baobab's ascorbic acid content is 300 mg per 100 grams of pulp, the oral intake of 25 and 30 grams respectively is able to provide to the vitamin C daily allowance for humans.[1,vi.] The fruit contains also other essential vitamins, such are riboflavin (vitamin B2), necessary for the organism growth and to maintain the integrity of nervous fibers, skin and eyes, and niacin (vitamin PP or B3), important for the regulation of several metabolic processes.[vii]
The fruit can contribute to the supply of others important dietary nutrients, as minerals and essential fatty acids. 100 grams of pulp contains 293 mg of calcium, 2.31 mg of potassium, 96-118 mg of phosphorus, and α-linolenic acid (27 μg of acid per gram of product expressed in dry weight).[viii,ix]
The characteristic acidulous taste is due to the presence of organic acids, as citric acid, tartaric acid, malic acid and succinic acid.[11]

DIETARY FIBERS

Today, the dietary fiber has gained increased importance as a component of the diet, for their capability to influence multiple aspects of the digestive physiology. The frequent consumption of dietary fiber associated to a diet rich in vegetables, cereals and fruits has been found in relation with the reduction of the risk of cancer involving the digestive tract, and in particular, the rectal colon tract.[x]
The dietary fiber levels are in average of 21 g/die (of which approximately 1/3 soluble) with variations that go from 18 g/die in the northern regions to the 22 g/die in the southern regions of Europe.
The optimal level of dietary fiber consumption has not yet been defined, but it is generally accepted that the fibers must be fundamental in the composition of an healthy and balanced diet.
Consumption through the diet of fiber rich foods is also in relation with the prevention of constipation and overweight.
Baobab fruit pulp provides soluble and insoluble fibers, with an amount of about 50 grams/100 grams of product.[xi] The insoluble fibers are not adsorbed by the intestine and are useful against constipation and to induce satiety, due to their ability to increase the fecal mass and to stimulate peristalsis. This latter aspect may be useful in case of hypo-caloric diet.[xii]

DIETARY USES

The Baobab fruit pulp can be used as powder, or it can be diluted in water in order to prepare drinks. In the traditional use, the Baobab drink is used by women in pregnancy and in some cases for the babies nourishment.[6,xiii]
The powder can be diluted directly with milk or fruit juices. In some African regions, this suspension is mixed to a type of beer, derived from fermented sorghum, called "mérissa", to prepare a refreshing drinks.[4]
It is also employed as substitute of cream of tartar (potassium bitartrate) for the preparation of the bread dough, due to its high content of tartaric acid and potassium bitartrate.[4]

NUTRICEUTICAL PROPERTIES

Analgesic, antipyretic and anti-inflammatory activity

Experiments lead on rats showed that dosages between 400 and 800 mg/kg determine a marked anti-inflammatory effect, and reduce a formalin-induced oedema in the animal.[xiv] These effects are comparable with those produced by 15 mg/kg of phenylbutazone, a common anti-inflammatory drug used as internal standard. This activity may be due to the presence of sterols, saponins and triterpenes. The pulp also produced a marked analgesic and antipyretic activity in mice at the oral dose of 800 mg/kg. This effect is similar to that induced by 50 mg/kg of acetylsalicylic acid.[24]
These results may explain the large employ of *Adansonia digitata* as antipyretic and febrifuge in the folk medicine.[4]

Treatment of dysentery and diarrhea

The typical feeding of the native African populations, and in particular of the children, essentially consists of vegetables and flour, and is poor of milk, hypocaloric and hypoproteinic. This potentially lead to development of rickets and cause organic dysfunctions as diarrhea and/or dysentery.[8]
The Baobab fruit pulp is used in the African countries as an effective anti-diarrhea product. A study conducted on 160 children, of the medium age of eight months, demonstrated that an aqueous solution of the Baobab fruit pulp, is significantly more effective than the traditional "WHO solution" for rehydration of children affected with diarrhea.[7,xv] The main constituents responsible of this activity is believed to be tannins (astringent effect), mucilage's (absorbents), cellulose, citric acid and other typical constituent of the fruit pulp.[xvi] Decoctions or milk suspensions have been used for oral treatment of diarrhea and dysentery.[2, xvii]
The Baobab fruit pulp shows interesting properties, in the stimulation of the intestinal microflora growth. Studies carried out in qualified Research Centers evidence that the hydrosoluble fraction of the fruit pulp has stimulating effects on the proliferation of Bifidobacteria in *in vitro* assays. In fact, soluble dietary fibers, as those contained in the pulp (about 25%), are known to have prebiotics effects stimulating the growth and/or the metabolic activity of beneficial organisms.

Antioxidant activity
Recent studies have shown that Baobab fruit has a marked antioxidant capacity, both water-soluble and lipid-soluble, preventing and combating free radicals damages.[xviii]

