https://repository.uaeh.edu.mx/revistas/index.php/icap/issue/archive

Boletín de Ciencias Agropecuarias del ICAP

Publicación semestral, Vol. 9, No. 17 (2023) 20-23

ICAP

ISSN: 2448-5357

Side effects in humans due to the consumption of glycosides present in nettle (*Cnidoscolus aconitifolius*)

Efectos secundarios en humanos por el consumo de glucósidos presentes en la ortiga (*Cnidoscolus aconitifolius*)

Margarita I. Esteves-Vargas[a], Aurora Quintero-Lira[a], Thania A. Urrutia-Hernández[a], Javier Piloni-Martini[a]

Abstract:

The nettle (*Cnidoscolus aconitifolius)* is a plant that extends through all the tropical and subtropical regions, it represents 3% of the vascular flora of Mexico. The phytochemical screening has shown the presence of cyanogenic glycosides, a compound to which its toxic potential in humans is attributed, causing reactions such as loss of consciousness, respiratory arrest and, ultimately, death. Side effects associated with cyanogenic glycosides, either by contact or ingestion of nettle are usually mild in most cases, even so, the plant is treated like a pest.

Keywords:

Nettle, glycosides, side effects, toxic

Resumen:

La ortiga (*Cnidoscolus aconitifolius*) es una planta que se extiende en regiones tropicales y subtropicales, representa el 3% de la flora vascular de México. Su tamizaje fitoquímico ha mostrado la presencia de glucósidos cianogénicos, compuesto por el cual se le atribuye su potencial tóxico en humanos provocando reacciones como la pérdida del conocimiento, paro respiratorio y, en última instancia, la muerte. Los efectos secundarios asociados a los glucósidos cianogénicos, ya sea por contacto y/o la ingestión de ortiga suelen ser leves en la mayoría de los casos, aun así, la planta es tratada como una plaga.

Palabras Clave:

Ortiga, glucósidos, efectos secundarios, tóxico

1. Introducción

The nettle belongs to the Euphorbiaceae family that is made up of around 8700 species, this family is considered one of the largest in the world, it extends in tropical and subtropical regions. It is estimated that in Mexico the family represents 3% of the vascular flora [1].

It is a shrub that measures from 3 to 6 m in height with an irregular slope [2], its petiolate leaves are long and thick, measuring up to 25 cm long and up to 30 cm wide, divided into five lanceolate lobes [3], it also has long stems covered with soft trichomes alternating with hard ones in its widest parts, which when cut release milky sap. Moreover, in spring it presents small bouquets of white flowers [4].

Components

[a]Universidad Autónoma del Estado de Hidalgo. Javier Piloni Martini, https://orcid.org/0000-0002-1367-5010, javier_piloni7632@uaeh.edu.mx; Margarita I. Esteves Vergas, es262346@uaeh.edu.mx; Aurora Quintero Lira, https://orcid.org/0000-0003-4638-6028, aurora_quintero1489@uaeh.edu.mx; Thania A. Urrutia Hernández, https://orcid.org/0000-0002-2152-2807, thania_urrutia9356@uaeh.edu.mx.

*Autor de correspondencia: Email: javier_piloni7632@uaeh.edu.mx

Fecha de recepción: 27/07/2022, Fecha de aceptación: 12/11/2022, Fecha de publicación: 05/01/2023

DOI: https://doi.org/10.29057/icap.v9i17.9594

Nettle (*Cnidoscolus Aconitifolius*) presents crude protein values of 16.5%, increasing to 29.9% in the leaves [5], moisture content of 13.53%, ash 4.8%-9.2%, fat 7.9%, fiber (31.165%) and minerals such as Fe 21.5 mg/100g, Mn 4.3 mg/100 g, Ca 880 mg/100 g of leaf, Zn 7.2 mg/100 g of leaf, Cu 1.3 mg/100 g of leaf and Mg 484 mg/100 g, also presents hydrocyanic acid 34.7 mg/100 g considered an anti-nutritional element [6].

