

Ethnomedicinal uses, phytochemistry and pharmacological activities of *Rumex nervosus*

Abstract

The genus *Rumex* is cosmopolitan plants consisted of about 200 species. *Rumex nervosus* that is known as nutraceutical plants widely distributed around the world. This review documents fragmented information on the ethnomedicinal uses, phytochemistry and pharmacological activities of *R. nervosus*. The review articles are carried out by searching in PubMed, Google scholar and Google search up to December 2020. *R. nervosus* is traditionally used to treat eye disease, headache, taniacapitis, haemorrhoids, dysentery, stomach-ache, diarrhoea, pharyngitis, arthritis, eczema, abscess and gynecological disorders. Secondary metabolites such as anthraquinones, naphthalenes, flavonoids, stilbenoids, triterpenes, carotenoids, and phenolic acids have been identified for this herb. The extracts of *R. nervosus* exhibited a wide range of pharmacological effects including antimicrobial, anti-inflammatory, antihypertensive, antidiabetic, antidiarrheal, anticoccidial and antileishmanial activities. These pharmacological studies have established a scientific basis for therapeutic uses of *R. nervosus*.

Keywords: rumex nervosus, ethnomedicinal, phytochemistry, pharmacology

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Introduction

Medicinal plants have been widely used for therapeutically purpose since antiquity.¹ It is estimated that about thirty five thousand species of plants have been utilized as traditional medicine worldwide. Traditional medicine provides health benefits for 80% of population of the developing countries to achieve their primary health care.² In Africa 60- 90% of the human being use herbal medicine to treat variable diseases. Like other African countries in Ethiopia traditional medicine has also played significant role to combat various ailments.^{3,4} Recent studies demonstrated that in Ethiopian about 80% of human population and 90% livestock still rely on medicinal plants to satisfy their primary health care needs mainly due to the fact that traditional medicine are acceptable, affordable and easily accessible.^{5,6} Medicinal plants are also used as a potential source of lead compounds that play vital role for the discovery of conventional drugs. Nowadays above 50 % of all modern medicines on market are from natural origin; therefore, these products have a great role in the pharmaceutical sciences for drug development.^{7,8} It is stated that around 25% of the modern remedies used globally have been obtained from medicinal plants.⁹

The plant *Rumex* genus is cosmopolitan in nature and valuable for its medicinal use. The genus mostly grows around the terraces of high altitude areas (above 1000m). They belong to polygonaceae family composed of about 200 species of annual, biennial and perennial herbs. Traditionally the use of *Rumex* genus either as food (edible plant) or medicine to intervene in curing or preventing ailments of mankind had been in existence from time immemorial in different parts of the world.¹⁰ *R. nervosus* which assumed as nutraceutical plant is one of the diversely distributed species globally. It spreads in large quantities on a high altitude areas roadsides, overgrazed areas, sandy areas, ups and down areas and relatively high rain fall areas. *R. nervosus* is highly branched shrub can grow up to 2-3 meters high. The leaves are usually arranged are densely small striated branchlets laterally, oblonged or upper lanceolated in shape. The leaves (2-3 inches; length) are bright green, subacute, glabrous and long narrow to the base rather than firm in texture.¹¹

R. vernosus as medicinal has been traditionally used for treating various communicable and non-communicable diseases/disorder such as eye disease, taniacapitis, haemorrhoids, infected wounds, dysentery, stoach-ache, diarrhea, pharyngitis, arthritis, eczema, abscess and gynecological disorders to mention few.^{12,13} In the pharmacological action *R. nervosus* is an effective source of urease inhibitory agents, analgesic, earthworms and influenza A virus and showed antileishmanial, anticancer, antioxidant, antimicrobial activities.^{13,14} Recently conducted research revealed that *R. nervosus* have been utilized to manage destructions caused by agricultural and veterinary insect pests. Many phytochemical investigations carried on *Rumex* species reported that they contain different secondary metabolites such as anthraquinones, naphthalenes, flavonoids, stilbenoids, triterpenes, carotenoids, and phenolic acids. So far no review compiled on the pharmacological and therapeutic benefits of *R. nervosus*. This initiated us to document the fragmented facts and information about isolated compounds, traditional and pharmacological uses of the *R. vernosus* species. This mini review will accentuate the importance of the species and will present baseline information interested researchers intending to do further work on the genus *Rumex*.

