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## Research Article

## Medicinal Plants As Anti Neospora Caninum Activity: A Systematic Review -

**Tsegaye Alemayehu\***

*Hawassa University College of Medicine and Health Science, School of Medical Laboratory Science, Ethiopia*

**\*Address for Correspondence:** Tsegaye Alemayehu, Hawassa University College of Medicine and Health Sciences, School of Medical Laboratory Science, P.O. Box: 1560, Hawassa, Ethiopia, Tel +251-913-872-2412; ORCID: 0000-0001-7579-8991; E-mail:alemayehutsegaye@ymail.com

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## Abstract

**Background:** Neospora is an obligate parasite that infects livestock and a common cause of abortion. The scarcity of effective treatments and vaccines for Neosporosis is a challenge in livestock production. Medicinal plants have an important impact to treat in many ways in different organisms. Therefore, the review aims to determine the effect of medicinal plants as anti-Neospora activity in many parts of the world.

**Methods:** Literature search conducted on four online databases namely PubMed, Google Scholar, Hinari, and Science Direct using the terms "Medicinal plants as Anti-Neospora activity". Articles published in the English language and fulfilled the inclusion criteria selected for a reading of full abstract. After reading all, the important data extracted and presented in a table 1. Articles published on the medicinal plant as anti-Neospora activities in the English language anywhere in the world included for review and otherwise excluded.

**Results:** One hundred seventy-six (176) articles were found related to medicinal plant and Neospora activity on databases. Of this, 135 excluded after looking for the title and published other than the English language. Of 41 articles selected for full abstract reading and 35 articles excluded removing the duplicates and eligible to the main aim of the review. After thoroughly reading the full articles, six (6) studies were included for the review. Through these six studies, 11 medicinal plants were evaluated for the effectiveness of anti-Neospora. Two studies were conducted both *in vitro* and *in vivo*. The rest nine plants conducted only *in vitro* testing. Our review indicated that two out of 11 plant extracts not effective for Neospora *in vitro* testing. The rest 9 plant extracts effective inhibiting growth of Neospora of this 2-plant extract conducted for *in vivo* on mice in which the mice survived after treatment with these plant extracts.

**Conclusion:** Our review indicated that there are medicinal plants that have anti-Neospora activities in different parts of the world. It also noted different medicinal plants extracts investigated in a different place. Most of the investigations tested *in vitro* and some of them advance *in vivo*. Therefore, considering medicinal plants as optional treatments may help to fulfill the scarcity of treatment of Neospora in livestock. Finally, we can recommend that more studies on advanced clinical trials may improve medical plants to convince pharmaceutical companies.

**Keywords:** Neospora; Livestock; Medicinal plants; systematic review; World

## INTRODUCTION

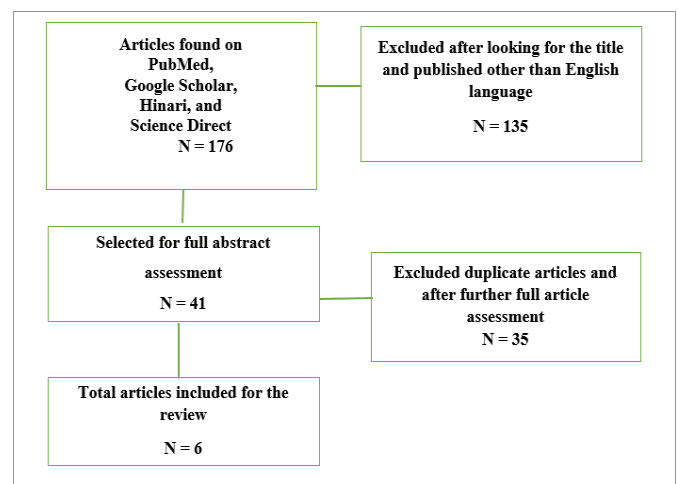
Neospora is an obligate intracellular apicomplexan parasite that first found in Norway in 1984 from dogs further identified from castles, horses, sheep's and goats [1,2]. It is known as a cause of abortion in a wide variety of wildlife [3]. Neospora has widely distributed, with reported cases in Asia, Africa, America, Europe, and Oceania [4-8]. The rates of Neospora infection reported from various places in different studies that are in China, 10 % of dogs were seropositive [9], in dairy cattle range from 3-60% worldwide, and 2-30% in cattle beef [10].

