

Review Article

Chemical Composition, Toxicological, Ethno-Medicinal and Pharmacological Reports of *Annona senegalensis*: A Review

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Received: February 20, 2021; Accepted: March 13, 2021; Published: March 20, 2021

Abstract

Annona senegalensis is a traditional medicinal plant commonly used in traditional medicine for the treatment of various diseases. It belongs to a family of Annonaceae and commonly known by the name of Wild Custard Apple and Wild Soursop, etc. It is a shrub or small tree 2-6 m tall but may reach 11m under favorable conditions. It is widely spread throughout tropics and sub-tropics. It is commonly used for therapeutic fighting of major diseases including dysentery, diabetes mellitus, heart stroke, epilepsy, parasite and worm infestations, constipation, hemorrhage, dysuria, fever, ulcer, and cancers. The plant has also been reported for several biological activities including anti-oxidant, antidiarrheal, antimicrobial, antiparasitic, anticonvulsant, antitrypanosomal, antimalarial, anti-inflammatory, anti-snake venom, and antinociceptive properties. In order to provide sufficient baseline information for future works and commercial exploitation, this review represents the ethnomedicinal properties, phytochemicals composition, pharmacological properties, and safety/toxicity profile of *A. senegalensis*.

Keywords: *Annona senegalensis*; Chemical composition; Toxicological; Ethno-medicinal; Pharmacological

Introduction

From ancient time to recent days, natural products particularly medicinal plants have a medicinal reputation in the management and treatments of several diseases, including cancers, diabetics, metabolic disorders, degenerative disease, parasitic and infectious disease, inflammatory diseases, and oxidative stress-induced diseases [1-4]. In addition, increase scientific research has been focused on identifying and isolating bioactive agents in medicinal plants [5]. Furthermore, natural products are bio-friendly and have demonstrated higher safety properties compared to conventional therapies which are besieged with adverse effects [6-9].

Annona senegalensis, is a small tree that belongs to the Annonaceae family commonly known as Wild Custard Apple and Wild Soursop, it is also known as Gwándàn dààjì in Hausa or dukuu-hi in Fulani speaking part of Nigeria. It is native to tropical east and northeast, west and west-central, and southern Africa, as well as southern subtropical Africa, and islands in the western Indian Ocean. In Nigeria, it is widely distributed in Northern part, primarily in Kaduna, Nasarawa, Kano, Plateau, and Niger States and in the Federal Capital Territory, Abuja [10]. It is a shrub or small tree 2-6 m tall but may reach 11m under favourable conditions. The bark is often roughish and grey-brown while the leaves are simple alternate, oblong, ovate or elliptic, green to bluish-green, mostly lacks hairs on upper surface, with brownish hairs on the lower surface. The flowers are up to 3cm in diameter while the fruits are formed from many fused carpels [11].

Annona senegalensis is commonly used for therapeutic fighting of

major diseases including dysentery, diabetes mellitus, heart stroke, epilepsy, parasite and worm infestations, constipation, hemorrhage, dysuria, fever, ulcer, and cancer [12]. The plant has also been reported for several biological activities including anti-oxidant, antidiarrheal, antimicrobial, antiparasitic, anticonvulsant, antitrypanosomal, antimalarial, anti-inflammatory, anti-snake venom and antinociceptive properties [10,12]. In the present study, we provided a review of traditional uses, Phyto-constituents, scientifically validated biological activities and safety/toxicity profile of *Annona senegalensis*.

Nutritional and Phyto-Compositions of *Annona senegalensis* Pers

Annona senegalensis has been reported to contain 12.20% moisture, 12.10% ash, 24.00% fat, 17.60% crude fibre, 8.80% crude protein and 25.3% of carbohydrate, respectively [13]. The mineral composition of *A. senegalensis* include potassium, phosphorus, calcium, sodium, magnesium, sulphur, chlorine, aluminum, silicon, vanadium, chromium, manganese, iron, nickel, copper, zinc, selenium, brome, molybdenum, tin, iodine, barium, and lead [14]. The phytochemical screening indicates the presence of saponins, steroid, flavonoid and glycoside in the sample. GC-MS analyses of essential oil of *Annona senegalensis* stem bark revealed the presence of p-cymene (36.0%), α -phellandrene (25.0%), α -pinene (8.3%), Z-sabinol (6.9%) and limonene (4.8%) [15]. While the essential oil from the leaves had oxygenated monoterpenes (65.0%), citronellal (30.0%), citronellol (14.8%), geranial (17.2%), thymol (8.1%), β -caryophyllene (7.8%) and carvacrol (6.92%) [16]. The plant has high values of amino acid content comparable to Food and Agricultural Organization/World Health Organization (FAO/WHO) standard.

In addition, fermentation of *Annona senegalensis* have been reported to enhance the nutritional contents and decreased the anti-nutrient contents of the seeds. Thus, large-scale production of fermented *A. senegalensis* seeds will be a valuable source of nutrients for humans and anima [17].

Ethno-Medicinal Uses of *Annona senegalensis* Pers

Annona senegalensis Pers. (Annonaceae) is a multipurpose plant with a high medicinal reputation in traditional medical practice. *A. senegalensis* has been used in traditional medical practice for the management of various diseases. The plant is commonly used as a stimulant, pain reliever, anti-oxidant, antidiarrheal, antimicrobial, antiparasitic, anticonvulsant, antitrypanosomal, antimalarial, anti-inflammatory, anti-snake venom, and antinociceptive properties and many other biomedical properties of pharmaceutical relevance [10,12]. The leaves have been reportedly used for the treatments of tuberculosis, yellow fever, smallpox [18,19]. The stem bark has been used for treatments of injury from venomous animals and in treatments of hernias [20]. The root is effective in treating gastritis, reproductive deficiency, snake bites, impotence, erectile dysfunction, tuberculosis, and infectious diseases [21], and in the management of diabetes and malaria [22].