Material and methods

Literatures related to *R. nervosus* based ethomedicinal uses, phytochemistry and pharmacological activities were carried out until December, 2020. The information were gathered by different search approaches, including; search for published journal articles using international scientific databases including PubMed, Google search, Google scholar, etc.

Ethnomedicinal uses of *R. nervosus*

R. nervosus is locally known by different names in Ethiopia such as “Dhangaggoo” in Afan Oromo, “Embuachew” in Amharic, and “Hhot” in Tigrigna to mention few.¹⁷ Traditionally the herb is utilized to as anthihemorrhoids, antipyretic, diuretic, antihypertensive, antirheumatic, antiscabies, antiemetic, aphrodisiac, antitussive, and antirabies hypoglycemic, antiacne, anti-infective. It is also used to

treat sexually transmitted gonorrhoea, dermal problem such as leprosy, lung tuberculosis, and hepatic problems, headache and dermatitis. *R. nervosus* root or leaf extract could be served as vermicides.¹⁵ In Ethiopia, *R. nervosus* extract is practised to seize bleeding after male circumcision.¹⁷ Eritreans traditionally used different parts of this plant to treat eczema, abscess, infected wounds, arthritis and gynaecological disorder. Traditionally the stem and leaves of this herb practised by the Eritrean women to clean their body presuming that its steam and vapour destroy and removes microbes from the body and make them comfortable.¹⁰

Pharmacological activities of *R. nervosus*

Antimicrobial activity

Hussein and his co-worker reported that except methanol extract other diethyl ether, chloroform, acetone extracts of *R. nervosus* root exhibited good antibacterial.¹⁴ From antimicrobial activity test conducted on *R. nervosus* ethanol and methanol extract by Al-Nowihi and his co-worker it is reported that, both extracts have antimicrobial effect. However, methanol extract showed better activity against both Gram-negative (*Escherichia coli*, *Klebsiella pneumonia*) and Gram-positive (*Staphylococcus aureus*, *Bacillus subtilis*) bacteria and Fungus (*Candida albicans*) strain than ethanol extract.^{14,19}

Anti-inflammatory effects

In the natural healing process inflammation has a significant role as the body's defense mechanism. However, chronic inflammation could aggravate the risk different disorders such as some cancers, atherosclerosis, rheumatoid arthritis, periodontitis and hay fever. Thus management of inflammation is very important practise in preventing and treating disease associated with inflammation. Desta et al.¹⁹ explained the role of inflammation in disease and how inflammatory response is induced in the body. They also describe how inflammatory mediators are regulated in the inflammation process. In this regard they reported that flavonoids isolated from *R. nervosus* flowers exhibited anti-inflammatory activity through decreasing IB Phosphorylation which holds down ERK and p38 activation, as well as by minimizing the secretion of pro-inflammatory mediators such as inducible nitric oxide synthase, cyclooxygenase-2 and interleukin-1.¹⁹

Antidiarrheal activity

Diarrheal disease is worldwide gastrointestinal problem stands second in killing under five children draws researcher attention. It is estimated that about five million people died from this gastrointestinal disorder in a year. This review stated that *R. nervosus* leaf extract is traditionally used by Ethiopian to combat diarrheal problems. Asad et al., (2004) assayed antidiarrheal activity of *R. nervosus* aqueous extract. Their investigation approved that the herbs extract show a protective effect against diarrhoea. But the exact mechanism of action and constituent responsible for antidiarrheal activity of this herb is not explained. However, they assume that since *R. nervosus* leaves extract has a variety of flavonoid which may inhibit release of acetylcholine in gastrointestinal tract. Prevention of gastrointestinal acetylcholine secretion leads to inhibition of intestinal motility and hydro-electrolytic secretions.¹⁸

Acute toxicity study

The methanolic extract of leaves of *Rumex nervosus* acute toxicity study was conducted on mice. There is no sign of toxicity observed. Hence, the drug was considered as safe.¹⁸

