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Research Article

Nutritional, Antioxidant and Physicochemical Properties of Baobab (*Adansonia Digitata* L) Fruit Pulp from Cameroon

Christiane Laure Fotso Maptouom[1,*], Michelle Carole Djouhou[2], Alex Dimitri Tchuenchieu[3], Borelle Mafogang[2], Gabriel Medoua[3], Pierre Onomo Effa[1], Helene Carole Edima[1], Dieudonné Njamen[4], Elie Fokou[2]

[1]Department of Biotechnology and Pharmacognosy, Faculty of Science, University of Ebolowa, Ebolowa, Cameroon

[2]Laboratory for Food Sciences and Metabolism, Department of Biochemistry, Faculty of Science, University of Yaounde I, Yaounde, Cameroon

[3]The Food, Food Security and Nutrition Research Center, IMPM, Yaounde, Cameroon

[4]Department of Animal Biology and Physiology, Faculty of Science, University of Yaounde I, Yaounde, Cameroon

Abstract

The baobab fruit (*Adansonia digitata* L.) is one of the tropical fruits found in some countries of sub-Saharan Africa, including Cameroon. Studies of its pulp in other countries have shown that it is rich in nutrients, bioactive compounds and medicinal properties. It is an auspicious tropical fruit although it has been little investigated and exploited in Cameroon. This work aimed to determine the nutritional, antioxidant and physicochemical characteristics of baobab fruit pulp from Cameroon. To achieve this objective, baobab fruits were harvested in the North Region of Cameroon and immediately transported to the laboratory. The nutritional (proximate composition, vitamin C, minerals), antioxidant (Total Phenolic Content, Radical Scavenging Activity of DPPH, Total Antioxidant Capacity (TAC) and Ferric Reducing Antioxidant Power (FRAP) using different extracted solvents) and physicochemical (pH, total soluble solids and colour) properties of the pulp were determined using standard reference methods. The characterisation of baobab fruit pulp showed the presence of all macronutrients: protein (3.95 ±0.00 g/100 g), lipid (12.11 ±1.02 g/100g), carbohydrate (57.62 ± 0.65 g/100 g), its richness in vitamin C (494.94 ±69.99 mg/100 g DM), fibre (8.17 ±1.03 g/100 g), minerals (calcium (333.75 ±0.01 mg/100 g), magnesium (167.45 ±0.01 mg/100 g), phosphorus (61.20 ±0.04 mg/100 g), Potassium (2670.05 ±0.012 mg/100 g)) and phenolic compound (566.46 - 2529.25 mg GAE/100 g). It also exhibited high antioxidant activity (FRAP: 1996.27 - 5861.33 mg $FeSO_4$/100 g, DPPH: 49.19 - 98.33% inhibition /100 g and TAC: 8.17 ±0.18 g AAE/100 g), an acidic pH (3.37 ±0.00) and total soluble solids of 5.00 ±0.00 °Brix. The present study shows that baobab fruit pulp from Cameroon has good nutritional and antioxidant properties. The consumption of this pulp would contribute to covering the Recommended Nutrient Intake of several nutrients and to the prevention and management of chronic diseases related to oxidative stress.

Keywords

Adansonia digitata L, Antioxidant Activity, Baobab Fruit Pulp, Cameroonian Baobab, Nutritional Properties, Phenolic Compounds

*Corresponding author: lauremaptouom@gmail.com (Christiane Laure Fotso Maptouom)

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1. Introduction

The fruit of the baobab tree (*Adansonia digitata* L) also called "monkey's bread" is well known for its exceptional nutritional, antioxidant and medicinal properties [1, 2]. Baobab is part of the *Adansonia* genus, which belongs to the Bombacaceae family and the Malvales order [3, 4].

There are eight species of *Adansonia* genus (the baobab tree); six are endemic to Madagascar, one to North West Australia and one, *Adansonia digitata* L, is native to the arid and semi-arid areas of Africa of which the North and Far North regions of Cameroon are part [5-7].

