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Potential Therapeutic use of *Anredera cordifolia* in Chronic Non-Communicable Diseases: A Scoping Review*

* Article derived from the master's thesis in nursing entitled "Propriedades terapêuticas da *Anredera cordifolia* nas doenças crônicas não transmissíveis: Revisão de escopo" [Therapeutic properties of *Anredera cordifolia* in non transmissible chronic diseases: A scope review], defended at Universidade Federal de Santa Maria, Brazil. Available at: <http://repositorio.ufsm.br/handle/1/28051>

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Theme: Promoting health, well-being, and quality of life

Contributions to the subject: The lack of a scientific basis regarding medicinal plants constitutes a significant barrier to safe healthcare. Therefore, it is imperative for health professionals to gain access to scientific knowledge concerning these plants and to be encouraged to conduct new research into their properties, effects, and safe usage. Medicinal plants are considered a potential therapeutic resource for inclusion in healthcare practices, and research on this topic can support their safe utilization. In this context, this study aims to contribute to further research into the properties of *Anred-
era cordifolia*.

Abstract

Introduction: *Anredera cordifolia* is a plant recognized as a non-conventional food plant. In folk medicine, it shows promise, being used in the treatment of skin diseases, diabetes, and hypertension. **Objectives:** to map the properties of the *Anredera cordifolia* plant in the therapeutic process of non-communicable chronic diseases. **Materials and methods:** The study was based on the Joanna Briggs Institute guidelines. The search was conducted in the Medline/PubMed, Scopus, Web of Science, and CINAHL databases in 2022 and updated in 2023. Selection criteria were primary studies, in any language, country of origin, and publication year, conducted with humans, animals, and/or cellular models, in a laboratory context, focusing on the properties of the plant. Selection was performed independently by two reviewers using the Rayyan software. Data were analyzed using content analysis. **Results:** In the 27 included articles, the results demonstrated that the plant has positive properties in the treatment of diabetes mellitus, arterial hypertension, chronic kidney disease, obesity, and cataracts, as well as being beneficial in controlling cholesterol, triglyceride, and uric acid levels. The main therapeutic properties identified were hypoglycemic effect and reduction in serum levels of triglycerides and total cholesterol. The plant also showed beneficial effects on the healing of diabetic wounds, reduction in heart rate, and obesity. **Conclusions:** Chronic diseases with evidence on the use of the plant include hypertension, diabetes, kidney disease, obesity, and cataracts. Additionally, the plant has beneficial properties regarding clinical markers such as triglycerides, cholesterol, and blood glucose.

Keywords (Source: DeCS)

Medicinal plants; phytotherapy; nursing; complementary therapies; noncommunicable diseases.

4 Potencial uso terapéutico de la *Anredera cordifolia* en enfermedades crónicas no transmisibles: revisión de alcance*

* Artículo derivado de la tesis de maestría profesional en enfermería "Propriedades terapêuticas da *Anredera cordifolia* nas doenças crônicas não transmissíveis" ("Propiedades terapéuticas de la *Anredera cordifolia* en las enfermedades crónicas no transmisibles"), presentada en la Universidade Federal de Santa Maria, Brasil. Disponible en: <http://repositorio.ufsm.br/handle/1/28051>

Resumen

Introducción: *Anredera cordifolia* es una planta reconocida como planta alimenticia no convencional. En la medicina popular, se muestra prometedora, siendo utilizada en el tratamiento de enfermedades de la piel, diabetes e hipertensión. **Objetivos:** mapear las propiedades de la planta *Anredera cordifolia* en el proceso terapéutico de las enfermedades crónicas no transmisibles. **Materiales y método:** el estudio se basó en las orientaciones del Instituto Joanna Briggs. La búsqueda se realizó en las fuentes de datos Medline/PubMed, Scopus, Web of Science y CINAHL, en 2022 y se actualizó en 2023. Los criterios de selección fueron estudios primarios, en cualquier idioma, país de origen y año de publicación, desarrollados con seres humanos, animales y/o modelos celulares, en contexto laboratorio y con enfoque en las propiedades de la planta. La selección se realizó de manera doble-independiente, utilizando el software Rayyan. Se analizaron los datos mediante análisis de contenido. **Resultados:** en los 27 artículos incluidos, los resultados demostraron que la planta tiene propiedades positivas en el tratamiento de la diabetes mellitus, la hipertensión arterial, la enfermedad renal crónica, la obesidad y la catarata, además de ser beneficiosa en el control de los niveles de colesterol, triglicéridos y ácido úrico. Las principales propiedades terapéuticas identificadas fueron efecto hipoglucémico y disminución de los niveles séricos de triglicéridos y colesterol total. La planta también mostró efectos beneficiosos en la cicatrización de heridas diabéticas, reducción de la frecuencia cardíaca y obesidad. **Conclusiones:** las enfermedades crónicas que tienen evidencia sobre el uso de la planta son hipertensión, diabetes, enfermedad renal, obesidad y cataratas. Además, la planta tiene propiedades beneficiosas en cuanto a marcadores clínicos, como triglicéridos, colesterol y glucemia.