Antileishmanial activity

Leishmaniasis is a parasitic disease caused by infection with leishmania obligate intracellular parasite. Different literatures stated

that leishmaniasis spread among susceptible individuals/ organisms when they are bitten by infected females and flies vector. So far, little investigation carried out on antileishmanial activity of phytochemicals of *R. nervosus*. In antileishmanial activity assay, the crude methanol extracts of both stems and leaves of *R. nervosus* and their fractions including: n-hexane, CHCl_3 fraction, EtOAc fraction and MeOH fraction was displayed variable effect of antileishmanial activities. The study showed that *R. nervosus* stems extract is more potent than the leaves extract. Among fraction, chloroform fraction revealed better antileishmanial activity than other fraction of the stem.²¹

Anticoccidial activity

Coccidia is reemerging parasitic and communicable disease, caused by the *Eimeria* parasite that could be the major intestinal tract pathogens of avian and many other domestic animals resulted in major economic loss. *Eimeria tenella* is the most dangerous chickens *Eimeria* species because it is virulent and leading to severe haemorrhage and very high mortality. When the caecal epithelial cells are attacked by *E. tenella* mucus production frequency increased and the epithelium are susceptible for invasion. This invasion affects the normal function of goblet cells acting as immunological defense line in the internal tract. Coccidiosis could be managed by using different synthetic anticoccidial drugs like amprolium, Diclazoril, Monincine. But serious challenges faced in utilizing these drugs such as drug resistant parasite emerged, their costs escalated and consumer prefer synthetic drug-residue free meats. This problem initiate researcher to search for alternative medicament from medicinal plants. One of these herbal medicines studied for this purpose is *R. nervosus*. From investigation *R. nervosus* leave extract against coccidial caused by infected birds (chickens) with oocyst of *E. tenella*, changes induced in goblet cells and cytokines of chickens by this parasite was mitigated. The findings reported that number of oocyst in bird's faeces was decreased. It is also stated that the number of goblet cells which was decreased after infection, was increased after treated with the herbal extract. From their investigation, they concluded that *R. nervosus* leave extract has anticoccidial activity.²²

Anti-diabetic activity

Diabetes mellitus is a common endocrine disorder characterized by hyperglycaemia, manifesting with symptoms and signs of osmotic diuresis such as polyuria, polydyspnea, calorie loss, and generalized weakness, polyphagia and weight loss. It results from either an absolute deficiency (type 1) or relative deficiency (type 2) of hormone, insulin.²⁴ Type 2 diabetes is highly associated with obesity which becomes a serious public health problem recently. As currently available anti-obesity medications induced unwanted effects and less efficacious, researchers are looking forward to develop new antiobesity agents from medicinal plants. Lots of animal and clinical investigation is going on different herbal medicines to develop new drugs with fewer side effects. *R. nervosus* is one of those antidiabetic claimed herbal medicine under research. From the antiobesity potential of *R. nervosus* Vahl leaves studied against high fat diet-induced obesity in female rats, it was reported that the body weight and blood glucose concentration was reduced. Hence they concluded that this leaves prevent high fat diet-induced hyperglycemia.²³

Antioxidant activity

A study by Al-naqeb¹⁹ on *R. nervosus* extract examined the DPPH radical scavenging activity. Phytochemicals of the extract are able to scavenge the DPPH free radicals. The antioxidant activity was concentration dependent. Al-naqeb revealed that this herb could be potential candidates to be used as antioxidant. Quradha et al (2019) has also reported that essential oil and fraction of this herb showed antioxidant activity.