Baobab fruit pulp is increasingly valued and exploited worldwide especially in countries where it is found [8]. Several studies have been conducted on its characterisation in various countries (Senegal, Mali, Kenya, Ivory Coast, Tanzania, Malawi, Ethiopia, Mozambique, etc.) and its processing [1, 9, 10]. These studies reveal that the pulp is rich in nutritional compounds (carbohydrates, proteins, minerals, acids and vitamins) and has good antioxidant properties, but its composition is affected by climate and geographical location [11-15]. Baobab fruit pulp has also demonstrated notable medicinal properties including anti-diarrheal, antioxidant, anti-cancer, hepato-protective, anti-diabetic, antimicrobial, anti-inflammatory, lipid-lowering properties and anti-hypertensive effects [16-24].

In Cameroon, this pulp, which was traditionally exploited only minimally in its production areas, is now widespread throughout the country and mainly used to produce traditional juice. This juice is consumed by both men and women in the North and Far North regions of Cameroon. Studies on its processing in northern Cameroon have identified four main traditional methods of juice production [25]. Other studies indicate it diverse uses for both food and health purposes [9, 26-28]. Since the nutrient and mineral contents of plants are affected by environmental factors (soil type, climate type) numerous studies have examined biochemical composition and mineral content of baobab fruit pulp in various geographical locations [15, 29] but there is little data on fruits from Cameroon. It is therefore important to focus on the later to enrich the food composition table, facilitate its use in health applications and enhance its value. The aim of this work was to determine the nutritional, antioxidant and physicochemical properties of baobab fruit pulp from Cameroon.

2. Materials and Methods

2.1. Plant Material

Mature baobab fruits (Figure 1) were harvested in Bascheo village, Benoue Subdivision, North Region, Cameroon, and immediately transported to the Laboratory of Food Science and Metabolism. The baobab fruit pods were broken and lightly pounded in a traditional mortar to separate the pulp from the seeds.

Figure 1. *Collection area.*

Figure 2. *Baobab fruits.*

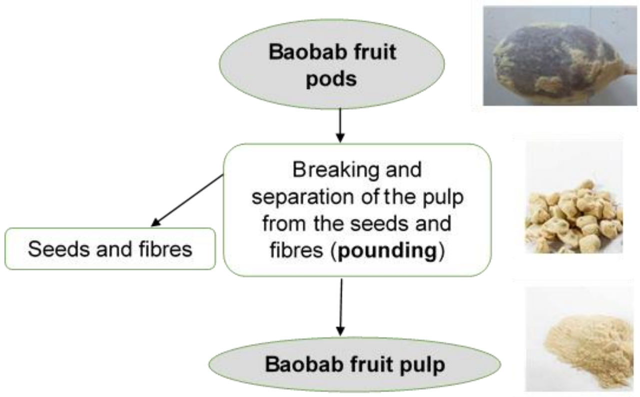

Figure 3. *Pulp processing stages.*

2.2. Methods of Analysis

2.2.1. Proximate Analysis and Nutritional Properties

The moisture and dry matter contents were determined using the gravimetric method at 105°C [30] (30 AOAC, 1980). Lipid content was measured by extraction following the Soxhlet method described by Bourely [31]. Total nitrogen content was determined using the Kjeldahl method, with a conversion factor of 6.25 applied to calculate total protein [32]. The contents of ash, carbohydrates, and dietary fibres were determined according to AOAC methods [30, 33]. Soluble sugars were quantified using the method described by Fischer and Stein [34].

The energy value per 100 g of baobab fruit pulp was obtained by summing up the multiplied values for protein, lipid and carbohydrate, using the factors (4 kcal, 9 kcal, and 4 kcal), respectively as follows [35].

$$\text{Energy value } \left(\frac{\text{Kcal}}{100\text{g}}\right) = (\text{Proteins } (\%) \times 4) + (\text{Carbohydrate } (\%) \times 4) + (\text{Lipids } (\%) \times 9) \quad (1)$$

Vitamin C content was determined by the redox titration method using dichloro-2, 6-phenolindophenol (2, 6-DCPIP) after extraction with 90% acetic acid [36].

Pulp mineral content was determined using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) after mineralisation, following the method described by Benton and Vernon [37].

