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RESEARCH ARTICLE

ANTIOXIDANT EFFICACY OF *VITELLARIA PARADOXA* NUTS DERIVATIVE PRODUCTS (BUTTER, HULLS AND PRESS CAKES)

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Abstract

Aim and objective: *Vitellaria paradoxa* is a useful African tree belonging to the Sapotaceae family. The nuts are mainly exploited for fat or butter content. This study demonstrated pharmacological virtues of shea nuts derivative products through their phytochemical components and their antioxidant efficacy.
Methods: The hydroalcoholic extracts of shea butter, hull and cake were qualitatively screened in order to detect phytochemical components, and their antioxidant efficacy was tested through their ability to reducing DPPH radical and iron.
Results: The results revealed that the whole shea nuts derivative products (butter, hull and press cake) tested contain phytochemical compounds, namely phenolics, flavonoids, tannins, terpenoids, triterpenic alcohols and sterols. Most of these compounds are known as active principles. Indeed, the DDPH and FRAP tests have proved that the whole shea nuts derivative products have antioxidant power. This power varied increasingly (5.37%, 58.56% and 62.99% for DPPH test and 0,152, 0,222 et 0,606 for FRAP test) from butter to hulls and press cake.
Conclusion: The results concluded that, shea nuts could constitute a value-added resource of bioactive principle, which might be taken into account in the prevention of diseases linked to oxidative stress, such as tumors, cancer and other degenerative diseases.
Keywords: Antioxidant efficacy, oxidative stress, pharmaceutical virtues, phytochemical compounds, *Vitellaria paradoxa* nuts.

INTRODUCTION

Vitellaria paradoxa nut is an oleaginous seed with fat or butter content that is widely exploited for food and non-food purposes, mainly due to its physicochemical properties[1-3] especially its glyceride composition and its high content of unsaponifiable matter[4]. Processing of the shea nut into butter involves several stages during which co-products (hulls and cakes) are generated. Its hulls and press cake are considered as waste and not efficiently exploited as those of other oleaginous seeds do. Indeed, shea hulls are either burned or used as fuel and fertiliser[5,6]. Press cakes as for them are given to cattle or used as salant in houses[4,5]. Parallely, hulls and press cakes of many seeds serve in food industry as supplements and vitamins and amaminiacids providers[7]. These hulls and press cakes are also incorporated in cosmetics either entirely or their extract. These special uses are mostly linked to their contents in active compounds which would confer pharmacological virtues[8]. But, what about shea nuts hulls and press cakes? Couldn't these shea hulls and press cakes contain elements of pharmacological interest? Hence, this study was carried out in order to demonstrate the pharmacological virtues of shea nuts derivative products (butter, hull and pressvirtus) through their antioxidant efficacy. The study might be considered as a contribution to the prevention/fight against diseases due to oxidative stress like tumor and cancer, and also to the search for non-conventional source of bioactive compounds.

MATERIALS AND METHODS

Plant Sample

For this study, 50 Kg of shea nuts were collected in M'bahiakro (a town located in the central-eastern part of Côte d'Ivoire) and transported to the national floristic centre of the Université Félix Houphouët-Boigny where they were identified. These nuts were then transported to laboratory of the Pedagogy and Research United of Biotechnology where they were

processed into butter using the method described by Megnanou *et al.*,[9]. The hull, press cake and butter were collected during processing and used for further analysis.

Qualitative Phytochemical Screening

Qualitative screening methods described by Edeoga *et al.*,[10], Paris and Moyse[11] and Evans[12] were used to check phenolic and terpenic compounds presence in shea nuts derivative products. Hence, hydromethanolic extracts of shea butter, hulls and press cakes were prepared folloing Singleton *et al.*,[13] method. For each qualitative test, an aliquot of 5mL of the extracts obtained was used.

DPPH assay

The DPPH assay was conducted following Benhammou *et al.*,[14]. The DPPH solution (6 mg in 100 mL methanol) was prepared by dissolving the DPPH radical in methanol at 70% (v/v). A 50µL aliquot of methanolic extract was pipetted into a haemolysis tube and 1950µL of DPPH solution was added. After 30 min of incubation in the dark, the absorbance was read in a spectrophotometer against a blank. The percentage of inhibition or antioxidant activity (AA) was calculated using the equation:

$$AA\ (\%) = \frac{DOcontrol - DOassay}{DOcontrol} x100$$

Ferric reducing antioxidant power (FRAP) assay

The FRAP assay was performed according to the method reported by Oyaizu[15]. A 1mL aliquot of methanolic extract is mixed with 2.5mL of 0.2 M phosphate buffer, pH 6.6, and 2.5mL of 1% $K_3Fe(CN)_6$. The mixture was incubated at 50°C for 20 min in the dark and 2.5mL of 10 % TCA were added to stop the reaction. After centrifugation at 3000 rpm for 10 min, 2.5 mL of the supernatant were mixed with 2.5 mL of distilled water and 0.5 mL of 0.1 % $FeCl_3$. The absorbance was measured at 700 nm using spectrophotometer.