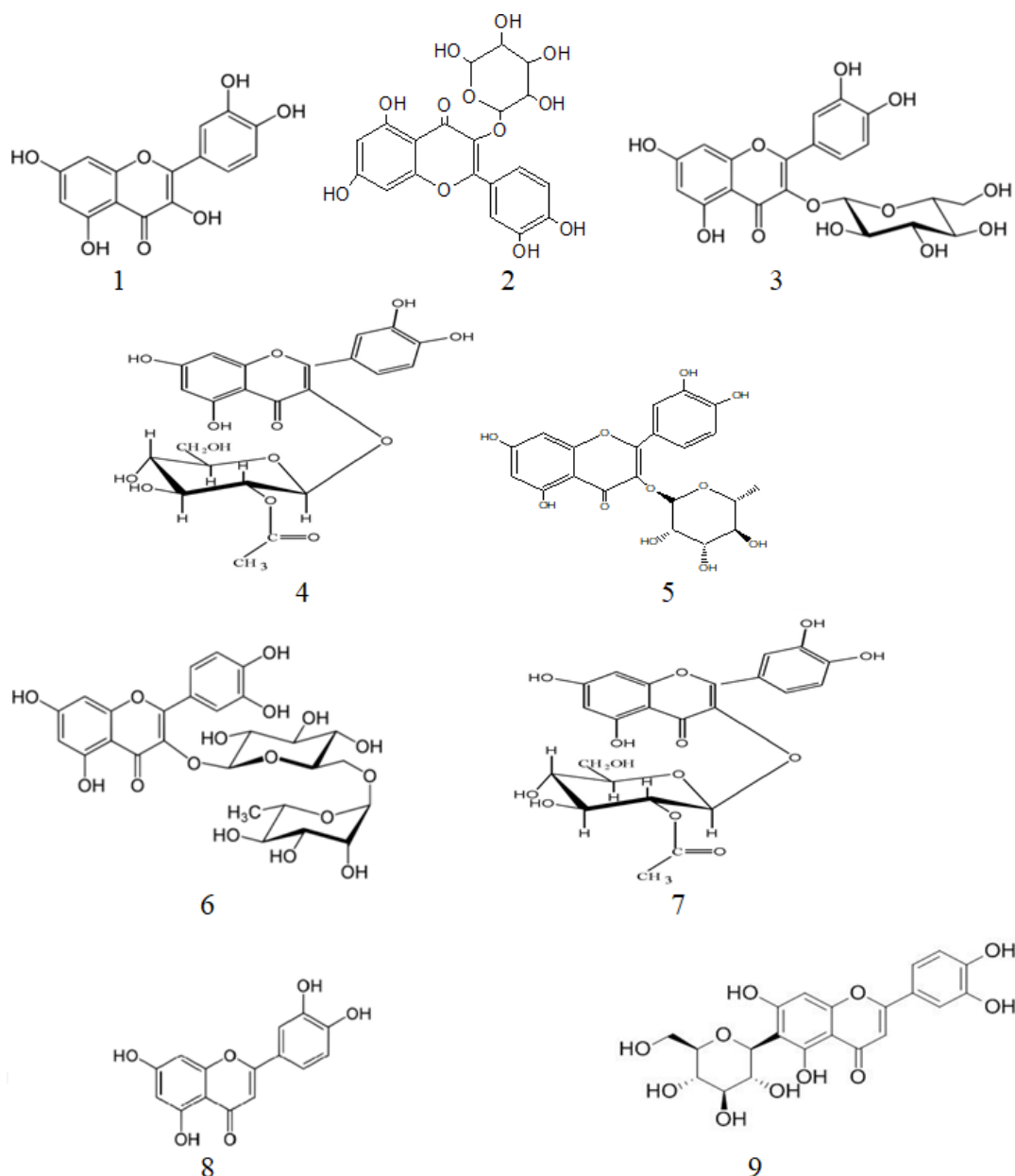
Natural phytogetic feed additives

World health organization urges that dairy, egg and meat product should devoid of pharmaceutical residues. But the aforementioned product producer uses pharmaceuticals as feed additives in view to promote growth and health. Antibiotics have been included in broiler to aid body weight growth and control Pathogens. The uses of these antimicrobial agents create multidrug -resistant microbes which become one of the main problems now a day. Owing to this prohibition of antibiotic application to animal production, researchers tried to substitute the antibiotics by natural phytogetic feed additives. Phytogetic additives (spices, herbs plants and product derived thereof) is one of antibiotics' substitute. In this regard *R. nervosus* was used as phytogetic feed additives in broiler diet up to a 1000mg/kg. Study conducted on *R. nervosus* used natural phytogetic feed additives showed that addition of this herb increased serum albumin and triiodothyronine levels. Higher levels of triiodothyronine in the serum accelerate the growth in chickens. Besides this feeding a diet with 1000mg/kg herb increased with duodenal villus height and

decreased cecal *Escherichia coli* counts. Thus *R. nervosus* leaves meal would be used as phytogetic feed additives in broiler diets.¹¹