As for vitamins, it contains vitamin C 892.02 mg/100g, B complex vitamins: vitamin B1 9,425 mg/100g, vitamin B2 5.84 mg/100g, vitamin B9 9,425 mg/100 g, which are essential for growth, development and maintenance of body functions. It also contains vitamin A 5,644 mg/100g, which is essential for normal vision, gene expression, growth, and immune function by maintaining epithelial cell functions. Another important vitamin that we can find is vitamin E with approximately 88.99 mg/100g, this vitamin is a powerful antioxidant that can prevent damage caused by free radicals. In this plant we can find most of the essential amino acids, in 100g of protein there are alanine 4.60g, arginine 5.17g, glutamic acid 13.50g, methionine 1.35g, histidine 2.60g, isoleucine 4.25g, lysine 5.05g, threonine 3.70g, tyrosine 3.33 g, aspartic acid 8.50g, serine 3.36g, and valine 4.54g [7]. Phytochemical screening has shown the presence of flavonoids, phenols, anthraquinones, triterpenoids, tannins, saponins, alkaloids, phytates, steroids, and cyanogenic glycosides [8,9,10].

Cyanogenic glycosides

Nettle (*Cnidoscolus aconitifolius*) is little considered for wild flora, due to its toxic potential for both humans and animals, which is attributed to the presence of cyanogenic glycosides, which are the product of secondary metabolism in the synthesis of compounds typical of the plant and an aglycone type α-hydroxynitrile and a sugar, mainly D-glucose are also composed [11].

The cyanogenic glycoside that has been found in nettle (*Cnidoscolus aconitifolius*) is linamarin [7]. Cyanogenic glycosides can form hydrocyanic acid (HCN) when hydrolyzed, which is a toxic compound [12]. HCN is a systemic poison and its toxicity is due to inhibition of cytochrome oxidase, which prevents cellular utilisation of oxygen. Inhibition of the terminal step of electron transport in brain cells leads to unconsciousness, respiratory arrest, and ultimately death [7]. The HCN is released by the action of linamarin, which is activated when the leaves or any part of the plant are crushed or fragmented, the linamarase comes into contact with the bound cyanide, producing the release of the toxicant [13].

Effects in humans

The presence of trichomes distributed throughout its vegetable and floral parts, in addition to favouring the absorption of nutrients for the plant, when it comes into contact with the skin, it injects the toxic compound present, causing severe pain accompanied by swelling, itching and the appearance of blisters on the affected part [14].

Its handling must be carried out with caution to avoid any direct contact with the skin. Once the intact leaves are removed, they maintain toxicity for up to 30 days and the leaves that are grounded for up to 3 days [15].

When the plant is ingested in small quantities, it causes vomiting, stomach disorders and nervous disorders, that is why it is considered the most painful stinging plant in Central America [16]. In case of high ingestion, neurotoxic effects have been observed, including convulsions and coma, and even death. In people who have experienced HCN poisoning, sequelae have been seen that include symptoms such as headache, apathy, muscle numbness including arms and legs, partial loss of vision, cardiac and central nervous system disorders [17].

Stinging nettle (*Cnidoscolus aconitifolius*) has 2.51 mg of HCN equivalents/100 g of fresh weight and it is estimated that the recommended safe amount for consumption of foods containing cyanide is 10 mg of HCN equivalents/100 g of weight fresh [7], in the same way it is recommended to avoid the consumption of the raw plant since this compound is eliminated with heat and is not retained in the cooking water [12].