Palabras clave (Fuente: DeCS)

Plantas medicinales; fitoterapia; enfermería; terapias alternativas; enfermedades no transmisibles.

Potencial uso terapêutico da *Anredera cordifolia* nas doenças crônicas não transmissíveis: revisão de escopo*

* Artigo derivado da dissertação de mestrado acadêmico em enfermagem intitulada "Propriedades terapêuticas da *Anredera cordifolia* nas doenças crônicas não transmissíveis", defendida na Universidade Federal de Santa Maria, Brasil. Disponível em: <http://repositorio.ufsm.br/handle/1/28051>

Resumo

Introdução: a *Anredera cordifolia* é uma planta reconhecida como planta alimentícia não convencional. Na medicina popular, mostra-se promissora, sendo utilizada no tratamento de doenças de pele, de diabetes e de hipertensão. **Objetivos:** mapear as propriedades da planta *Anredera cordifolia* no processo terapêutico das doenças crônicas não transmissíveis. **Materiais e método:** o estudo teve como base as orientações do Joanna Briggs Institute. A busca foi realizada nas fontes de dados Medline/PubMed, Scopus, Web of Science e CINAHL, em 2022 e atualizada em 2023. Os critérios de seleção foram estudos primários, de qualquer idioma, país de origem e ano de publicação, desenvolvido com seres humanos, animais e/ou modelos celulares, em contexto laboratorial e com enfoque nas propriedades da planta. A seleção ocorreu de modo duplo-independente, utilizando o software Rayyan. Os dados foram analisados por meio de análise de conteúdo. **Resultados:** nos 27 artigos incluídos, os resultados demonstraram que a planta tem propriedades positivas no tratamento da diabetes *mellitus*, da hipertensão arterial, da doença renal crônica, da obesidade e da catarata, além de ser benéfica no controle dos níveis de colesterol, de triglicerídeos e de ácido úrico. As principais propriedades terapêuticas identificadas foram efeito hipoglicêmico e diminuição dos níveis séricos de triglicerídeos e colesterol total. A planta também demonstrou efeitos benéficos na cicatrização de feridas diabéticas, na redução da frequência cardíaca e na obesidade. **Conclusões:** as doenças crônicas que possuem evidência sobre o uso da planta são hipertensão, diabetes, doença renal, obesidade e catarata. Além disso, a planta tem propriedades benéficas quanto a marcadores clínicos, como triglicerídeos, colesterol e glicemia.

Palavras-chave (Fonte DeCS)

Plantas medicinais; fitoterapia; enfermagem; terapias alternativas; doenças não transmissíveis.

Introduction

In Brazil's Unified Health System, integrative and complementary health practices (PICS) are crucial in achieving one of its foundational principles: Integrality. These practices represent treatments that draw on traditional knowledge and utilize therapeutic resources aimed at preventing a range of diseases, including hypertension and diabetes mellitus (DM). Thus, applying these practices can promote health beyond the physical realm, considering they encompass social, cultural, and emotional concerns within a multidisciplinary approach (1, 2).

Currently, approximately 29 PICS are available at no cost within Brazil's public healthcare system, with the utilization of medicinal plants being particularly notable. These plants, whether cultivated or wild, can be administered through various methods, such as orally or via infusion, and possess therapeutic effects. However, similar to any medication, they must be employed judiciously due to potential risks of adverse effects, contraindications, or interactions (2).

Brazil boasts the highest level of biodiversity worldwide, accounting for 15-20 % of all known species. Plant life, a key component of this biodiversity, is the foundation for home remedies in traditional medicine. Furthermore, Brazil's rich cultural and ethnic diversity has fostered a wealth of knowledge about managing and utilizing medicinal plants, which has been endowed through successive generations (3, 4).

In 2019, chronic non-communicable diseases (NCDs) accounted for 75 % of morbidity and mortality among the Brazilian population (5); NCDs are chronic conditions generally attributable to multiple factors, characterized by a gradual onset and prolonged or indefinite duration (6). They arise from lifestyle-related factors such as unhealthy diets, physical inactivity, smoking, and alcohol consumption (7).

When used responsibly, medicinal plants can play a pivotal role as a complementary and integrative approach to treating NCDs. Various species offer therapeutic benefits and functional properties, in addition to being accessible and cost-effective (8). Among the native plants of Brazil, many are acknowledged for their therapeutic and nutritional value by both traditional and scientific medicine (9). For example, *Anredera cordifolia* (Ten.) Steenis is a species native to Brazil found in various regions but is not endemic (10). *A. cordifolia* is primarily recognized for its nutritional value; it is a plant with high nutrient content and biomass yield, classified as an unconventional food plant (11).

