



Quality Control and in Vitro Evaluation of The Antioxidant Activity of Baobab (*Adansonia Digitata* L.) Seed Oil Marketed in Senegal: A Study Conducted in Thiès

Souleymane AIDARA^{1*}, Mor FALL¹, Mamadou Lamarana Sow¹, Amadou DIOP²

¹UFR of Health Sciences, Iba Der Thiam University of Thiès, Senegal

²Cheikh Anta Diop University of Dakar, Analytical Chemistry Laboratory

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ABSTRACT:

Introduction: Baobab (*Adansonia digitata* L.) seed oil is used in cosmetics and traditional medicine, but its quality and antioxidant potential need to be documented through analytical controls.

Objective: To evaluate the quality (physicochemical parameters) and in vitro antioxidant activity of baobab oils marketed in the Thiès region (Senegal).

Methods: Five samples (Hb1–Hb5) collected in April 2024 (one production site and four retail outlets). Determination of acid value, iodine value, water content and pH. Antioxidant activity assessed using the DPPH and ABTS assays, with ascorbic acid as reference.

Results: The oils were oily liquids, light yellow to dark yellow, with a nutty odor. The acid value was identical (0.67%) and the water content was zero (0%). pH ranged from 5 to 7. Iodine value ranged from 6.34 to 9.52 mg I₂/100 g. DPPH and ABTS assays showed moderate antioxidant activity (about 20% inhibition at most depending on the sample), markedly lower than vitamin C (about 100%).

Conclusion: The evaluated oils have physicochemical profiles compatible with good stability (low acidity, absence of water) and a moderate in vitro antioxidant activity that varies with origin, highlighting the importance of systematic quality control for marketed oils.

KEY WORDS: *Adansonia digitata*; seed oil; quality control; acid value; iodine value; DPPH; ABTS; antioxidants.

INTRODUCTION

Baobab (*Adansonia digitata* L.) is a major resource of African savannas, valued for its nutritional, medicinal and economic uses (Viljoen, 2011). The seeds constitute an oil-bearing raw material; the oil is sought after in cosmetics and pharmaceuticals because of its lipid and micronutrient composition (Kamatou et al., 2011).

The variability in the quality of marketed oils makes it necessary to document simple stability parameters (acidity, water, pH, degree of unsaturation) based on standardized methods and quality requirements (Codex Alimentarius Commission, 1999), and to explore their in vitro antioxidant activity using reference assays such as DPPH and ABTS (Brand-Williams, 1995).

1. MATERIALS AND METHODS

1.1. Study setting and period

The study was conducted at UMRED within the UFR of Health Sciences (Iba Der Thiam University of Thiès) between 24 April and 10 November 2024, including physicochemical analyses (chemistry laboratory) and antioxidant assays (biophysics laboratory).

1.2. Sampling

Five baobab seed oils (Hb1–Hb5) were collected in the Thiès region in April 2024: Hb1 from a production site and Hb2–Hb5 from retail outlets/markets.

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Table 1. Description of collected baobab oil samples

Code	Source	Batch number	Expiry date
Hb1	Baobab des Saveurs	HGB-B018	01/07/2026
Hb2	Natural Pro	Not determined	01/01/2026
Hb3	Auchan (Valdafrique)	299	01/07/2026
Hb4	Biologique nature (Thiès central market)	Not determined	01/12/2026
Hb5	Fraicheur (Moussante market)	823	01/05/2026

1.3. Physicochemical parameters

The following parameters were determined: acid value (titration with KOH), iodine value (Wijs reagent and titration with thiosulfate), water content (gravimetric method, 105°C/4 h) and pH (pH paper).

1.4. In vitro antioxidant activity

Antioxidant activity was assessed using the DPPH assay (absorbance read at 517 nm after 30 min incubation in the dark) and the ABTS assay (absorbance read at 734 nm after 10 min incubation). The percentage inhibition was calculated as: $PI = ((A_0 - A_i) / A_0) \times 100$. Ascorbic acid was used as the reference.

2.RESULTS

2.1. Organoleptic characteristics

The samples appeared as oily liquids ranging from light yellow to dark yellow, with a characteristic nutty odor.

2.2. Physicochemical parameters

The acid value was strictly identical for all samples, with a value of 0.67%, indicating no variability between Hb1 and Hb5 for this parameter. In contrast, iodine value differed among samples, ranging from 6.34 mg I₂/100 g (Hb3) to 9.52 mg I₂/100 g (Hb5), with intermediate values of 6.98 (Hb1) and 7.61 mg I₂/100 g (Hb2 and Hb4), reflecting variability in the degree of unsaturation. Water content was zero (0%) for all samples, suggesting no detectable moisture under the measurement conditions. Finally, pH showed moderate variation between 5 and 7: Hb2 and Hb3 were the most acidic (pH=5), Hb5 showed an intermediate pH (pH=6), whereas Hb1 and Hb4 were neutral (pH=7).

Table 2. Physicochemical parameters of Hb1–Hb5 oils

Parameter	Hb1	Hb2	Hb3	Hb4	Hb5
Acid value (%)	0.67	0.67	0.67	0.67	0.67
Iodine value (mg I ₂ /100 g)	6.98	7.61	6.34	7.61	9.52
Water content (%)	0	0	0	0	0
pH	7	5	5	7	6

2.3. Antioxidant assays (DPPH and ABTS)

Figure 1 shows the assessment of antioxidant activity using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, expressed as percentage inhibition (or antiradical activity) as a function of concentration (mg/mL).

