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Systematic review on the vasodilation activity of medicinal plants in the family Asteraceae

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Abstract

The current study aims to review the studies on the vasodilation activity of medicinal plants in the family Asteraceae. We carried out the review based on the 06- PRISMA guideline (14) and registered in the CAMARADES-NC3Rs Preclinical Systematic Review and Meta-Analysis Facility (SyRF) database. Various English databases, such as Scopus, PubMed, Web of Science, EMBASE, and Google Scholar were used to find publications about the vasodilation effects of medicinal herbs with no date limitation. Among 2420 papers, 8 papers including up to 2021, met the inclusion criteria for discussion in this systematic review. The obtained results showed that the most common parts used in the studies were aerial parts (40%) followed by leaves (30%) and fruit (10%). The findings of the present review showed that methanolic extract (20%), essential oil (20%), and aqueous extract (20%) were considered as the desired approaches of herbal extraction. The findings of the present review showed that several investigations have been carried out on antihypertensive and vasodilation activity of extracts and essential oils of Asteraceae family alone or in combination with present synthetic drugs. We found that the plant-based vasodilation drugs are considered as an alternative and complementary source for treating hypertension as had lower important toxicity. However, more studies are required to clear this conclusion, particularly in clinical systems.

Key words: vasodilation, vasorelaxant, Asteraceae, antihypertensive, extract, essential oil

Introduction

Todays, one of the most prevalent cardiovascular diseases between the human population mainly in developing countries is high blood pressure which is also named “arterial hypertension” (AHT). Vasodilators as one of the important agents for hypertension therapy, persuade or start the widening of blood vessels, which are regularly used to treat hypertension, congestive heart failure and also angina (1-3). Currently, a number of vasodilator drugs through different mechanisms, including inhibitors of angiotensin-converting enzyme (ACE), Blocking calcium channels, openers of potassium channel, inhibitors of cGMP-specific 3',5'-cyclic phosphodiesterase (PDE5) inhibitors, etc are broadly used for hypertension condition (4, 5). Nevertheless, reviews demonstrated that these agents are associated with some adverse side effects such as drug resistance, and drug dependence, decreasing the systemic vascular resistance through renal retention of sodium and water, orthostatic hypotension and syncope upon standing, increasing the heart rate and inotropy., etc (6, 7). Consequently, improvement and finding of new drugs as blood vessel dilators is encouraging among investigators.

Based on the World Health Organization (WHO) reports, the consumption of herbs and their derivatives has been considered as valuable pharmaceutical resources worldwide (8, 9). Asteraceae herbs family is recognized as one of the main herb families with broad spectrum of herbal species. Nowadays, reviews have demonstrated a wide range of the pharmacological and therapeutic properties such as antioxidant, anticancer, antimicrobial, analgesic, antiproliferative, anti-inflammatory, as well as antihypertensive of the plants of this family (10). The present study purposes to systematically review the studies on the vasodilation effects medicinal herbs in the Asteraceae family.

Materials and methods

Search strategy

We carried out the review based on the 06- PRISMA guideline (11) and registered in the CAMARADES-NC3Rs Preclinical Systematic Review and Meta-Analysis Facility (SyRF) database. Various English

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databases, such as Scopus, PubMed, Web of Science, EMBASE, and Google Scholar were used to find publications about the vasodilation effects of medicinal herbs with no date limitation. The searched words and terms were: "Asteraceae family", "medicinal plants", "vasodilator", "vasorelaxant", "hypertension", "high blood pressure", "vasodilation", "extract", "essential oil" (Fig. 1.).

Studies selection

The publications were imported to the EndNote X9 software (Thomson Reuters, New York, NY, USA) and duplicate papers were deleted. Three independent authors tested the title and abstract of the paper and the relevant publications were included for further analysis. The same authors carefully analysis the publication and the suitable papers with acceptable inclusion criteria were selected. Corresponding author resolved any disagreement between the authors.

Inclusion and exclusion criteria

Here, the inclusion criteria were the studies of assessing he vasodilation effects of medicinal herbs from the Asteraceae family; whereas the studies with inadequate information, only abstract, failure to match methods with results, inappropriate interpretation of the results were excluded from the study (Fig.1).

Data extraction

The independent researchers extracted data include: name of plant, plant family, part of used, Type of extraction, concentration, and important results.