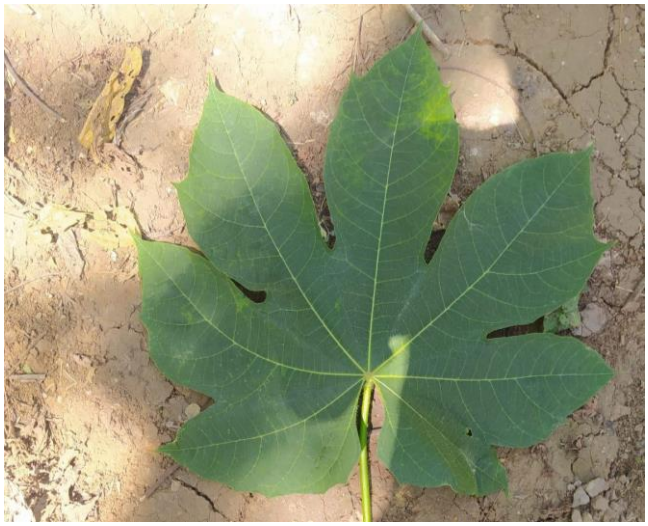

Figure 1. Nettle leaf (Cnidoscolus aconitifolius)

Applications

Traditionally known as chaya, this plant is frequently used as a living fence, in thickets, rocky streams and coastal dunes [18], These fences take advantage of the physical characteristics present in the bush, especially its long stems. With this plant, an ointment is also made, which is used as an adjuvant, in popular medicine, in the treatment of inflammatory diseases such as rheumatoid arthritis or in case of blows and/or sprains [15].

Some species of Cnidoscolus are of interest for their nutritional potential, their leaves and flowers are usually incorporated into dishes or even consumed in salads [19]. However, its consumption is mainly intended as forage food [15], this is mainly attributed to the toxic potential that has been attributed to the plant. In the Huasteca region, fresh cheese is made in a traditional way in which nettle is used as a coagulating agent for milk, according to the inhabitants from the Sierra of Hidalgo, the plant was used in the production of cheese when commercial rennets were not yet known in In this area, however, this tradition still continues and it has been observed that using this technique, cheeses with a softer texture and higher yield are obtained compared to those obtained using other coagulants [3].

Conclusions

Side effects associated with cyanogenic glycosides, either by contact or ingestion of nettle (*Cnidoscolus aconitifolius*) are usually mild in most cases, even so, the toxic potential of the plant makes it seem as a pest. However, it has been observed that it has a great nutritional potential, which has been little studied, its wide content of secondary metabolites could make it a product of interest for the food and/or pharmaceutical industry. Technological advances can allow the extraction of compounds of interest in the plant without exposure to toxic compounds, which can lead to the creation of products, such as nutraceuticals and pharmaceuticals, thus taking advantage of a plant that is currently not used. The incorporation of nettle as a vegetable food, either in salads or in a more specialised way in cheese making, acting as a coagulant, could positively favour an increase in its consumption, thus taking advantage of its nutritional characteristics.

References

[1] Escobar Varela, K.. *Anatomía foliar y del pecíolo de especies del género Cnidoscolus Pohl. (Euphorbiaceae) en el estado de Puebla* [Tesis de Licenciatura, 4643]. Repositorio institucional BUAP. 2021.

https://repositorioinstitucional.buap.mx/handle/20.500.12371/15435

[2] Drumond, M., Salviano, L., Cavalcanti, N. y Pereira, L. Producción, distribución de biomasa y composición bromatológica de la parte aérea de la faveleira. Rev. Brás. Ciencias Agrarias. 2007; 2, 308-310.

[3] Lagunes-Olivares, F., Avila-Badillo, F., Guerrero-Castillo, J. y Estrada-García, I. Propiedades Coagulantes de la Ortiga (Cnidoscolus Multilobus) en productos lácteos. Revista de Ciencias Naturales y Agropecuarias. 2017; 4, 1-12.

[4] Awoyinka, O., Balogun, I. y Ogunnowo, A. Análisis fitoquímico y bioactividad in vitro de Cnidoscolus aconitifolius (Euphorbiaceae). J.Med. Plantas Res. 2007; 1, 63-65.

[5] García, D., Medina, M., Domínguez, C., Baldizán, A., Humbría J. y Cova, L.. Evaluación química de especies no leguminosas con potencial forrajero en el estado de Trujillo, Venezuela. Zootecnia tropical. 2006; 24, 401- 415.