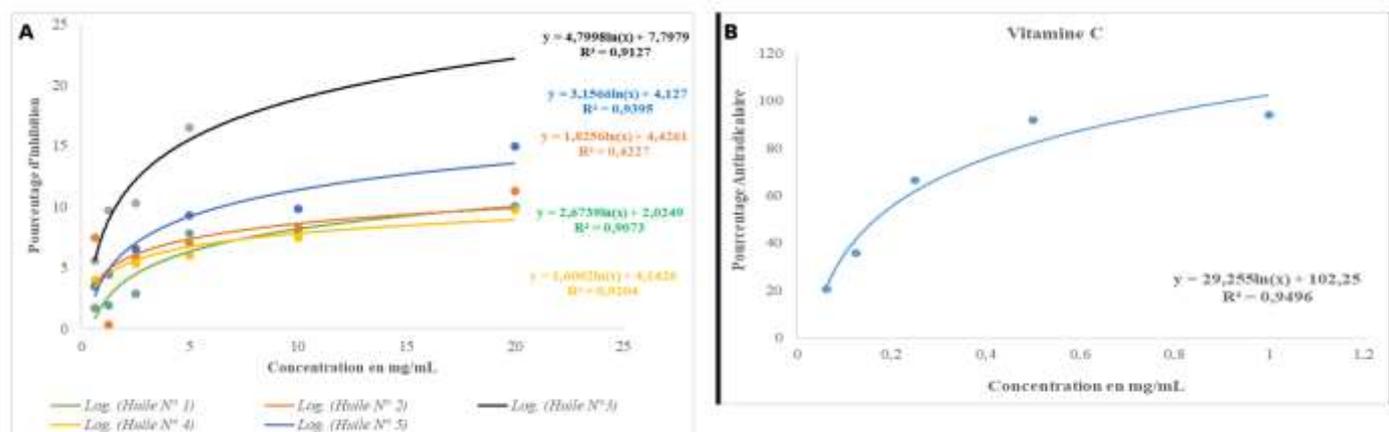


Figure 1. Assessment of antioxidant activity using the DPPH assay, expressed as percentage inhibition (antiradical activity) as a function of concentration (mg/mL).

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Dose–response curves showed a progressive increase in DPPH radical inhibition with increasing oil concentration, with a tendency toward saturation (plateau) at the highest concentrations. Points represent experimental values and lines correspond to logarithmic fits (equations shown on the graph). Among the tested oils, oil No. 3 generally exhibited the highest inhibition values across concentrations. Coefficients of determination (R^2) indicated a generally satisfactory fit for several oils, while one oil showed a lower fit, reflecting greater variability in experimental points.

3. DISCUSSION

Baobab seed oil, extracted from *Adansonia digitata* seeds, is of growing interest in cosmetics and therapeutics. This study evaluated its properties through analysis of physicochemical parameters (acid value, iodine value, water content, pH) using reference methods (ISO 660:2020; ISO 3961:2024) and antioxidant activity assays, particularly the DPPH test, in order to assess its quality, stability and potential applications.

From a physicochemical standpoint, the measured acid value (0.67%) indicates a low level of free fatty acids, suggesting good preservation and favorable quality, as acidity is a standardized criterion for quality control of fats and oils.

This value is lower than that reported for argan oil (0.8–2.5%) across quality classes, suggesting less hydrolytic degradation and better suitability for long-term pharmaceutical uses (Gharby et al., 2022).

Iodine value, which reflects the degree of unsaturation, is determined by a reference method; an overall low value suggests, in practice, better stability against oxidation (ISO 3961:2024).

Zero water content is a major asset for microbiological and chemical stability; as a benchmark, the Codex Alimentarius sets a limit for volatile matter at 105°C of $\leq 0.2\%$ (m/m) (Codex Alimentarius Commission, CXS 210-1999).

Finally, the oils' pH was neutral to slightly acidic, compatible with skin physiology (skin surface is generally acidic, on average <5), which supports their interest for well-tolerated topical formulations (Lambers et al., 2006).

Regarding antioxidant activity, the tested oils showed inhibition far below that of ascorbic acid (vitamin C), while the oils reached only about 20% at most at 20 mg/mL. Most samples reduced the ABTS⁺ radical (Re et al., 1999), whereas in the DPPH test (Brand-Williams et al., 1995), oils No. 1, No. 2, No. 4 and No. 5 showed moderate activity, lower than that of oil No. 3 (Hb3), which displayed the best activity.

CONCLUSION

Baobab seed oils marketed in the Thiès region showed low acidity, absence of water and a pH compatible with topical uses. In vitro antioxidant activity assessed by DPPH and ABTS was moderate and varied among samples. These findings support the value of systematic quality control for marketed oils and of complementary analyses for standardization.

Perspectives

Conduct fatty acid profiling, quantify polyphenols and tocopherols, include peroxide value and accelerated stability tests, and study the relationship between these parameters and antioxidant activity in order to optimize the valorization of these oils.

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Declarations

Conflicts of interest: The authors declare [no conflicts of interest / to be specified].

Data availability: [to be specified].

Authors' contributions: [to be specified].

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