Studies on *A. cordifolia* have highlighted its varied popular names in Brazil, including *bertalha-coração*, *madeira vine*, and *folha gorda* (12-14). In traditional medicine, the plant is valued for its therapeutic properties in treating skin diseases, DM, and hypertension (13). There is also documentation on its anti-inflammatory, antibacterial, anti-ulcer, and healing properties (15-17). However, despite experi-

mental studies confirming those effects, the understanding of its properties remains in the early stages (15-17).

Hence, examining the existing evidence concerning its use and potentially identifying gaps in our knowledge is essential. Given the context described and the increasing interest in therapeutic practices involving medicinal plants, particularly the therapeutic potential of *A. cordifolia*, the significance of this study is evident. This study sought to survey both national and international scientific literature on the properties of *A. cordifolia* within the therapeutic management of NCDs.

Materials and Method

This study comprises a scoping review, a type of systematic literature review that adopts the PCC research approach, where P stands for population, C for concept, and the second C for context. This type of review is utilized to map the key concepts underpinning a research field and elucidate the definitions and conceptual limits of a topic (i.e., provide an overview or evidence map) (18).

The purposes of this method include serving as a precursor to a systematic review, identifying the types of evidence available in a specific field, analyzing knowledge gaps, elucidating the main concepts/definitions in the literature, examining research methodologies within a given topic or field, and identifying the principal characteristics or factors related to a concept (19).

A scoping review initiates with the development of a protocol, which acts as a blueprint and is crucial to minimize bias occurrence (18). For this study, a protocol was formulated and registered on the Open Science Framework platform. The review question posed was as follows: What are the properties of *A. cordifolia* in the therapeutic process of NCDs in laboratory studies involving humans, animals, and cell models?

The inclusion criteria were: a) studies involving human beings, animals, or cell models; b) studies investigating the therapeutic properties of the plant in NCDs; c) experiments executed in a laboratory setting; d) primary studies; e) studies regardless of the language, country of origin, or timeframe. The exclusion criteria consisted of incomplete or unavailable articles; duplicates were also excluded.

The search was conducted in July and August 2022 and updated in August 2023, using the Medline/PubMed, Scopus, and Web of Science databases, as well as the reference lists of the included studies after an exhaustive reading. The controlled descriptor searches were conducted in the Descriptors in Health Sciences (DeCS) and Medical Subject Headings (MeSH) databases, while non-controlled descriptors were identified by reviewing the titles and abstracts of previously published studies. The search strategies applied to each data source are described in Table 1.

Database	Search strings
Medline via PubMed	((<i>"anredera cordifolia"</i> [Title/Abstract]) OR (<i>"binahong"</i> [Title/Abstract])) OR (<i>"madeira vine"</i> [Title/Abstract])
Scopus	<i>"anredera cordifolia"</i> OR <i>"madeira vine"</i> OR binahong
Web of Science	ALL = (<i>anredera cordifolia</i> OR <i>madeira vine</i> OR binahong)

Source: Elaborated by the authors.

The selection of evidence was conducted in a double-independent manner, with a third reviewer available in case of any disagreements. The studies retrieved from the data sources were transferred to the Rayyan software; their titles and abstracts were reviewed, followed by a full reading of the selected articles and a critical assessment of the reference lists.

For data extraction, a script was devised containing relevant information to map the data, including author/year, country of study/ language, part of the plant and type of extract used, experimental model utilized, NCD or clinical marker researched, and the therapeutic properties of the plant in NCDs.

The data underwent coding and content analysis, as proposed in the literature (20). The results will be presented below, accompanied by descriptive summaries and in-depth discussions based on the existing literature.