Oxygen Radical Antioxidant Capacity method (ORAC).
The use of the oxygen radical absorbance capacity (ORAC) assay as a tool for antioxidant assessment is described and proposed as a method for comparing botanical sources and for standardizing antioxidants supplements. The ORAC procedure uses 2,2'-azobis(2-amidinopropane) dihydrochloride as a peroxyl radical source, which is relevant to biological systems because the peroxyl radical is the most abundant free radical. A sensitive, highly fluorescent compound *Fluorescein* was used to measure the oxygen radical absorbing capacity of the tested compounds. One of the principal characteristics of this compound is that the fluorescence is rapidly lost when it is exposed to a source of free radicals. This method use Trolox as standard compound, and measure areas in terms of ORAC units, where 1 ORAC unit was defined was defined as the net protection area provided by 1µM Trolox in final concentration.
When comparing ORAC data, care must be taken to ensure that the units and food being compared are similar. Some evaluations will compare ORAC units per grams dry weight, others will evaluate ORAC units wet weight and still others will look at ORAC units/serving. Under each evaluation, different foods can appear to have higher ORAC values.
The range of ORAC for common fruits is around 1.40 micromoles TE per gram (watermelon) to 95 (cranberry). Lowbush blueberry (wild blueberry) is also very high at 92.6 µmol/g. For vegetables or legumes, it from 1.15 (cucumber) to 149 small red (red kidney bean); for nuts, 7.19 (cashew) to 179.4 (pecan); and for dried fruits, 23.87 (medjool dates) to 85.78 (prune). By comparison, different species of apples has ORAC values of 22.10 to 42.75 micromoles TE per gram, white potato is under 11, peanut is 31.66 and tomato about 4.00 Spices (clove, cinnamon) shows very high ORAC values (>2500). Cocoa has a high ORAC value, giving baking chocolate a value of 1032 and milk chocolate an average of 71.30. **(Nutrient Data Laboratory, Agriculture Research Service, US Department of Agriculture, Oxygen radical absorbance capacity (ORAC) of Selected Foods - 2007)**

SAMPLE	ORAC TE per gram (µmol Trolox Equivalents/g)	**ORAC** **TE per serving** (5-15 gr)
BAOBAB FRUIT PULP 100% NATIVE DRIED	250 ±12	1250-3750*

*Suggested daily antioxidant intake is 5000 TE **(source: Department of Agricolture, USA, 2007)**

Baobab fruit pulp high antioxidant capacity remains stable up to one year storage at 25°C.

DOSAGE
Antioxidant effects may be obtained at concentration as low as 5 grams per day. To ensure an high nutritional contribution of fibers, vitamins, proteins and carbohydrates, the suggested intake goes from 5 to 15 grams of pulp diluted in water, fruit juices or milk depending on the effects pursued.

Specifications:

Physical Characteristics	**Specifications**
Appearance	Powder Hydro-Dispersible
Colour	White / White peach
Odour	Characteristic
pH (sol 10%)	2.7 - 3.7
Energetic value	150 - 175 Kcal/100 g of fruit pulp
	700-750 Kj/100 g of fruit pulp
Proteins	2.3 - 2.9 g/100 g of fruit pulp
Fats	0.4 - 0.8 g/100 g of fruit pulp
Total Carbohydrates	36.0 - 39,0 g/100 g of fruit pulp
Dietary Fibers	42,9 - 45,9 g/100 g of fruit pulp
Sodium	0,20 - 0.6 mg/100 g of fruit pulp
Moisture	8,5 – 11 g/100 g of fruit pulp
Ash	4.4 - 6.0 g/100 g of fruit pulp

Microbiological characteristics	
Total plate count	<10.000 **CFU/g**

Clostridium SR-spores	<10 **CFU/g**
Bacillus cereus	<100 **CFU/g**
Enterobacteriaceae	Absent in 1 grams
Escherichia Coli	Absent in 1 grams
Yeasts and moulds	<1.000 **CFU/g**
Salmonella sp	Absent in 10 grams
Staphylococcus aureus	Absent in 1 grams

HEAVY METALS

Lead as Pb	< 3 mg/Kg (ppm)
Cadmium as Cd	< 1 mg/Kg (ppm)
Mercury as Hg	< 0,1 mg/Kg (ppm)

Pesticides	Delivers relationship test
Aflatoxines B1/B2/G1/G2 (HPLC)	<4.00 µg/Kg (ppb)
Ocratoxin A	< 0,5 µg/Kg (ppb)

Proteins

Average values of aminoacids per 100 g of protein.

Proline	2.35 g
Histidine	2.71 g
Leucine	8.41 mg
Lysine	14.62 g
Arginine	6.04 g
Isoleucine	10.73 g
Methionine	4.92 g
Cysteine	11.23 g
Glutamic acid	4.02 g
Valine	1.62 g
Tyrosine	4.21 g
Tryptophan	1.49 g
Threonine	2.96 g

Dietary Fibers

Average values per 100g of fruit pulp.

Soluble dietary fibers	21.6-23 g / 100 g.
Insoluble dietary fibers	21-22.9 g / 100 g.

SUGARS

Average values per 100g of fruit pulp.

Glucose	3.4-3.7 g/100 g.
Fructose	3.3-3.8 g/100 g.
Saccharose	20-25 g/100 g.
Maltose	N.D.
Lactose	N.D .

Minerals

Average values minerals per 100g of fruit pulp.

Calcium	275-300 mg/100 g
Phosphorus (P)	30-60 mg/100g
Iron	6,5-7,02 mg/Kg
Potassium (K)	2,0-3.1 g/100g
Manganese	6.0-7,50 mg/Kg

Vitamins

Average values vitamins per 100g of fruit pulp.

Vit.C	260-295 mg / 100 g
Total carotenes (Vit.A)	180 - 200 mcg/100 g
Vit.B1 (thiamin)	0.6-0,8 mg/100 g
Vit.B2 (riboflavin)	0.03-0,0 mg/100 g

Vit.B6 (piridoxin)	0,33 – 0,50 mg/100 g
Vit.PP (niacin)	1,85 - 2.16 mg/100 g

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While the information contained in the following note, are presented in good faith and believed to be accurate on the base of the references cited, they are provided for guidance only. Because many factors may affect processing or application/use, we recommend that you make test to determine the suitability of the product for your particular purpose prior to use.

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