Table 1: Phenolic compounds.

	Polyphenols	Flavonoids	Tannins	Saponin	Sterols	Triterpenic alcohols
SK	+	+	+	+	+	+
SB	+	+	+	+	+	+
SH	+	+	+	+	+	+
SPC	+	+	+	+	+	+

SK: Shea kernel ; SB : Shea butter ; SH : shea hull ; SPC : shea press-cake (+) : Detected

RESULTS AND DISCUSSION

Phytochemical Analysis

Qualitative screening of phytochemical compounds revealed that the whole shea nuts derivative products tested positive to phenolic compounds, flavonoids, tannins, terpenoids, triterpenic alcohols and to sterols (Table 1). Indeed, the presence of each compound is respectively materialized by the appearance of a greenish-blue, red or pink, blue-black coloration, persistent moss or a brown ring. These results mean that shea kernels, hulls, butter and press-cake contain valuable phytochemical compounds which are researched and widely exploited for pharmacological and cosmetical purposes.

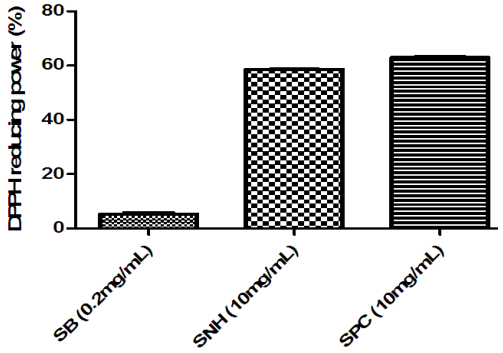

Figure 1: DPPH reducing power of shea nuts derivative products.

SB: Shea Butter; SNH: Shea Nut Hull; SPC: Shea Press Cake.

Indeed, terpenoids would be widely exploited in cosmetical industries under their identity of unsaponifiable fraction[16] for their properties of antiaging, repairing, moisturing, etc.[17]. About unsaponifiable, anterior study has reported optimized shea butter important content Megnanou *et al.*,[9]. As for phenolic compounds which are constituted by flavonoids and tannins chemical groups, they would confer antioxydant[7,18], antidiabetic[19,20], etc. virtues to their matrix ; they would be bioactive compounds like terpenoids. Matrix here, consisted in kernels, hulls, butter and press cakes; the whole resulting from shea nuts. Hence shea nuts which are mostly exploited just for its fat could now constitute a value-added resource of bioactive principle. A proof of this bioactivity was the antioxidant efficacy of its derivative products.

Antioxidant efficacy

Results of the antioxidant essay proved that all the derivative products of shea nuts (butter, hulls and press cakes) reduced significantly DPPH and iron which constituted in this study, the free radicale to be scavenged. DPPH and FRAP reducing powers varied (5.37±0.89 %, 58.56±0.24 % and 62.99±0.56 %, and 0.152, 0.222, 0.606 respectively for DPPH and FRAP tests as well as for shea butter, hulls and press cakes) significantly from a matrix to another (Figure 1). The

low antioxidant power of shea butter compared to hull and oilcake could be explained by the nature of the antioxidant compounds themselves. Indeed, these compounds are generally hydrophilic in nature; hence the low content in the butter. These molecules would then be found in the press cakes and could justify their high antioxidant activity. Indeed, with the present prevalence of metabolic diseases and those dues to oxidative stress, shea nuts, with its derivative products, appears as a solution to the research for non-conventional source of antioxidants.

CONCLUSIONS

Shea nuts which are mainly trader and exploited for their fats, revealed through the present study, their ability to be a valuable matrix of bioactive compounds like phenolic compounds, flavonoids, tannins, terpenoids, triterpenic alcohols and to sterols. Moreover, all of the derivative products (butter, hulls and press cakes) proved antioxidant efficiency. These results suggest a valorisation, even an exploitation of shea hulls and cakes in the same way as butter; but place the shea nut as a value-added resource in bioactive principles, and could be taken into account in the prevention of diseases related to oxidative stress, such as tumours, cancer, etc.

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AUTHORS' CONTRIBUTIONS

MEGNANOU RM: study design, writing original draft. **KOUAKOU AB:** field data collection and analysis. **DJOMAN AÉS:** literature survey, data interpretation. The final manuscript was read and approved by all authors.

DATA AVAILABILITY

Data will be made available on reasonable request.

CONFLICT OF INTEREST

None to declare.

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