



# Phytochemical Screening of *Sclerocarya birrea* (Anacardiaceae) and *Khaya senegalensis* (Meliaceae), Antidiabetic Plants

Atto Virginie<sup>1</sup>, Koffi Dago Pierre<sup>2</sup>, Monteomo Gnate Francois<sup>3</sup>, Adeoti Mansour Franck<sup>3</sup>

<sup>1</sup>Laboratory of Animal Physiology, UFR Biosciences University Felix Houphouët Boigny Abidjan, Abidjan, Côte d'Ivoire

<sup>2</sup>Endocrinology and Diabetology Service, CHU Yopougon Abidjan, Abidjan, Côte d'Ivoire

<sup>3</sup>Laboratory of Biochemistry, UFR Med. Sciences-University Felix Houphouët-Boigny of Abidjan, Abidjan, Côte d'Ivoire

## Email address:

Monteomo\_gnate@yahoo.fr- (M. G. Francois)

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**Abstract:** This study aimed at investigate the phytochemical screening of aqueous, methanolic, dichloromethane extracts of the stem barks of *Sclerocarya birrea* (Anacardiaceae) and *Khaya senegalensis* (Meliaceae). Experiments were performed with the test tubes. The phytochemical analysis revealed the presence of polyphenols, flavonoids, saponides, triterpenes and tannins. We couldn't found alkaloids and quinoids compounds in the tested extracts. Each of these phytochemical compounds has a specific mechanism for lowering blood sugar levels in diabetes rats. However, the large amount of chemical compounds confers to *Sclerocarya birrea* and *Khaya senegalensis* extracts its antidiabetic activities. So, that experience could justify the use of *Sclerocarya birrea* for diabetic therapeutics in traditional medicine.

**Keywords:** Phytochemical Screening, *Sclerocarya birrea*, *Khaya senegalensis*, Mechanism, Diabetes

## 1. Introduction

According to estimates of the World Health Organization [25], over 80% of the world population, especially in developing countries use traditional treatments to meet their health needs and primary care.

Herbal medicine is a medical therapy that uses plants to develop remedies to improve the general well-being and care. Number of plants contain active principles that may have the same properties as synthetic drugs.

The medicinal value of these secondary metabolites is due to the presence of chemical substances that produce a definite pharmacological action to the human. The most important of these include alkaloids, glucosides, glycosides, steroids, flavanoids, fatty oils, phenols, resins, phosphorus and calcium for cell growth, replacement, and body building [8].

Some limonoids have been isolated from the stems, barks, leaves and flowers of *Khaya senegalensis* (Meliaceae). This could mexicanolide limonoids named seneganolide, hydroxyseneganolide and acetoxyseneganolide. These

limonoids have a wide range of biological activities and growth-regulating properties to humans and animals [1].

In West Africa, the *Sclerocarya birrea* (Anacardiaceae) tree is one of the vegetable most widely used and generate income. It serves both to food and medicines. Fruits and plum products from Africa, including alcoholic drinks, jams and fruit juices are sold in local, regional and international markets. Ascorbic acid is present in high concentration in the fruit juice. its almonds contain in dry matter protein and fat. The oil is rich in oleic acid which gives it a good oxidative stability.

In addition, an inhibitor of tyrosinase, hydroxy-methoxy benzaldehyde, was isolated from the bark of *Sclerocarya birrea* and the ester of epicatechin galloyl which has a secretagogue activity the rat colon.

The stem barks of *Sclerocarya birrea* and *Khaya senegalensis* are used to treat diabetes in traditional medicine [12, 17] to western Africa. The preliminary study of the

photochemical screening of that plant can contribute to a better knowledge of the antidiabetic activities and for optimization of its uses in traditional medicine [13].

The aim of this study is to investigate the phytochemical screening of aqueous, methanolic, dichloromethane extracts of the stem barks of *Sclerocarya birrea* and *Khaya senegalensis*.