2.2.2. Antioxidant Properties

Extraction procedure

Five extractions were performed using different solvents: H_2O, 1%HCl, 70% ethanol, 70% acetone and 80% methanol. The procedure was as follows: 2 g of sample was weighed, and 20 mL of solvent was added. The mixture was agitated using a magnetic stirrer for two hours at room temperature, then filtered. Subsequent extractions were performed with 10 mL of solvent for 30 minutes, followed by filtration. The total volume was adjusted to 25 mL with each solvent. Extracts were stored at 4°C.

Determination of Total Phenolic Content (TPC)

TPC was determined using the Folin-Ciocalteu method [38]. Gallic acid standards (0, 25, 50, 100, 150, 200, 250, 300, 350, 400, 450, and 500 mg/L) were used to construct a standard curve for quantifying the phenolic content. Results were expressed as mg Gallic Acid Equivalent (GAE)/100 g.

Determination of antioxidant capacity

Radical Scavenging Activity (RSA) was evaluated using the DPPH radical, as described by Plaza *et al*. [39]. RSA was calculated using the formula from Yen and Duh [40]:

$$\text{RSA } \% = \text{AA } \% = [(\text{ADPPH} - \text{ASam}) / \text{ADPPH}] \text{ x } 100 \quad (2)$$

Where, ADPPH = the absorbance of the DPPH control and ASam = the absorbance of the sample. Results were expressed as antioxidant activity (AA%), which indicates the percentage inhibition compared to the control.

The FRAP (Ferric Reducing Antioxidant Power) method was used to measure total antioxidant capacity, as described by Benzie and Strain [41]. This method evaluates the reducing power of antioxidants via electron transfer.

Total Antioxidant Capacity (TAC) was determined only with aqueous extract using the phosphomolybdenum reagent method described by Prieto *et al*. [42]. Ascorbic acid at 5 mg/mL served as the standard. TAC was calculated as follows:

$$\text{TAC} = \left(\frac{\text{ASample}}{\text{AStandard}}\right) \text{x Concentration of Standard} \quad (3)$$

Where, ASample = the absorbance of the sample and AStandard ASam = the absorbance of the standard. Results were expressed in mg Ascorbic Acid Equivalent (AAE)/100 g of pulp.

2.2.3. Physicochemical Analysis

Physicochemical characterisation was assessed by determining the pH, total soluble solids and colour. A pH meter (Mttler Toledo seven compact, sensibility: 0.002 pH) and digital refractometer (VWRTm international ATC) were used to determine the pH and the total soluble solids, respectively [33, 43]; while a colour meter (CR-10 Konica Minolta, Japon) was used to measure the changes in L*a*b values [44].

2.3. Statistical Analysis

Statistical analysis was performed using SPSS 20.0 for Windows. Data were analysed via one-way Analysis of Variance (ANOVA). The post-hoc Tukey test was used to assess significant differences ($p < 0.05$) between values. All analyses were performed in triplicate, and the results are expressed as mean ± standard error of the mean (SEM).

3. Results and Discussion

3.1. Nutritional Characterisation

3.1.1. Proximate Composition, Vitamin C content and Energy Value

Table 1 presents the results of proximate analysis, vitamin C content and energy value of baobab fruit pulp from Cameroon.

Table 1. *Proximate composition, vitamin C content and energy value of baobab fruit pulp.*

Elements	Baobab fruit pulp content
Dry matter content (g/100 g FM)	86.59 ± 0.42
Water content (g/100 g FM)	13.41 ± 0.42
Total lipid (g/100 g DM)	12.11 ± 1.02
Total protein (g/100 g DM)	3.95 ± 0.00
Total carbohydrates (g/100 g DM)	57.62 ± 0.65
Soluble sugars (g Glucose Eq/100 g DM)	3.97 ± 0.69
Crude fibre (g/100 g DM)	8.17 ± 1.03
Total ash (g/100 g DM)	4.73 ± 0.20
Vitamin C (mg/100 g DM)	494.94 ± 69.99
Energy value (kcal/100 g DM)	355.27

Values are expressed as mean ± SEM, FM = fresh matter; DM = dry matter.