Results

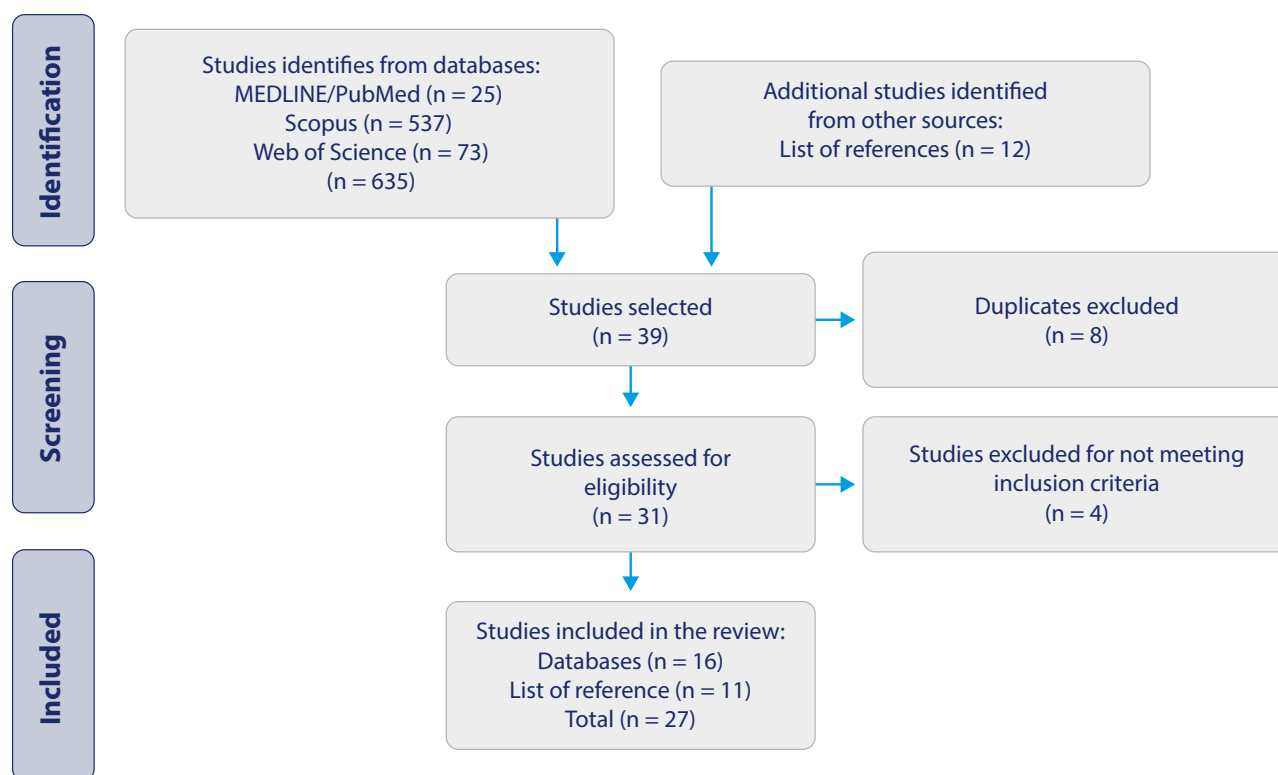
The search yielded 635 studies, of which 31 were selected for comprehensive review. Among them, eight were excluded due to duplication, and, upon detailed review, four more were excluded for failing to meet the selection criteria. This resulted in a total of 19 articles. Further evaluation of the reference lists of these studies led to the inclusion of an additional 11 studies, composing a final corpus of 27 articles (Figure 1).

All the studies were conducted in Asia, written predominantly in English, and conducted by the same researchers (Table 2).

Table 2 also indicates that 26 studies utilized ethanolic leaf extract, and one used leaf powder (24), with only five studies specifying the concentration of the extract (22, 26, 33, 37, 38). The most common dose used in the experiments was 100 mg/kg, as noted in 11 studies (25, 27, 30-32, 35-37, 39, 43, 45).

Furthermore, DM and HT were the most frequently studied NCDs, with 9 studies on DM (21, 33, 34, 36, 38, 42, 45-47), and 6 studies on HT (23, 26, 30, 37, 40, 44). Three studies examined clinical markers of chronic kidney disease (CKD) (25, 27, 29), 6 investigated serum cholesterol and triglyceride levels (24, 28, 31, 32, 39, 43), 3 focused on obesity (35, 38, 39), 1 on cataracts (22), and another one on serum uric acid levels (41).

Figure 1. Study's design Flowchart Based on the PRISMA Extension for Scoping Reviews (PRISMA-ScR), Santa Maria, Rio Grande do Sul, Brazil, 2023



Source: Elaborated by the authors.

Table 2. Characterization of the Studies, Santa Maria, Rio Grande do Sul, Brazil, 2023

Author and publication year	Country and language	Plant part, extract type, concentration, and/or dose used	NCD or clinical marker	Population model
Dwitiyanti et al. (2021) (21)	Indonesia English	Leaves/ethanolic extract (50 mg/kg)	DM	Rats (<i>in vivo</i>)
Feriyani et al. (2021) (22)	Indonesia English	Leaves/ethanolic extract (100, 200 µg; concentration)	Cataract	Goat lenses (<i>in vitro</i>)
Sukandar et al. (2021) (23)	Japan English	Leaves/ethanolic extract (50 mg/kg)	HT	Rats (<i>in vivo</i>)
Hashimoto et al. (2022) (24)	Indonesia English	Leaves/leaf powder (1.12 g; powder)	Triglycerides, glucose	Humans (<i>in vivo</i>)
Sukandar et al. 2011 (25)	Indonesia English	Leaves/ethanolic extract (50, 100, 150 mg/kg)	CKD	Rats (<i>in vivo</i>)
Sukandar et al. (2019) (26)	Indonesia English	Leaves/ethanolic extract (1 and 2 % concentrations; 50 mg/kg)	HT	Rats (<i>in vivo</i>)
Sukandar et al. (2013) (27)	Indonesia English	Leaves/ethanolic extract (100 mg/kg)	CKD	Rats (<i>in vivo</i>)
Dwitiyanti and Rorenza (2021) (28)	Indonesia English	Leaves/ethanolic extract (12.5, 25.50 mg/kg)	Cholesterol triglycerides	Rats (<i>in vivo</i>)
Bahtiar et al. (2021) (29)	Indonesia English	Leaves/ethanolic extract (75, 150, 300 mg/kg)	CKD	Rats (<i>in vivo</i>)
Garmana et al. (2016) (30)	Indonesia English	Leaves/ethanolic extract (100 mg/kg)	HT	Rats (<i>in vivo</i>)