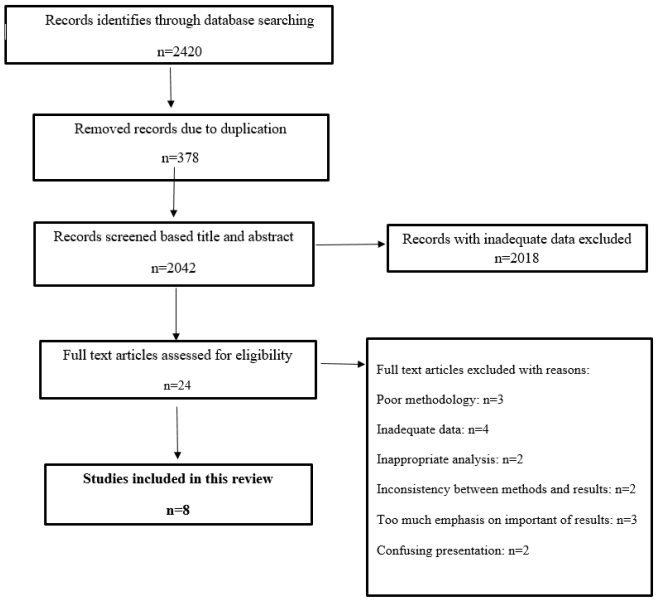

Fig 1. Flowchart describing the study design process**.**

Results and discussion

Among 2420 papers, 8 papers including up to 2021, met the inclusion criteria for discussion in this systematic review with the data extracted presented in Tables 1. The obtained results showed that the most common parts used in the studies were aerial parts (40%) followed by leaves (30%) and fruit (10%). The findings of the present review showed that methanolic extract (20%), essential oil (20%), and aqueous extract (20%) were considered as the desired approaches of herbal extraction.

Phytochemical analysis of the plants of this family demonstrated that the main constituents were flavonoids, terpenes, polyphenols, and flavonoids (20). Previous studies have reported that polyphenols have been measured as an antihypertension through some mechanisms such as regulating calcium channels, increasing endothelium-derived nitric oxide bioactivity, and affection the smooth muscle activation (21-24). Sesquiterpene as terpenes derivatives which are present in Asteraceae family have various pharmacological activities such as antihypertensive and vasodilation effects through relax smooth muscles, activating the NO-cGMP pathway, inhibition of Ca2+ influx, etc (25-28).

Polystyrenes are secondary metabolites of Asteraceae family which have various biological activities such as antihypertensive and anti-platelet aggregation properties (29, 30). Flavonoids are one of the main

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constituents of plants in this family which have a number of pharmacological effects in the cardiovascular diseases, including vasodilation, antiatherogenic, antihypertensive, antioxidant, and antiplatelet properties (31,32) through inhibiting tyrosine kinase Pyk2 as the main enzyme to regulate calcium channels, and activation of the cAMP/protein kinase A cascade, and affecting calcium channels, etc (33). Hence, it can suggest that anti-hypertensive activity and vasodilation effects of these plants in Asteraceae family is associated to these components. Considering the toxicity and safety of medicinal herbs (34), previous reviews have demonstrated that adverse side effects of herbal medicinal are linked to a number of factors including toxicity of main constituents, lack of the suitable manufacturing techniques and consequently contamination of preparations by heavy metals or microbes, and side effects on consumers which are dependent on age, and genetic and underlying diseases of them (35, 36).

Conclusion

The findings of the present review showed that several investigations have been carried out on antihypertensive and vasodilation activity of extracts and essential oils of Asteraceae family alone or in combination with present synthetic drugs. We found that the plant-based vasodilation drugs are considered as an alternative and complementary source for treating hypertension as had lower important toxicity. However, more studies are required to clear this conclusion, particularly in clinical systems.

Competing Interests

The authors declare that they have no competing interests.

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Table 1. List of included papers related to the vasodilation effects of medicinal herbs.

Plant	Part of used	Extraction	Concentration	Results	Ref.
Cocos nucifera	Fruit	Ethanolic extract	0.25–2 mg/ml	Through nitric oxide production in a concentration and endothelium-dependent manner demonstrated the vasorelaxant and antihypertensive effects of CNE,	12
Tanacetum vulgare	Leaves	Aqueous extract	800 µg/ml	This study indicates that the aqueous extract of Tanacetum possesses NO-mediated and NO-independent vasorelaxing properties in vitro.	13
Pectis brevipeduncu lata	Aerial parts	Essential Oil	1-10 mM	Showed the vasorelaxation of thoracic aorta by affecting the NO/cyclic GMP pathway and reduced the calcium influx by the blockade of voltage-dependent L-type Ca2+ channels.	14
Senecio nutans	Branches, leaves	Hydroalcoholic extract	1-4 µg/ml	Extract showed the vasodilator effect through endothelium-dependent (NO) and or independent, and may involve a modulation of the calcium channels.	15
Artemisia campestris	Aerial part	Essential oil	0.5, 1, 1.5 and 2 mg/kg	The essential oil showed vasorelaxation via inhibition of L-type Ca2+ channels and the activation of SERCA pumps of reticulum plasma	16
Artemisia annua	Aerial parts	Aqueous extract	100 mg/kg	Extract showed the the vasodilator effect through inhibition of prostaglandin generation both indirectly and directly.	17
Inula viscosa	Leaves	Methanol extracts	40 mg/kg/day	The results suggest that I. viscosa extract has an vasorelaxant effect, mainly mediated by an endothelium-dependent vasodilatory effect.	18
Gynura procumbens	Leaves	Methanol extracts	1 mg/mL	Extract significantly amplified ACh-endothelium dependent vasodilation and mediated relaxation at 1 mg/mL in endothelium-intact and endothelium-denuded aortic rings with MEGP as a more effective vasodilator than AEGP.	19

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