Phytochemistry

Desta and his co-workers from their works reported that seven flavonols (quercetin, quercetin-3-O-pentoside, quercetin-3-O-glucoside, quercetin-3-acetyl-glucoside, quercetin-3-O-rhamnoside, quercetin-3-O-rutinoside, quercetin-3-acetyl rhamnoside), six flavones (luteolin, luteolin-6-C-glucoside, apigenin-6-C-glucoside, apigenin-8-C-glucoside, apigenin-6-C-glucoside-7-O-glucoside and acacetin) and three flavanones (hesperetin, naringenin and liquiritin) were characterized from the 70% methanolic extract of the flowers of *R. nervosus* Vahl growing in Ethiopia by using HPLC-ESI-MS/MS.^{20,25} It is assumed that these polyphenols are responsible for biological activities of *R. nervosus* Figure 1. Other studies also showed that palmitic acid ,palmitic acid methyl ester, Palmitoleic acid , methyl cis-9- hexadecenoate, chlorogenic acid, catechin and orientin has been isolated form *R.nervosus* leaves.^{13,25} Their structures are shown below Figure 2.



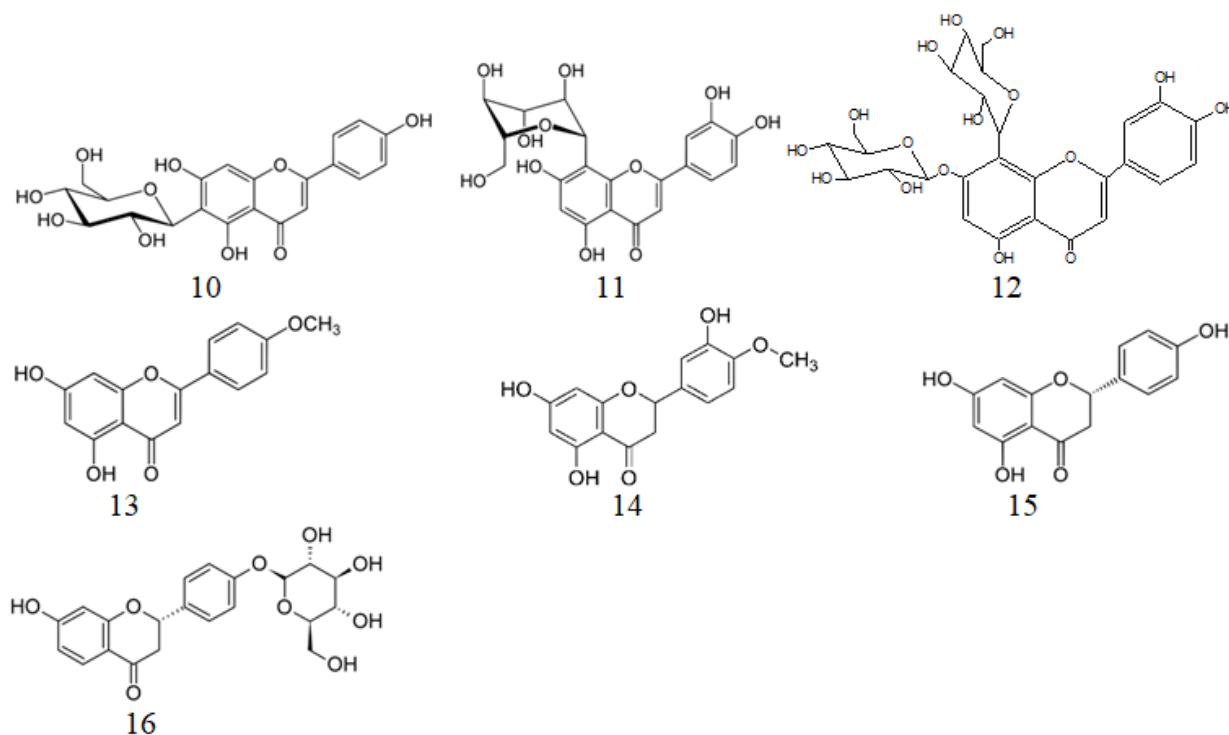


Figure 1 Some the chemical constitutes of *Rumex nervosus*.