## 2. Material and Method of Tri Phytochemical

### 2.1. Material of Tri Phytochemical

#### 2.1.1. Botanical Species

The vegetal material is constituted by fresh trunk barks of *Sclerocarya birrea* (Anacardiaceae) and *Khaya senegalensis* (Meliaceae). The barks of trunk have been collected in the savannas area of Korhogo (the north of Côte d'Ivoire) and escorted to the urban market in Abidjan, the south of the country.

The samples of *Sclerocarya birrea* and *Khaya senegalensis* have been identified by Pr Aké-Assi [Aké, 2001] and registered respectively at the herbarium to National Floral Center of University Félix Houphouët-Boigny Abidjan under N° 3023 and N° 325.

#### 2.1.2. Preparation of the Aqueous Extract

Each extract was prepared from stem bark powder of 300g which were introduced into a flask containing 3 liters of distilled water. The decoction was carried out with stirring in a water bath at 100°C for 2 hours.

After cooling, the decoction was filtered through cotton wool and paper Whatman N°1; the filtrate obtained was concentrated in a rotary evaporator (Laborata 4000 Heidolph,

France) under vacuum at a temperature of 50°C. After concentration, the filtrates are taken up with a little distilled water and then lyophilized after 48 hours of freezing.

#### 2.1.3. Chemical Equipment

The chemical extraction equipment includes, Dichloromethane, Ethanol 96% Methanol 96% and Distilled water for the infusion and the decoction.

The study phytochemical requires sorting Hydrochloric acid 20%, Sulfuric acid 50%, Alcohol 50% hydrochloric and 96° Alcohol (ethanol). We used also Alcohol iso amyl, Ammoniac 25% and Acetic anhydride. Finally, Ferric chloride to 2%, Magnesium shavings and Formalin 30% had necessary.

### 2.2. Method of Tri Phytochemical

The phytochemical analysis was a qualitative test to permit to characterize the major chemical group in the stem bark extract of *Sclerocarya birrea* and *Khaya senegalensis*.

The experiences were repeated three hours ago. The following were used:

- Reaction of Boucharde and Dragendorff for alkaloids [19, 20];
- Reaction of called "with cyanidine" for flavonoids [19, 20];
- Reaction of Borntraeger for quinoids compounds [5, 20];
- Reaction of Liebermann for steroids [5, 23];
- Reaction with ferric chloride for polyphenols [3, 23];

For coumarines characterization, 5 ml of the macerated extract is evaporated. After, we put 2 ml of hot water and the reagents used were 0.5 ml of ammoniac hydroxide (25%), the expected results the fluorescence.

The others methods of determination of phytochemical compounds were in the table 1.

Table 1. Methods of the phytochemical screening.

Materials to search (Reagents used)	Characterization methods (Expected results)
Sterols et Polyterpenes (Liebermann-Buchard)	Evaporate 5 ml of the extract in a capsule+1 ml of acetic anhydride+0.5 ml sulfuric acid (Ring purple)
Flavonoïds (cyanidin)	Evaporate flavonoids 2 ml of the extract into a capsule and then cooled, to the residue in 5 ml of hydrochloric alcohol, add 3 drops of isoamyl alcohol (orange to pink)
Catechic tannins (Stiany)	Evaporate 5 ml of the extract in a capsule+15 ml mixture (formalin 30% and 30%HCl) Maintain at 80°C for 30 min then cool (Rushed into large flakes)
Gallic tannins (Sodium acetate Iron trichloride)	Filter 5 ml of the extract in a capsule Saturate with sodium acetate Add 3 drops of iron trichloride to 2% (Intense blue)
Quinones (Borntraeger)	Evaporate 2 ml dry extract Triturate the residue Add 5 ml of HCl heated at 100 ° C for 30 min Cool and add 2 ml of chloroform and 0.5 ml of 50% ammoniac (red).
Alkaloids (Dragendorff-Bouchardat)	Evaporate 4 ml of the extract+4 ml of alcohol at 60°C+2 drops of Reagent-Iodo bismutate (Orange) +2 drops of Reagent Iodo-iodized (Brun)
Saponosides	1 g of powder extract Add 100 ml of water to a boil for 15 minutes to cool and filter Successively introduce 1ml, 2ml, 3ml....10ml of decoction, stir for 15 seconds Let stand for 15 minutes and measure the foam height (Height of foam equal to 1 cm)

## 3. Result of Tri Phytochemical

Bark *Sclerocarya birrea* contained a significant amount of flavonoids, sterols, terpenes and saponins. Polyphenols, catechin tanins, gallic tanins and coumarins were present.