The water content was 13.41 ± 0.42 g/100 g FM, yielding a dry matter content of 86.59 ± 0.42 g/100 g FM. These results fall within the ranges reported in the literature by Chadare *et al.* [45] (2-27.5 g/100 g FM for water content and 73-98 g/100 g FM for dry matter content) and Monteiro *et al.* [13]. However, the water and dry matter contents are higher than the averages reported by Chadare *et al.* [45] (11.6 g/100 g FM) and the contents of pulps from countries such as Ivory Coast, Tanzania, Zambia, Mali, Kenya, Nigeria and Malawi [46-49]. These differences can be attributed to variations in geographical area, climate, soil quality, harvesting season, and fruit ripeness, as noted by several authors [9, 46]. The low water content of baobab pulp facilitates its preservation, extending its shelf life and making it available year-round despite its seasonal nature.

The total lipid content (12.11 ± 1.02 g/100 g DM), although within the range reported in the literature (0.2-15.5 g/100 g DM) [50-52], is significantly higher than that described by most authors. For instance, Osman [52] reported 0.3 g/100 g DM, Ibrahim *et al.* [29] found 0.52 g/100 g DM and Abdulsalam *et al.* [49] reported 5.94 g/100 g DM. This high lipid content may result from climatic and geographical variations [15]. Baobab pulp's fatty acid profile indicates the presence of unsaturated and polyunsaturated fatty acids [53], which are beneficial for health. The significant fibre content in the pulp may contribute to improving the lipid profile of consumers [54].

The protein content (3.95 ± 0.00 g/100 g DM) is higher than that typically found in other fruits. This value exceeds those reported by Osman [52] (3.2 g/100 g DM), Cissé *et al.* [1] (3.00 g/100 g DM), Kinuthia *et al.* [46] (1.58-2.65 g/100 g DM), Kouamé *et al.* [47] (2.78 g/100 g DM) and Monteiro *et al.* [13] (2.10-2.42 g/100 g DM) for pulps from various regions, including Sudan, Mali, Kenya, Zambia and Angola. Common fruits such as papaya (0.5 g/100 g DM), kiwi (1.14 g/100 g DM), and passion fruit (2.6 g/100 g DM) contain lower protein levels [55, 56]. Though low in total protein, baobab pulp contains essential amino acids that the body cannot synthesize, such as leucine, lysine, isoleucine, valine, tryptophan, methionine, phenylalanine, and threonine. It also contains high levels of tyrosine, arginine, glutamic acid, and aspartic acid [52]. These amino acids contribute to the nutritional value and flavor development in food products like cheese, wine, and honey [57] and may contribute to improve acceptability of baobab pulp derivatives (cake, juice…). Despite a lower proportion of essential amino acids [52] than the levels recommended by the FAO/WHO, their diversity in baobab pulp remains noteworthy [58].

The total carbohydrate content (57.62 ± 0.65 g/100 g DM) and soluble sugar content (3.97 ± 0.69 g glucose equivalent/100 g DM) are consistent with those reported for most fruits, which typically contain 50-70% dry matter as carbohydrates. These values align with the ranges observed in previous studies (46.6-87.7 g/100 g DM) [45] but are lower than those found by Osman [52] (76.2 ± 1.0 g/100 g DM), Kouamé *et al.* [47] (72.7 g/100 g DM) and Kimani *et al.* [48] (85.90 g/100 g DM). Soluble sugars are also slightly lower than the average (4.8 g glucose eq/100 g DM) reported by Kouamé *et al.* [47] in Ivory Coast. This high carbohydrate content supports the classification of baobab fruit as an energy-dense food.

The average fibre content (8.17 ± 1.03 g/100 g DM) is similar to that reported for baobab pulp from Kenya [46] but higher than values reported for Sudan, Malawi, Mali, Zambia, Tanzania, and Ivory Coast [46, 47]. Lockett *et al.* [50] and

Osman [52] noted considerable variability (0.67-12.57 g/100 g DM) in fibre content among *A. digitata* species. Differences in fibre content can stem from variations in processing methods, including fruit crushing, separation of inedible portions, and sieving [29]. This fibre level surpasses those found in commonly consumed fruits (e.g., pineapple, avocado, mango), vegetables (e.g., cabbage, lettuce), and whole cereals (e.g., maize, rice, wheat). Fibre helps to improve intestinal transit and prevent cardiovascular disease and certain cancers [47]. Baobab fruit pulp contains dietary fibre and could therefore be considered a functional food.