1:quercetin, 2:quercetin-3-O-pentoside, 3:quercetin-3-O-glucoside, 4:quercetin-3-acetyl-glucoside, 5:quercetin-3-O-rhamnoside, 6:quercetin-3-O-rutinoside, 7:quercetin-3-acetyl rhamnoside, 8:luteolin, 9:luteolin-6-C-glucoside, 10:apigenin-6-C-glucoside, 11:apigenin-8-C-glucoside, 12:apigenin-6-C-glucoside-7-O-glucoside, 13:acacetin, 14:hesperetin, 15:naringenin, 16:liquiritin

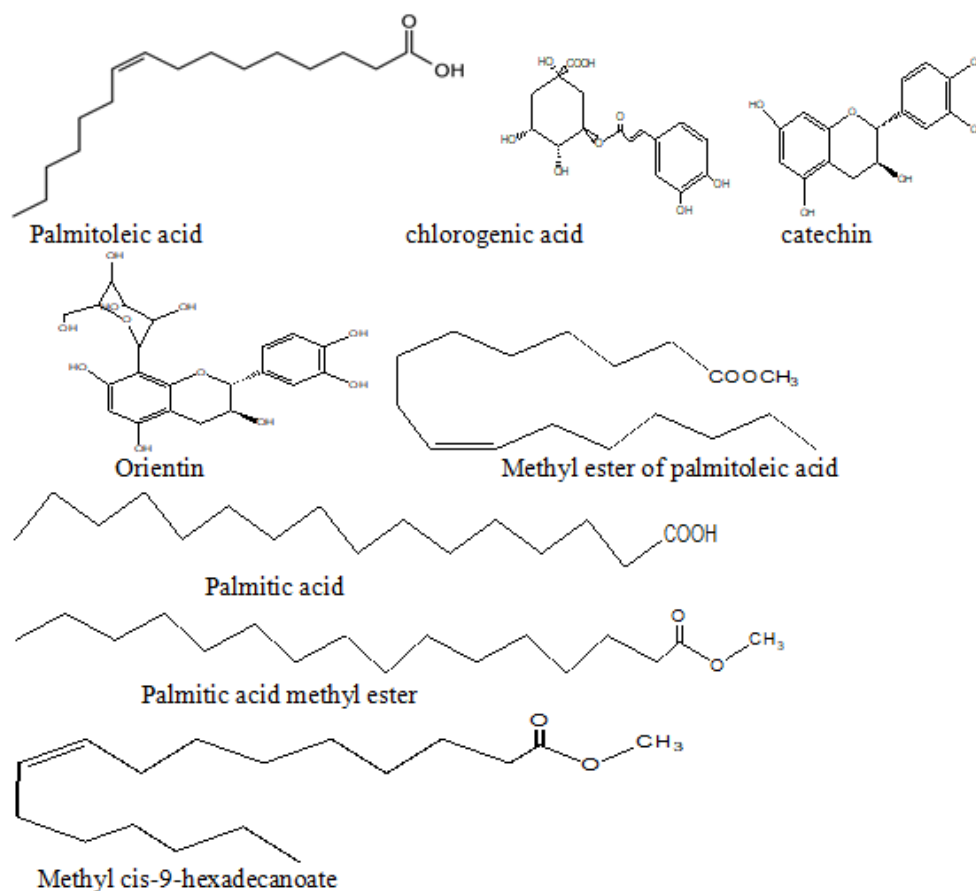


Figure 2 some of the compounds isolated from *R. nervosus*.

Conclusion

The present review has attempted to explore ethnomedicinal uses, phytochemistry and pharmacological activity of *R. nervosus* plant that is widely distributed throughout the world. People have used this plant traditionally to treat various ailments even though some of the claims have not proved yet. So far confirmed pharmacological activities of this herb are antimicrobial, anti-inflammatory, antihypertensive, antidiabetic, antidiarrheal, anticoccidial and antileishmanial activities.

Acknowledgments

None.

Conflicts of interest

The author declares there is no conflict of interest.

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