However, alkaloids and quinones could not be demonstrated.

The catechol tannins and flavonoids were the more chemical groups present in the extracts of *Khaya senegalensis* trunk barks. Quinones, polyphenols, sterols and terpenes were present. Saponins, gallic tannins and coumarins have not been identified in the extracts.

**Table 2.** Chemical groups present in the extracts of *Sclerocarya birrea* (Anacardiaceae).

	Ext 1	Ext 2	Ext 3	Ext 4	Ext 5
Flavonoids	++	++	++	++	++
Alkaloids	-	-	-	-	-
Polyphenols	+	+	+	+	-
Catechin tannins	+	+	+	+	+
Gallic tannins	+	+	+	+	+
Quinones	-	-	-	-	-
Saponins	++	++	++	++	++
Sterols and Terpenes	++	++	++	++	++
Coumarins	+	+	+	+	+

NB: ++ Abundant precipitate, +: Traces, -: Absence

Ext 1: Extract 1 (Dichloromethane)

Ext 2: Extract 2 (methanol)

Ext 3: Extract 3 (Infusion)

Ext 4: Extract 4 (Ethanol)

Ext 5: Extract 5 (Decoction)

**Table 3.** Chemical groups present in the extracts of *Khaya senegalensis* (Meliaceae).

	Ext 1	Ext 2	Ext 3	Ext 4	Ext 5
Flavonoids	++	++	++	++	+
Alkaloids	-	-	-	-	-
Polyphenols	+	+	+	+	+
Catechin tanins	++	++	++	++	++
Gallic tanins	-	-	-	-	-
Quinones	+	+	+	+	+
Saponins	-	-	-	-	-
Sterols and Terpenes	+	+	+	+	+
Coumarins	-	-	-	-	-

NB: ++ Abundant precipitate, +: Traces, -: Absence

Ext 1: Extract 1 (Dichloromethane)

Ext 2: Extract 2 (Methanol)

Ext 3: Extract 3 (Infusion)

Ext 4: Extract 4 (Ethanol)

Ext 5: Extract 5 (Decoction)

## 4. Discussion

The aqueous and ethanol solutions have allowed to extract a maximum of soluble constituents in antidiabetic medicinal plants while *Sclerocarya birrea* and *Khaya senegalensis* [17]. Aqueous and ethanol extracts gave the highest yields which are not mentioned in the result. For the first solvent, the trunk barks of *Sclerocarya birrea* and *Khaya senegalensis* were respectively 6,7% and 7,2%. With the second solvent, the above yields were in the order of 8,5% and 11%.

The amount of extract obtained from these two antihyperglycemic plants before the screening phytochemical was then sufficient. In effect, water and alcohol are two extractions solvents commonly used in traditional medicine and having a high dissociation of power [6]. This would justify the use of these two solvents to obtain the active compounds from a plant in general and in particular the relevance of the

decoction form used by the traditional healer.

Knowledge of the chemical composition of a plant derived drugs is essential to understand how it acts on the body [6, 9]. For this, it was made the sequential analysis of chemical components of these two drugs to identify the active chemical elements. In our experimentation, it was about antihyperglycemic chemical compounds we identified to these two medicinal plants.

The various extracts *Sclerocarya birrea* trunk barks showed the presence of flavonoids, tanins, saponins, coumarins, sterols and triterpenes.

These results are in agreement with those of Marles [15] who identified the presence of the preceding molecules in the extract of the stem bark of this plant. Furthermore, *Sclerocarya birrea* leaves showed a similar chemical composition but a lack of sterols and triterpenes [12]. The different results of barks and leaves concerning the chemical compounds confirmed the presence of chemical groups in a same plant species may be related to organ type.