Author and publication year	Country and language	Plant part, extract type, concentration, and/or dose used	NCD or clinical marker	Population model
Lestari et al. (2016) (31)	Indonesia English	Leaves/ethanolic extract (50, 100, 200 mg/kg)	Cholesterol	Rats (<i>in vivo</i>)
Sukandar et al. (2016) (32)	Indonesia English	Leaves/ethanolic extract (100 mg/kg)	Cholesterol triglycerides	Rats (<i>in vivo</i>)
Sutrisno et al. (2018) (33)	Indonesia English	Leave/ethanolic extract (2 %; concentration)	DM	Rabbits (<i>in vivo</i>)
Wahjuni et al. (2019) (34)	Indonesia English	Leaves/ethanolic extract (20 mg/kg)	DM	Rats (<i>in vivo</i>)
Sukandar et al. (2016) (35)	Indonesia English	Leaves/ethanolic extract (100 mg/kg)	Obesity	Rats (<i>in vivo</i>)
Djamil et al. (2017) (36)	Indonesia English	Leaves/ethanolic extract (10, 50, 100 mg/kg)	DM	Mice (<i>in vivo</i>)
Garmana et al. (2018) (37)	Indonesia English	Leaves/ethanolic extract (12.86 % concentration; 50, 100, 200 mg/kg)	HT	Rats (<i>in vivo</i>)
Kintoko et al. (2016) (38)	Indonesia English	Leaves/ethanolic extract (10 and 30 % concentration; 150 mg/kg)	DM Obesity	Rats (<i>in vivo</i>)
Lestari et al. (2015) (39)	Indonesia English	Leaves/ethanolic extract (50, 100, 200 mg/kg)	Cholesterol triglycerides, obesity	Rats (<i>in vivo</i>)
Sukandar et al. (2016) (40)	Indonesia English	Leaves/ethanolic extract (0.9 mg/mL)	HT	Isolated rabbit aorta (<i>in vitro</i>); Frogs (<i>in vivo</i>)
Widyarini et al. (2015) (41)	Indonesia English	Leaves/ethanolic extract (250 mg/kg)	Uric acid	Rats (<i>in vivo</i>)
Astuti et al. (2012) (42)	Indonesia English	Leaves and tubers (ethanolic extract)	DM	Rats (<i>in vivo</i>)
Wahjuni (2014) (43)	Indonesia English	Leaves/ethanolic extract (100 mg/kg)	Cholesterol	Rats (<i>in vivo</i>)
Sukandar et al. (2016) (44)	Indonesia English	Oleanolic acid and apigenin (extracted from the leaf extract); ethanolic extract/oleanolic acid (0.5 µg/mL); apigenin (0.05 µg/mL)	HT	Isolated rabbit aorta (<i>in vitro</i>); Frogs (<i>in vivo</i>)
Sukandar et al. (2011) (45)	Indonesia English	Leaves/ethanolic extract (50, 100, 200 mg/kg)	DM	Rats (<i>in vivo</i>)
Kusriani et al. (2023) (46)	Indonesia English	Leaves/ethanolic extract (15 g/mL)	DM	Rats (<i>in vivo</i>)
Sulfianti et al. (2023) (47)	Indonesia English	Leaves/ethanolic extract (250 mg/kg)	DM	Rats (<i>in vivo</i>)

DM: Diabetes mellitus; HT: hypertension; CKD: chronic kidney disease. Source: research data.
Source: Elaborated by the authors.

As per the selection criteria for this review, all of the studies included had an experimental design with quantitative/statistical analysis: 1 with an *in vitro* population (22), 22 *in vivo* (21, 23-39, 41-43, 45-47), and 2 studies that used both *in vitro* and *in vivo* models (40, 44). Of the *in vitro* studies, 1 was performed on goat lenses (22) and 2 on rabbit aortic rings (40, 44). The *in vivo* research comprised 21 studies conducted on rats (21, 23, 25-32, 34, 35, 37-39, 41-43, 45-47), 2 on frogs (40, 44), 1 on rabbits (33), 1 on mice (36), and 1 on humans (24). Regarding the plant's therapeutic properties, the results of the studies included in this review are detailed in Table 3.