The ash content was 4.73 ± 0.20 g/100 g DM. Several authors have reported an ash content varying between 1.9 and 6.4 g/100 g DM, with an average of 4.9 g/100 g DM [50-52].

The baobab pulp analysed in this study showed a vitamin C content of 494.94 ± 69.99 mg/100 g DM, higher than those of Gebauer *et al*. [59], Cissé *et al*. [1], Ibrahim *et al*. [29], and Kouamé *et al*. [47], who obtained values of 300, 67, 263.27, and 240 mg/100 g DM, respectively. Parkouda *et al*. [60] reported a content varying from 397 to 575 mg/100 g DM. This vitamin C content is 8.5 times that of an orange (58.30 mg/100 g), 8 times that of a papaya (62 mg/100 g), and 3 times higher than that of kiwi (98-180 mg/100 g) [55, 61]. For an adult, 17 g of this pulp would be enough to meet the recommended daily intake of vitamin C (85 mg/day). These results rank baobab fruit among the richest in vitamin C, making it a food that could be of interest in the prevention and management of metabolic diseases and oxidative stress.

The energy value of baobab fruit pulp was 355.27 kcal/100 g DM. This metabolizable energy is within the range reported by Murray *et al*. [51] and Osman [52]. It is higher than results obtained by Kouamé *et al*. [47] for baobab fruit pulps from Ivory Coast and Chabite *et al*. [10] for pulp from Mozambique; and lower than what Monteiro *et al*. [13] reported for pulp from Angola and Kimani *et al*. [48] in Kenya. Geographical, soil, and climatic variations could also explain these results [15].

3.1.2. Mineral Composition

Among the macro-elements (Table 2), calcium, potassium, and magnesium were the most abundant, while phosphorus and sodium were the least abundant. Their levels were 333.7, 2670.1, 167.5, 61.2, and 9.0 mg/100 g DM, respectively. Microelements (Table 2) were represented in decreasing order as follows: iron (1.66 mg/100 g DM), manganese (0.86 mg/100 g DM), copper (0.77 mg/100 g DM), and zinc (0.48 mg/100 g DM).

Table 2. *Mineral composition of baobab fruit pulp.*

Mineral	Baobab fruit pulp (mg/100 g DM)
Ca	333.75 ± 0.01
Mg	167.45 ± 0.01
P	61.20 ±0.04
K	2670.05 ± 0.012
Na	9.02 ± 0.012
Cu	0.77 ± 0.11
Fe	1.66 ± 0.00
Mn	0.86 ± 0.06
Zn	0.48 ± 0.01

Values are expressed as mean ± SEM, FM = fresh matter; DM = dry matter.

Calcium

The calcium content of the baobab fruit pulp analysed falls within the range reported by various authors (302-701 mg/100 g DM) according to Chadare *et al*. [45]. It was higher than the results obtained in pulps from Mali (250 mg/100 g DM), Kenya (270 mg/100 g DM), Zambia (320 mg/100 g DM), Tanzania (320 mg/100 g DM), and Ivory Coast (187-297 mg/100 g DM) [46, 47], Mozambique [10], but lower than those from Malawi (430 mg/100 g DM) and Sudan (344 mg/100 g DM) [29, 46]. Baobab fruit pulp is therefore an important natural source of calcium, higher than milk, which could be used to supplement calcium-poor diets in pregnant or breastfeeding women, children, and the elderly [1, 46]. Moreover, the calcium content of baobab pulp is far higher than that of commonly consumed fruits such as guava (18 mg/100 g) and orange (11 mg/100 g) [62].