The chemical groups of polyphenols which are known for their antidiabetic activity are found both the *Sclerocarya birrea* and *Khaya senegalensis*. These anthocyanins and flavonoid glycosides.

Anthocyanins, a significant group of polyphenols in bilberries and other berries, may also prevent type 2 diabetes mellitus and obesity. Anthocyanins from different sources have been shown to affect glucose absorption and insulin level, secretion, action and lipid metabolism by *in vitro* and *in vivo* methods [16]. Many *in vitro* studies suggest that the anthocyanins may decrease the intestinal absorption of glucose by retarding the release of glucose during digestion [24]. A flavonoid glycoside from an aqueous extract of stem bark of *Ficus benghalensis* produced a mild hypoglycemic effect in healthy and alloxan-induced diabetic rodents [4].

Catechin tanins and quinones that we identified in *Khaya senegalensis* also have hypoglycemic activity in the ethanol extract of *Rauvolfi vomitoria* (Apocynaceae) during oral administration of glucose load of 4g/kg/vo to Wistar rats [18]. Catechin tanins and quinones have an effect on liver enzymes stimulating glycogenesis [18].

And, certain antidiabetic plants contain some chemical group like saponins have found only to *Khaya senegalensis* in our experience.

The alkaloids although their antidiabetic property had been demonstrated [7, 21] could not find in the two medicinal plants we used, it is related to their absence or manipulation. So, alkaloids like catharanthine obtained of *Catharanthus roseus* (Apocynaceae) also lowered blood sugar levels when tested in normal and streptozotocin-induced diabetic rat model reduces blood glucose in normal and alloxan diabetic rabbits [7]. This experience suggesting that the mechanism of hypoglycemic activity of alkaloids is due to its ability to inhibit alpha-glucosidase and decrease glucose transport through the intestinal epithelium [21].

In fact, chemical tests have demonstrated the presence of flavonoids associated with sterols, polyterpenes, polyphenols, saponides, coumarins and tanins in extracts of *Khaya*

*senegalensis* trunk barks. This group of tanins could be the limonine subgroup from the bark of *Khaya senegalensis*, a rich source of limonoids which gave its antidiabetic properties [10, 26]. This assumes that *Khaya senegalensis* stem bark preserved enough chemical constituents despite their regional disparities.

Also, terpenes that we have identified are bioactive compounds found naturally in many plants with known hypoglycemic activity have been reported in bioassays [11]. Five triterpenes oligoglycosides named escins were isolated from the seeds of *Aesculus hippocastanum* (Sapindaceae). These compounds were tested for their effects on ethanol absorption and hypoglycemic activity on oral glucose tolerance test in rats. Escins were found to exhibit inhibitory effect on ethanol absorption and hypoglycemic activity on oral glucose tolerance test in rats [11]. Forskolin, a diterpene is isolated from *Coleus forskohlii* (Lamiaceae). The effects of forskolin on cyclic AMP content and insulin release have been studied in rat pancreatic islets. It was observed that forskolin stimulates glucose-induced insulin secretion *in vitro*. This appears to reflect a general stimulatory influence of forskolin on adenylate cyclase activity, obviating its specific suitability as an antidiabetic treatment [11].

In total, the hypoglycemic activity of the aqueous extract of *Sclerocarya birrea* and *Khaya senegalensis* can be explained by the action of secondary metabolites (flavonoids, polyphenols and terpenes) that stimulate the regulation and release of insulin in the pancreas in animal hyperglycemia state for a glucose uptake by muscle tissue of the animal.

## 5. Conclusion

Large chemical groups antihyperglycemic effect such as flavonoids are found in the extracts of *Sclerocarya birrea* and *Khaya senegalensis*.

Chemical compounds catechin tannins, alkaloids, triterpenes and anthocyanins have shown their antidiabetic activity mechanism. So, this study can be completed by the research of antioxidant compounds of these medicinal plants, necessary in cases of diabetic complications or inflammation reaction.

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