[6] Orozco Andrade, A. Caracterización farmacobotánica de tres poblaciones del género Cnidoscolus (chaya) con fines de cultivo y comercialización. 2013. [Tesis de Licenciatura]. http://biblioteca.usac.edu.gt/tesis/06/06_3528.pdf

[7] Panghal, A., Shaji, A.O., Sajitharan, D., Nain K., Garg, M.K. y Chhikara, C. Cnidoscolus aconitifolius: Nutritional, phytochemical composition and health benefits- A review. Bioactive Compounds in Health and Disease. 2021; 4(11): 260-286.

[8] Akachukwu, D., Okafor, P. y Ibegbulem, C. Contenido fitoquímico de las hojas de Cnidoscolus aconitifolius y efecto toxicológico de su extracto acuoso de hojas en ratas wistar. J. Investig. Bioquímica. 2014; 3, 26-31.

[9] Otitolaiye, C. y Asokan, C. Análisis GC-MS de extractos acuosos de hojas de Cnidoscolus aconitifolius. En t. J. Ciencia. Res. 2016; 6, 8376-8381.

[10]Obichi, E., Monago, C. y Belonwu, D. Efecto del extracto acuoso de hojas de Cnidoscolus aconitifolius (familia Euphorbiaceae) sobre algunas enzimas antioxidantes y parámetros hematológicos de una dieta alta en grasas y ratas albinas diabéticas wistar inducidas por

estreptozotocina. Aplicación J. Ciencia Reinar. Administrar, 2015; 19, 201-209.

[11] Arrázola, G., Grané, N., Martin, M. L. & Dicenta, F. Determinación de los compuestos cianogénicos amigdalina y prunasina en semillas de almendras (Prunus dulcis L.) mediante cromatografía líquida de alta resolución. Rev Colomb Quim. 2013; 42(3): 23-30.

[12] Fernando-Casas, F.J. Cnidoscolus notulæ: C. aconitifolius (Mill) I.M. Johnston subsp. aconitifolius. Madrid: Adumbrationes Ad Summe Editionem. 2007; 18-32.

[13] Alvarado, L. y Núñez, M. Proyecto de factibilidad para la elaboración y comercialización de té de chaya para la ciudad de Guayaquil. (Tesis de Ingeniero Comercial Mención Comercio Exterior). Universidad de Politécnica Salesiana. Facultad de Ciencias Administrativas y Económicas. Ecuador. (2012.

[14]Peixoto, T., Castro, V., Saraiva, A., Almeida, D. y Tavares, E. Contenido fenólico y capacidad antioxidante de cuatro especies de Cnidoscolus (Euphorbiaceae) utilizadas como etno farmacológicas en Caatinga, Brasil. Afr. J. Pharm. Farmacol. 2011; 5, 61-68.

[15] Moura, L., Silva Neto J., Lopes, T., Benjamin, S., Brito, F., Magalhães, F., Florean, E., de Sousa, D. y Guedes, M. Ethnobotanic, phytochemical uses and ethnopharmacological profile of genus Cnidoscolus spp. (Euphorbiaceae): A comprehensive overview. Biomedicine & Pharmacotherapy. 2019; 109, 1670-1679.

[16] Flores, J., Canto-Avilés, G. y Flores -Serrano, A.Plantas de la flora yucatanense que provoca alguna toxicidad en el humano. Revista Biomédica. 2001; 12, 86- 96.

[17] Ramírez, A.V. Toxicidad del cianuro: Investigación bibliográfica de sus efectos en animales y en el hombre. *Anales de la Facultad de Medicina*, 2010; *71*(1), 54-61.

[18] Molina Cruz, A. La chaya, una hoja muy nutritiva que muy pocos aprovechan. Revista Agricultura. 1998; 2, 47- 52.

[19] Jiménez-Arellanes, M.A., García-Martínez, I. y Rojas-Tomé, R. Potencial de especies medicinales del género Cnidoscolus (Euphorbiaceae). Rev. México. Granja Ciencias. 2014; 45, 1-6.

[20] Kidney Disease Improved Global Outcomes (KDIGO). KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Off. J. Int. Soc. Nephrol. 2013; 3(1): 1–163.