Magnesium

The magnesium content of baobab fruit pulp differs from those obtained by several authors. This content (167.45 ± 0.01 mg/100 g DM) was within the range reported in the literature (100-300 mg/100 g DM) by Chadare *et al*. [45] but lower than that reported by most authors [1, 29, 46, 52]. However, this level was higher than that reported by Kouamé *et al*. [47]. Furthermore, it should be noted that magnesium is one of the major minerals in the human diet as a cofactor for several enzymes and an essential constituent in bone formation and function. The results of this work show that the pulp of the baobab fruit has potential for managing certain conditions such as chronic muscle weakness, cramps, tiredness, memory loss, and cardiac arrhythmia [63].

Potassium

As with the minerals mentioned above, its content is within the range reported in the literature (720-3272 mg/100 g DM) by Chadare *et al*. [45]. As in most plant products, the predominant mineral compound is potassium. This content is much higher than that found by several authors [1, 29, 46, 52] and that of commonly consumed fruits: guava (417 mg/100 g), banana (358 mg/100 g), orange (200 mg/100 g), and apple (90 mg/100 g) [62]. The baobab is one of the main sources of potassium, the most abundant mineral in its pulp. Potassium and sodium are very important in regulating muscle contraction and the transmission of nerve impulses.

Phosphorus and sodium

The baobab fruit pulp analysed has interesting concentrations of phosphorus and sodium. Phosphorus is important for the growth and maintenance of bones, teeth, and muscles [64], as well as for the formation of energy in the body. Baobab pulp can therefore be recommended as an excellent source of mineral macro-elements; the variations obtained compared to those of other authors are due to geographical location, soil types, climate, and harvesting periods. The concentrations of microelements (Fe, Cu, Mn, and Zn) found in the pulp analysed show that it would be interesting to consume this pulp when it is available.

Iron

The iron content in baobab fruit pulp varies widely from 1.1 mg/100 g [65] to 10.4 mg/100 g [52]. The iron concentration found here (1.66 ± 0.00 mg/100 g) was within the range reported in the literature (1.1-10.4 mg/100 g) by Chadare *et al.* [45]; however, it was lower than that of the various studies consulted [1, 29, 46-48, 52]. Iron is a trace mineral that is a component of haemoglobin in red blood cells, myoglobin in muscles, and numerous enzymatic reactions required for cell respiration [66]. Its deficiency leads to anaemia, which is a major health problem affecting around two million people worldwide [67]. It is important to encourage and improve the consumption of baobab fruit pulp. The richness of this pulp in vitamin C is an asset for potentiating the absorption of the non-haem iron it contains.

3.2. Antioxidant Potential of Baobab Fruit Pulp

The Table 3 and figures 4-6 shows the phenolic compounds content, overall antioxidant capacity using the FRAP (*Ferric Reducing Antioxidant Power*) method, DPPH anti-radical activity and total antioxidant capacity of baobab fruit pulp.

Table 3. *Phenolic compound content and antioxidant activity of baobab fruit pulp according to the different extraction solvents.*

Extraction solvent	Phenolic compounds (mg GAE/100 g DM)	FRAP (mg FeSO4/ 100 g DM)	DPPH (% Inhibition 100 g DM)	TAC (g AAE/100 g DM)
H2O	1151.79 ± 0.00^{a}	5364.31 ± 6.43^{a}	89.11 ± 5.41^{b}	8.17 ± 0.18
1% HCl	2529.25 ± 0.00^{b}	2481.04 ± 5.16^{b}	49.19 ± 9.38^{a}	
70% Ethanol	569.59 ± 10.83^{c}	1996.22 ± 5.66^{c}	96.31 ± 2.13^{bc}	
70% Acetone	1453.26 ± 17.64^{d}	5861.33 ± 12.98^{d}	93.99 ± 1.19^{bc}	
80% Methanol	427.52 ± 0.00^{e}	3781.88 ± 3.6^{e}	98.33 ± 1.14^{bc}	

