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Nutraceutical Potential of *Cnidoscolus aconitifolius*

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Abstract: *The genus Cnidoscolus belongs to the family of the Euphorbiaceae. The plant traditionally known as Chaya, is used in traditional medicine for fight cancer, as a treatment to lose weight, for high blood pressure, ulcers, diabetes mellitus, as well as kidney affections. This article is a review of the main chemical composition and biological activity reported with respect to the nutraceutical potential of Cnidoscolus aconitifolius* Mill.

Keywords: *Cnidoscolus aconitifolius, biological activity, phytochemicals*

1. Introduction

In Mexico exist two known species with the common name of Chaya: *Cnidoscolus-chayamansa* and *Cnidoscolus aconitifolius*, both have been used as an ornamental and medicinal plant as well as food. They belong to the family *Euphorbiaceae*, it is composed of 50 species and distributed in tropical areas, mainly in deciduous forest and xerophytic scrub [1].

C. aconitifolius is a perennial arborescent shrub that reaches a height up to 6 meters, its structure possesses a palmate lobed leaf and white flowers distributed in clusters. It has been cultivated since pre-hispanic times and used by the Mayan groups and Mesoamericans as an edible, medicinal and ornamental plant [2]. In Mexico, traditional medicine uses the *C. aconitifolius* to treat cancer, weight loss, high blood pressure, ulcers, diabetes mellitus, as well as kidney diseases[1].

Nutritional content of these plants, reveals the presence of proteins, fiber, and a low-fat content, also they have high levels of saponins, tannins, alkaloids, and flavonoids. As well as some minerals such as iron, manganese, magnesium, phosphorus, and zinc [1-3]. That's why they are of great interest for their medicinal and nutritional potential. *C. chayamansa*, for example, has been widely studied, there are reports about different biologics activities as antimutagenic, antioxidant, hypoglycemic, anti-inflammatory, antiprotozoal and antibacterial.[4-6].

However, there are not many reports of biological activity of the second variety *C. aconitifolius*, some properties are the hepatoprotective effect, modulation of lipid profile and insulin levels, anti-inflammatory and analgesic effect[7-10]. In this review, we focused in the phytochemical composition, biological activity, and nutraceutical potential of *C. aconitifolius.*

2. Phytochemical Composition and Nutritional Value

Several analyses have been carried out to evaluate the phytochemical composition of *C. aconitifolius*, these analyses have been performed in various extracts and fractions. The presence of flavonoids, saponins, alkaloids, phlorotannins, tannins, oxalates, cyanogenic glycoside, anthraquinone steroids and phenols has been reported with regularly, mainly in the ethanolic extract, in addition to the presence of cyanogenic glycosides [11]. Lwuji and collaborators in 2015, reported the presence of flavonoids such as isoquercetin, campesterol, eupafolin, hispidulin, among others [12].

The analyzes of *C. aconitifolius* revealed a high content of proteins in leaves, as well as fiber and a low content of carbohydrates [11].

C. aconitifolius has a high percentage of mineral content, as potassium and calcium 3.14 mg / g and 2.3 mg / g respectively, in addition, has been reported the presence of iron (4.7 mg / 100 g). Besides other components as ascorbic acid (142.11 mg / 100 g) and vitamins such as A (carotene) (13.10 mg / 100 g), B6 (pyridoxine) (1.34 mg / 100 g), B9 (folic acid) (1.06 mg / 100 g), B12 (cyanocobalamin) (0.13 mg / 100 g) [11, 13, 14].

3. Biological Potential

As mentioned earlier *C. aconitifolius* has bioactive components of importance for the treatment of some diseases.

Flavonoids, for example, are antioxidants that neutralize free radicals having the potential to protect against the development of heart diseases, also inducing mechanisms that can kill cancer cells and inhibit tumor invasion [13].

Phenols are antioxidants that prevent oxidative damage to biomolecules such as DNA, lipids, and proteins that play a role in chronic diseases such as cancer and cardiovascular diseases. Plant phenols can interfere with all stages of the cancer process, which can result in a reduction in cancer risk [3].