Biological Activity of *Annona senegalensis* Pers

Antimicrobial activity: Crude ethanol, methanol-methylene chloride extract, and fractions of *A. senegalensis* has been reported for antimicrobial activities against both gram negative and gram-positive bacteria including *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and fungi with MIC range between 30-150 µg/ml while it inhibits fungi *Candida albicans* and *Aspergillus niger* with MIC range between 30-250 µg/ml [23-25]. Ethanol extract of *A. senegalensis* has also been reported for antimicrobial activity against some oral pathogens [26].

Antiplasmodial activity: *Annona senegalensis* has been reported for antiplasmodial activity against *Plasmodium* species exhibiting 57.1% and 91.1% suppression of parasite at extract concentrations of 100 and 800 mg/kg BW [27]. Furthermore, Ajaiyeoba et al. [28] reported that, the methanol extract of *Annona senegalensis* exhibited higher anti- *Plasmodium berghei* activity than the standard drug, chloroquine disphosphate.

Cytotoxic activity: *Annona senegalensis* exhibited a cytotoxic effect against A2780 ovarian cancer cells with an IC₅₀ of 28.8µg/ml [29]. In addition, different fractions of the *A. senegalensis* have shown mild to moderate cytotoxicity effect in brine shrimp lethality bioassays [30,31]. Aporphine alkaloid from *A. senegalensis* has been reported for the cytotoxic effect [32].

Antioxidant activity: *Annona senegalensis* have been reported to exhibit ameliorative effect on CCl₄-induced hepatocellular damage in rats [33].

Antitrypanosomal activity: Various extract and fractions of *Annona senegalensis* have been reported for significant *in vivo* anti-trypanosoma effects, with little or no *in vitro* effects [34-37], with acetogenins been the active compound identified in the seeds extract [38].

Anti-Inflammatory and analgesic activities: *A. senegalensis* stem bark methanol extract have been reported for significant dose-dependent anti-inflammatory activities in hot plate test and egg albumin induced paw oedema [39]. The authors reported a comparable anti-inflammatory activity to standard drugs pentazocine and piroxicam. The ethanol leaf extract of the plant also demonstrated significant anti-inflammatory effects [40]. Adzu et al. [41] also reported the anti-nociceptive effects of the methanolic root bark extract of *Annona senegalensis*. The chloroform root extract of *Annona senegalensis* L have also been reported for analgesic activity [42].

Anthelmintic activity: Ethanol leaf extract of *A. senegalensis* at .8%w/v have been reported to induce 98.33% lethality of *Haemonchus contortus* larvae [43]. In addition, inhibition of egg hatching at 7.1mg/ml of the whole plant was achieved [44]. The identified anthelmintic compound in the *A. senegalensis* root extract included glaucanisine, glaucanetine, goniotalamicine, liriodenine, gigantetronenine, squamacocine and noroliveroline [45].

Hypnotic activity: Crude extract and fractions of *A. senegalensis* leaves have been reported to dose-dependently and significantly (p<0.05) decreases the sleep latency and prolonged sleeping time in pentobarbitone-induced sleeping animal model [46]. Furthermore, in an phenobarbitone assays, the root bark extract of *A. senegalensis* potentiated the central nervous system depressant effect of phenobarbitone in a dose dependent manner [47].

Other activities: Kitadi et al. [14] reported the anti-sickling effect of *A. senegalensis*, they demonstrated that aqueous extract of *A. senegalensis* significantly prevent the sickling and the hemolysis of red blood cells. Methanol root bark extract of *Annona senegalensis* has also been evaluated for anticonvulsant and muscle relaxant effects in mice, interestingly, the extract exhibited a non-dose dependent significant (P<0.05) delay in the onset of both tonic and clonic phases of seizure-induced by PTZ as well as offering 100% protection in mice from PTZ induced seizures at 200mg/kg BW [48].

Toxicity and Safety Properties of *Annona senegalensis* Pers

Crude methanol-methylene chloride extract, methanol fraction, n-hexane and ethyl acetate fraction of *A. senegalensis* had LD50 of 1 296, 3 808, 1 265 and 2 154 mg/kg respectively in the acute oral toxicity study [49], while the methanol root bark extract of *Annona senegalensis* have oral LD50 of 1, 296mg/kg [48]. Subacute administration of the extracts at 100 and 400 mg/kg doses produce no significant alterations (p>0.05) to the activities of aspartate transaminases and alanine transaminase. Hematological and histopathological evaluations also indicated no significant alterations except for an increase in the total WBC count and hepatocytes degeneration observed at the highest dose. Furthermore, the extract enhances the weight gain of the animals [49]. Coherently, another study revealed that a 28 days' administration of aqueous extract of *A. senegalensis* did not significantly alter (p>0.05) the blood serum biochemical parameters such as total proteins, alanine Aminotransferase (ALT), glucose, creatinine, and lipid levels of the treated mice [50]. However, Adisa et al. [51] reported that *Annona senegalensis* is relatively safe, but prolonged ingestion could induce oxidative stress and impair ATP synthesis through the modulation of the activity of mitochondrial

succinate dehydrogenase.

Conclusion

The present review summarizes information concerning the ethno-medicinal properties, phytochemicals composition, pharmacological properties and safety/toxicity profile and toxicological reports of *A. senegalensis*. This review aims at gathering the research work undertaken till date on this plant in order to provide sufficient baseline information for future works and commercial exploitation.

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