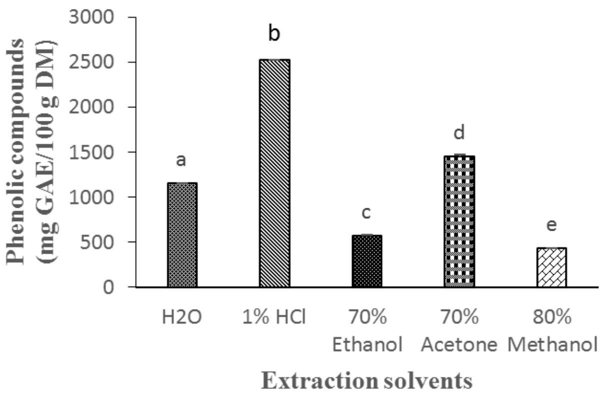

Figure 4. *Phenolic compounds content.*

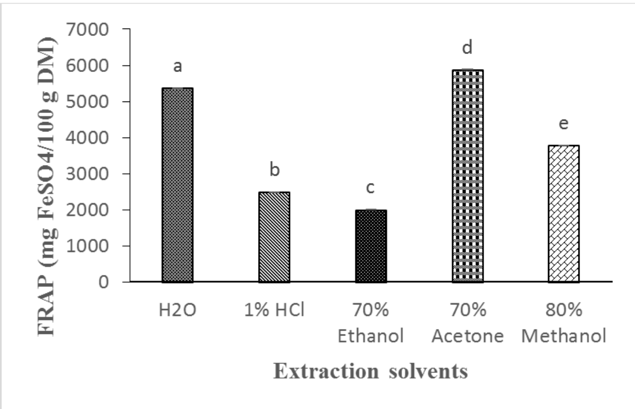

Figure 5. *Antioxidant capacity (FRAP).*

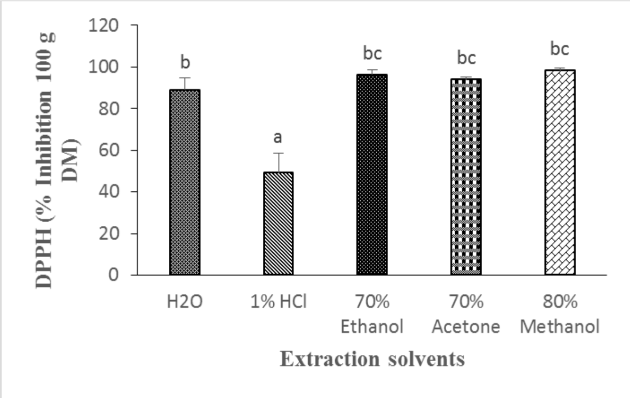

Figure 6. *DPPH anti-radical activity.*

In the columns of the Table and on the diagram of each figure, the means assigned different letters are significantly different at the p<0.05 threshold.

In general, the content of total phenolic compounds varied from 427.52 to 2529.25 mg GAE/100 g DM, regardless of the solvent used. Kouamé *et al.* [47] found a variation of 389.0 to 975.00 mg/100 g DM with an average of 683.10, which is higher than that found in this study with the same solvent (Ethanol 70%), but around two to four times lower than that of the other solvents. Similarly, Tembo *et al*. [68] obtained with 80% methanol a content of 1870 mg EAG/100 g, which was 4 times higher than the pulp of Cameroon, with Malawi pulps, but also lower than with 1% HCl. Cissé *et al.* [26] obtained a content of 250 mg GAE/100 g, which is lower than the pulp of Cameroon, while Lamien-Meda *et al.* [69] obtained the highest levels of phenolic compounds (3518-4058 mg GAE/100 g) in baobab pulp from Burkina Faso. The pulp analyzed contained a higher quantity of phenolic compounds than that of some commonly consumed fruits considered rich in phenolic compounds, such as apples (205 mg GAE/100 g) [70].

The results in Table 3 also show that baobab fruit pulp has a high antioxidant activity and capacity (FRAP, DPPH, and TAC). Ferric ion reducing activity (FRAP) ranged from 1996.22 to 5861.33 mg FeSO4/100 g DM. This result is higher than that obtained by Braca *et al.* [71], whose activity ranged from 293.99 to 458.50. That of Malawi [68] is within the range we found (4660 ± 11.8). The DPPH free radical scavenging activity ranged from 49.19 to 98.33%. This is higher than that found by Tembo *et al.* [68] (50.93 ± 0.4%) in Malawi. The total antioxidant capacity was 8.17 ± 0.18 g AAE/100 g DM.