Table 3. Therapeutic Properties of the Plant *A. cordifolia*, Santa Maria, Rio Grande do Sul, Brazil, 2023

NCD/clinical marker	Therapeutic properties
DM	Hypoglycemic effect/reduced blood glucose levels (21, 24, 34, 36, 42, 45-47)
	Increased insulin secretion (42)
	Diabetic wound healing (33, 38)
	Increased fibroblast cell proliferation (33)
	Improved glucose tolerance (21)
	Increased water intake (38)
	Reduced fatty acids (21)
	Increased essential amino acid concentrations (21)
	Repairing effect on pancreatic beta cells (45, 47)
	Reduced liver weight (21)
HT	Decreased heart rate (37, 40)
	Vasodilator effect (40, 44)
	Reduced systolic blood pressure (23, 30)
	Reduced diastolic blood pressure (23, 30)
	Reduced blood pressure (26, 44)
	Increased nitric oxide levels (30)
	Diuretic properties (37)
Lipid profile (cholesterol and triglycerides)	Reduced serum triglyceride levels (24, 28, 31, 32, 39)
	Reduced LDL (31, 32, 39)
	Increased HDL (31, 39)
	Reduced total cholesterol (28, 31, 32, 39, 43)
CKD	Reduced serum creatinine level (25, 27, 29)
	Reduced serum urea concentration (25, 27)
	Improved kidney structure (27)
	Increased antioxidant enzyme levels (catalase and superoxide dismutase) (27, 29)
	Reduced hydronephrosis (29)
Obesity	Inhibition of body weight gain/fat layer reduction (35, 38, 39)
Uric acid	Anti-hyperuricemic effect, xanthine oxidase inhibitory activity (41)
Cataract	Lowest degree of cataract (22)
	Reduced malondialdehyde (22)

DM: Diabetes mellitus; HT: hypertension; CKD: chronic kidney disease; LDL: low-intensity lipoprotein; HDL: high-density lipoprotein.

Source: Elaborated by the authors.

Notably, the properties with the most scientific evidence pertain to a hypoglycemic effect or reduction in blood glucose levels (21, 24, 34, 36, 42, 45-47). These are closely followed by those demonstrating reduced triglyceride levels (24, 28, 31, 32, 39) and decreased total cholesterol levels (28, 31, 32, 39, 43). Furthermore, the plant has shown beneficial effects on the healing of diabetic wounds (33, 38), in lowering systolic, diastolic blood pressure, and overall blood pressure (23, 26, 30, 44), in addressing obesity (35, 38, 39), and in treating CKD. This treatment for CKD is evidenced by the reduction of creatinine levels (25, 27, 29) and serum urea concentrations (25, 27), along with an increase in antioxidant enzyme levels (27, 29).

Discussion

Commonly, the first treatment option for chronic conditions includes drug therapy along with encouraging patients to change their lifestyles. An alternative, however, which remains underutilized, is the use of herbal medicine as a complement to conventional medication (48). In Brazil, policies have been implemented to encourage the therapeutic use and production of herbal medicine under the supervision of the National Health Surveillance Agency (49).

Diabetes mellitus is one of the most prevalent NCDs in the world. In 2021, 537 million individuals were diagnosed with DM, with Brazil accounting for 14.3 million of these cases (50). It is characterized by persistent hyperglycemia (51), and various studies have demonstrated the hypoglycemic effect of various treatments (21, 24, 34, 36, 42, 45-47). Hyperglycemia arises due to a deficiency in insulin production, action, or both (51). Specifically, the oral ingestion of the ethanolic extract of *A. cordifolia* has been documented to enhance insulin secretion (42). In the context of DM, pancreatic beta cells may be deficient, which are critical for insulin secretion and glucose tolerance (51, 52). It has been shown that oral treatment with this plant extract can repair these cells and improve glucose tolerance (21, 45, 47).

Moreover, an increase in the concentration of essential amino acids has been observed regarding DM (21). These amino acid chains play a pivotal role in protein synthesis within living organisms and are essential for muscle tissue strength, improved intestinal function, and blood sugar level regulation, among other functions (53). They are crucial supplements for individuals with DM, as they can lower blood glucose levels, enhance insulin resistance, and alleviate oxidative stress (54). Furthermore, they can reduce the likelihood of complications associated with DM, effectively diminishing the condition's damage (55).