4. Antidiabetic Potential

There is enough evidence that demonstrates the effectiveness of *C. aconitifolius* in the control of blood glucose. Glucose regulation is proportional to the doses administered, showing effective doses between 100 and 200 mg/kg of body weight, in murine models [15].

Moreover, diabetic murine models with weight parameters monitoring have been normalized using the doses previously mentioned, as well as the regulation of serum lipids in the same disease model has been analyzed; besides analyses related to the hematological parameters using different extracts of *C. aconitifolius* in animals [16, 17].

5. Potential Against Liver Damage

Oyagbemi in 2013 designed a recovery diet with *C. aconitifolius*, which was administered for a few weeks to rats with malnutrition, liver and kidney damage induced with poor protein diet. The results showed a reduction in liver and kidney damage and a decrease in the malnutrition of the treated individuals, the authors suggest that *C. aconitifolius* can be an adequate option to treat energy-protein malnutrition [18] and for food supplementation in trauma patients, since their condition is common in these circumstances [19].

Furthermore, there is evidence of hepatoprotective effect in murine models, where a liver damage was induced by chronic administration of alcohol at doses of 100 and 200 mg/kg of *C. aconitifolius* [20]. Having those experiments as antecedent, the study anti-intoxicant properties of the ethanolic extract were investigated in a model with rabbits, finding that *C. aconitifolius* facilitates alcohol detoxification, but the exact mechanism has not been demonstrated [21].

6. Regulatory Activity of Lipids

The potential of *C. aconitifolius* to regulate the lipid profile has been tested on different occasions, as in the case of Adaramoye et al. who tested the hepatoprotective potential of Chaya after prolonged alcohol administration. It was found that the administration of 100 and 200 mg / kg of weight of the extract helped to reduce hyperlipidemia in a murine model [20]. It has also served not only to decrease the lipid profile but also to help reverse the appearance of oxidative and hematological markers caused by a high-fat diet in rats [22].

Moreover, a clear advantage has been found in the use of *C. aconitifolius* at 500 mg/kg (methanolic extract) since in diabetic models it helps to decrease triglycerides, total cholesterol and helps maintain HDL in its normality values [7].

In another study in normoglycemic models of rabbits, the effectiveness of the extract was tested at 400 mg/kg after the induction of hypercholesterolemia with egg yolk, lowering cholesterol and triglycerides in all extracts, this effect was concentration-dependent [23].

7. Anti-Inflammatory Activity

Reports have shown the possible anti-inflammatory effect of *C. aconitifolius* in animal models. As the specific case of Onasanwo and collaborators who proved anti-inflammatory activity using the methanolic extract of *C. aconitifolius* at a dose of 200 mg/kg of body weight. Through the measurement of edema in rat paw, obtaining encouraging results to carry out more studies for anti-inflammatory effect [24].

8. Others Activities

The effectiveness of *C. acontititfolius* has not been reported regularly. However, Ayoyinka of

collaborators in 2007 evaluated the phytochemical composition and antimicrobial activity of the ethanolic and aqueous extracts (dried and fresh leaves). Which obtained results an inhibition zone of 3.0 ± 0.1 mm against *Staphylococcus aureus*, in the ethanolic extract and of 1.5 ± 0.5 mm against *Salmonella typhi* for the same extract. However, the effectiveness of aqueous extracts of dry and fresh leaf was little or null [25].

In 2011 Andaramoye et al demonstrated the antioxidant activity of *C. aconitifolius*, they treated two groups of rats with ethanolic extract at 100 and 200 mg, for 8 weeks, obtaining antioxidants effects [20]. However, in another study in 2005 it was shown that this antioxidant activity could vary depending on the type of processing of the plant material, so the extraction of the extracts must be monitored to assure their antioxidant activity [26].

9. Conclusion

The nutraceutical potential of *Cnidoscolus aconitifolius* is considerable and presents interesting work perspectives, from its potential use as an anti-inflammatory, as well as its lipid-lowering activity, and its use has potential effects in the treatment of malnutrition. The methanolic extract has been the one that in most cases shows effectiveness this should be considerated for future experiments.

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