Baobab fruit pulp is a rich source of phenolic compounds and vitamin C, which may play a protective role against oxidative stress due to their known antioxidant activities. The different classes of phenolic compounds in this pulp vary depending on the plant and geographical region [71]. Sokeng *et al.* [53] reported the presence of procyanidins, phenolic acids, flavonols, and glycosides in Cameroon pulp. These phenolic compounds contain molecules capable of releasing H protons to stabilize DPPH free radicals. The ferric ion reduction activity of an extract measures its ability to give up electrons and reduce oxidized intermediates in the lipid peroxidation process. It also indicates that the extract can act as a primary and secondary antioxidant [72]. The high antioxidant activity of baobab pulp is attributed to its high levels of vitamin C and total phenolic compounds.

3.3. Physicochemical Properties of Baobab Fruit Pulp

Table 4 presents the results of the analysis of several physicochemical parameters (pH, total soluble solids, and color) of baobab fruit pulp.

Table 4. *Some physicochemical parameters of baobab fruit pulp powder.*

Elements	Baobab fruit pulp
pH (T= 29.6°C)	3.37 ± 0.00
Brix (T= 20°C)	5.00 ± 0.00
Colour	L*= 44.50 ± 0.78; a*= 2.83 ± 0.15; b*= 4.23 ± 0.30

Baobab fruit pulp has a pH of 3.37 and a Brix value of 5. The pH value is consistent with findings by Cissé *et al.* [26] and Kouamé *et al.* [47] in Ivory Coast, while the Brix value is lower than that reported by [58] Cissé (2012) (6.7 ± 0.10). The high acidity of the pulp may help limit the proliferation of pH-sensitive microorganisms and favor the preservation.

4. Conclusion

This study, which aimed to determine the nutritional, antioxidant, and physicochemical properties of baobab fruit pulp from Cameroon, revealed its rich nutritional composition, antioxidant properties, and phytochemical profile. Baobab fruit pulp from Cameroon has a higher content in proteins, fibre, vitamin C, calcium, potassium, antioxidant activity and capacity (FRAP, DPPH, TAC) than that reported in many others countries. It also have a higher phenolic compounds content than that of some commonly consumed fruits considered rich in phenolic compounds. The baobab fruit pulp is nutrient-dense, has a good energy value, and possesses notable antioxidant properties. It offers significant benefits for human nutrition, food security, health and could serve as a functional food for the prevention and management of nutrient deficiency-related diseases and oxidative stress. We recommend promoting baobab fruit pulp for use in the formulation of food and beverages. Further research is recommended to investigate amino acid, fatty acid and phenolic compounds profile of baobab fruit pulp from Cameroon; the study of *in vivo* antioxidant activity will also be great for the application in health.

Abbreviations

AA	Antioxidant Activity
AAE	Ascorbic Acid Equivalent
ANOVA	Analysis of Variance
AOAC	Association of Official Analytical Chemists
DM	Dry Matter
DPPH	2, 2-Diphenyl-1-picrylhydrazyl
FAO	Food and Agriculture Organization
FM	Fresh Matter
FRAP	Ferric-Reducing Antioxidant Power
GAE	Gallic Acid Equivalent
IRAD	Agricultural Research Institute for Development
RSA	Radical Scavenging Activity
SEM	Standard Error of the Mean
SPSS	Statistical Package for Social Sciences
TAC	Total Antioxydant Capacity
TPC	Total Phenolic Content
WHO	World Health Organization

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Author Contributions

Christiane Laure Fotso Maptouom: Conceptualization, Formal Analysis, Investigation, Methodology, Writing – original draft

Michelle Carole Djouhou: Conceptualization, Data curation, Formal Analysis, Methodology, Writing – review & editing

Alex Dimitri Tchuenchieu: Formal Analysis, Methodology

Borelle Mafogang: Methodology, Writing – review & editing

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Pierre Onomo Effa: Resources

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Conflicts of Interest

The authors declare no conflicts of interest.

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