As for DM complications, the most prevalent and significant are microvascular alterations, particularly diabetic neuropathy. Diabetic peripheral neuropathy, the most common form, results from chronic hyperglycemia and cardiovascular risk factors, manifesting as a symmetrical, diffuse, distal, and progressive lesion of both autonomic and sensory-motor fibers. Affected individuals experience

pain in the impacted area, negatively affecting their quality of life, functionality, and mood. It can lead to additional comorbidities such as anxiety, depression, insomnia, loss of functionality, and, notably, the diabetic foot (52).

With the global rise in DM prevalence, incidents of foot complications (e.g., diabetic foot) and infection and amputation rates have increased, constituting the most debilitating complications and leading to significant loss of functionality (52, 56). Two studies featured in this scoping review demonstrated the positive effects of *A. cordifolia* on healing diabetic wounds, with one utilizing an ointment combining the ethanolic extracts of the *A. cordifolia* and *Centella asiatica* plants at a 2 % concentration and the other employing a gel of the *A. cordifolia* leaf extract at concentrations of 10 and 30 % (33, 38). Its application has also been associated with an increase in fibroblast cell proliferation (33), which is critical for the healing process as these cells form a layer differing in function and structure from the original tissue, thereby generating the scar and contributing to regeneration.

One study reported that ingesting the ethanolic extract of the plant led to a reduction in liver weight (21). The liver is crucial for carbohydrate metabolism, and the regulation of glucose homeostasis, and excessive fat deposition constitutes non-alcoholic fatty liver, a chronic liver disease linked with obesity, insulin resistance, and type 2 DM, affecting up to 30 % of the general population and significantly predisposing individuals to type 2 DM (58).

Additionally, the oral administration of *A. cordifolia* extract has been shown to increase water intake and reduce fatty acid levels (21, 38). Fatty acids, while essential for the normal functionality of beta cells, can lead to fat accumulation in muscles, liver, and pancreas when in excess (45). Regarding water intake, hydration is critical in preventing and controlling DM, and low water consumption is associated with an increased risk of type 2 DM and cardiovascular, liver, and kidney problems (59).

In terms of HT, the studies present promising outcomes. HT is characterized by a persistent rise in blood pressure, confirmed using the correct technique at least two separate times in the absence of antihypertensive medication. Controlling blood pressure to normal levels is vital for diminishing the risk of both micro and macrovascular complications (60). In this context, the ethanolic extract from the leaves of *A. cordifolia* has proven effective in treating hypertension by reducing both systolic, diastolic blood (23, 30) and total blood pressure (26, 44).

Some factors directly influence blood pressure such as heart rate, which, when high, becomes a risk factor for the occurrence of adverse events and mortality in users with hypertension (61). Studies have shown that the plant's leaf extract reduces heart rate (37, 40), suggesting that research should be carried out on human beings, as the plant could be used to benefit people with hypertension.

Moreover, in experiments where the vasodilator effect was examined, the results were affirmatively in favor of using the extract (40, 44). The mechanisms of vasodilation and the application of drugs or phytomedicine that facilitate it are critically important in individuals with HT, as this process increases blood flow to the tissues and decreases blood pressure and central venous pressure, ultimately reducing cardiac workload (62).

Furthermore, the plant has demonstrated an ability to elevate nitric oxide levels and exhibited diuretic properties (30, 37). Nitric oxide plays a significant role in vasodilation, which leads to lower blood pressure and provides positive cardiac, renal, and vascular effects (62). Conversely, diuretics work to reduce intravascular volume through increased renal excretion of water and sodium. In cases of hypertension, the decline in intravascular volume results in decreased cardiac output and, consequently, a lowering of blood pressure (63).

Continuing with NCDs, CKD is characterized by a long-term and gradual deterioration of kidney function, with the most common causes being diabetic nephropathy (a complication of DM) and hypertensive nephrosclerosis (a complication of HT) (64). The diagnosis is based on various tests, including serum creatinine and urea levels. Creatinine is one of the biomarkers for CKD, whereas urea is extensively utilized in clinical settings to assess kidney function (65). Research demonstrating the effects of *A. cordifolia* on rats with CKD has shown its efficacy in reducing serum creatinine levels and serum urea concentrations (25, 27, 29). In addition, in the context of CKD, the use of the extract has led to improvements in kidney structure (27), increased antioxidant enzymes catalase and superoxide dismutase levels (27, 29), and reduced hydronephrosis (29). Antioxidant enzymes play a crucial role in the kidney's defensive mechanisms and in mitigating oxidative stress (66), while hydronephrosis is a condition characterized by kidney enlargement due to the obstruction of urine flow into the bladder, caused by a blockage in the ureter (29).

Another NCD for which evidence has been found is obesity. The application of the plant's ethanolic extract resulted in the inhibition of body weight increase and a diminution of the fat layer (35, 38, 39). Obesity is a NCD of multifactorial origin, implying that excess weight is associated with the population's lifestyle, shaped by historical, biological, ecological, social, economic, cultural, and political factors (67). It is also a risk factor for other NCDs, such as HT and DM (68).

Turning to clinical markers influenced positively by *A. cordifolia*, the lipid profile (total cholesterol, low-intensity lipoprotein [LDL], high-density lipoprotein [HDL], and triglycerides) has shown positive outcomes. Cholesterol is a lipid categorized into LDL and HDL. Elevated serum total cholesterol and LDL levels amplify the risk of cardiovascular disease (69-71). HDL, conversely, is vital for stabilizing total cholesterol, as it facilitates the transport of cholesterol to the liver, where it is sequestered and eliminated. It also contributes

to vascular protection by stimulating nitric oxide release and removing oxidized lipids from LDL (69).

Elevated triglyceride levels are identified as a risk factor for cardiovascular disease, HT, and DM. Individuals with hypertriglyceridemia (high triglyceride levels) are more prone to develop obesity, hepatic steatosis, and ectopic fat deposition (48, 60, 72, 73). For these clinical markers, the use of *A. cordifolia* has been shown to decrease serum triglyceride levels (24, 28, 31, 32, 39), total cholesterol levels (28, 31, 32, 39, 43), and LDL (31, 32, 39), in addition to increasing HDL (31, 39). Another clinical marker, uric acid, which is a product of purine metabolism, when elevated, results in hyperuricemia, known as gout (74). Gout is a form of inflammatory arthritis, with the most typical clinical presentation being intense acute inflammatory arthritis (75). Moreover, there is evidence that uric acid is significantly associated with hypertension, indicating that effective management is crucial in preventing HT (74). According to the findings of this scoping review, the plant extract exhibits an anti-hyperuricemic effect and inhibits the enzyme xanthine oxidase (41), which is responsible for converting xanthine into uric acid and thus directly relates to the quantity and rate of uric acid production (76).

Another pathology highlighted in the studies was cataracts, characterized by the opacification of the eye's lens, leading to impaired visual acuity, which can be partial or total. The prevalence of cataracts in diabetic patients is significantly higher—two to five times—compared to the general population (77). Additionally, it remains a leading cause of visual impairment among individuals with DM due to increased incidence and progression, as well as earlier occurrence. It is estimated that 20 % of cataract surgeries are conducted on patients with DM (78, 79). Regarding the therapeutic use of *A. cordifolia*, the plant demonstrated positive effects in an experiment on induced cataracts in goat lenses (22), where the treated lenses exhibited a lesser degree of cataract, along with a reduced concentration of malondialdehyde. Malondialdehyde, a biomarker indicative of oxidative stress, is closely linked to the development of cataracts; the higher its level, the greater the ocular lens turbidity and the cataract severity. The level reduction is presumably due to the extract's high antioxidant content (22).

After reviewing all the articles and learning about the benefits of *A. cordifolia* and its therapeutic potential, it is evident the plant holds promise for the production of herbal medicine. It is critical to acknowledge that scientific research has been a pivotal factor driving the increased interest in herbal medicine. There remains a need to enhance awareness about the vast biodiversity of medicinal plants in Brazil and how to access them for both the public and professionals who can offer guidance on their use (80).

Health professionals, especially nurses, are at the forefront of recognizing PICS and play a significant role in fostering the ex-

change and development of new knowledge regarding medicinal plants. Nevertheless, the lack of awareness about PICS and the absence of a scientific basis for these practices are barriers to providing safe care (81). Hence, professionals must possess scientific knowledge about medicinal plants, such as *A. cordifolia*, and encourage ongoing scientific research into their properties, effects, and safe usage to integrate them into future care practices (80).

Conclusions

This scoping review has facilitated the identification and mapping of evidence regarding the therapeutic properties of *Anredera cordifolia* in treating chronic non-communicable diseases. The compiled studies suggest that the plant may effectively treat DM, HT, CKD, obesity, and cataracts. Additionally, it has demonstrated the potential for controlling triglycerides, cholesterol, and uric acid levels.

The primary attributes identified include its hypoglycemic effects, antihypertensive activities, and ability to lower total cholesterol and triglyceride levels. It is also worth noting that *Anredera cordifolia* has been found to have healing properties for diabetic wounds, reduce serum creatinine levels, prevent body weight gain, and exhibit positive effects on factors directly influencing CNDs. Therefore, our findings contribute to advancing research on the therapeutic benefits of *Anredera cordifolia*, particularly highlighted by the urgency for further research in different geographical locations and by various researchers to validate the published research data.

Emphasizing and incorporating traditional knowledge into new research is crucial. Given the significance of medicinal plants and the positive impacts of *Anredera cordifolia* and its potential as a therapeutic resource in healthcare practice, further investigation in the field of nursing is suggested. This approach aims to provide a scientific foundation and support for the safe use of medicinal plants in healthcare settings.

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