Neospora can be transmitted transplacentally (vertically, congenitally, or endogenous) and postnatally [11]. Postnatal transmission occurs by ingestion of tissues infected with tachyzoites or tissue cysts and/or by ingestion of food or drinking water contaminated with sporulated oocytes. During an acute phase of infection, tachyzoite is virtually found at all host tissues and fluids, including peripheral blood, placenta, and amniotic fluid of pregnant cows [12,13]. Even though there is a concern about the zoonotic transmission of *N. caninum*, there is no convincing evidence, that *N. caninum* effectively infects humans [3,14,15].

Clinical neosporosis in dogs treated with prolonged administration of clindamycin or potentiated sulfa drugs. The prognosis is negatively associated with the severity of presenting clinical signs and delayed treatment. The prognosis is poor in puppies if the disease has progressed to hind limb paresis with atrophied, rigid limbs [16]. There is no approved treatment for neosporosis in cattle; hence, searching for medicinal plants is an appropriate treatment option to treat Neospora infection is mandatory [17]. Therefore, this review aims to compile available data from a different continent in the world regarding medicinal plant activities to Neospora *in vitro* as well as *in vivo*.

## LITERATURE SEARCH STRATEGY

A literature search was conducted on four databases on PUBMED, Google Scholar, Science Direct, and Hinari using the terms "Medicinal plants as Anti-Neospora activity". Articles published in the English language and fulfilled the inclusion criteria selected for the reading of full abstract. After reading all, the important data extracted and presented in a table. The follow of articles selection presented below figure 1 using the PRISMA protocol.



**Figure 1:** The follow of article selection for medicinal plants and anti- Neospora activity worldwide: A systematic review.

## Eligibility criteria

Articles published on the medicinal plant as anti-Neospora activities in the English language anywhere in the world included for review and otherwise excluded.

**Table 1:** Articles selected for a systematic review of medicinal plants as anti-Neospora activity worldwide: A systematic review.

Sr. No	Author & year of publication	Country of origin	Parts of the plant	The scientific name of the plant	Model used	Experimental Dose	Outcome	Reference
1.	Arpron <i>et al.</i> , 2017	Thailand	Leave & seed	Thai Piperaceae	<i>In vitro</i>	22.1 µg/ml	inhibiting parasite growth in human foreskin fibroblast cells	[18]
				• <i>Piper betle</i>		25 µg/ml	inhibited parasite invasion into host cells	
					<i>In vivo</i>	400 mg/kg	100% mice survived after 30 days	
						100mg/kg	66.6% mice survived after 30 days	
				• <i>P. nigrum</i>		<i>In vitro</i>	50 µg/ml	
• <i>P. sarmentosum</i>	<i>In vitro</i>	50 µg/ml	Not effective					
2.	Ybañez <i>et al.</i> , 2016	Japan	Plant hormone	• Phytohormone (fluridone)	<i>In vitro</i>	100 µM	Inhibited growth	[19]
				<i>In vivo</i>	< 1500 µM	Inhibit the death of mice		
3.	Hun-Su Seo <i>et al.</i> , 2013	South Korea	Root	• <i>Sophora flavescens</i>	<i>In vitro</i>	2.85 ng	Inhibit growth	[20]
			Fruit	• <i>Torilis japonica</i>		2.85 ng	Inhibit growth	
4.	Chun-Ping Tang <i>et al.</i> , 2010	China	Steam & leaf	• <i>Ancistrocladus tectorius</i>	<i>In vitro</i>	35 mg	Moderate toxicity to Neospora	[21]
5.	H.J. Youn <i>et al.</i> , 2004	South Korea	Root, steam & leaf	• <i>Sophora flavescens</i>	<i>In vitro</i>	2.850 to 0.356 ng/ml	Inhibited N. caninum proliferation	[22]
				• <i>Torilis japonica</i>		2.850 to 0.356 ng/ml	Inhibited N. caninum proliferation	
6.	H.J. Youn <i>et al.</i> , 2003	South Korea	Root, steam & leaf	• <i>Sophora flavescens</i>	<i>In vitro</i>	156 to 19.5 ng/ml	Inhibited N. caninum proliferation	[23]
				• <i>Torilis japonica</i>		625 to 19.5 ng/ml	Inhibited N. caninum proliferation	

### Data extraction

Our data extraction includes the author's name, year of publication, country of origin of the article, parts of the plant extracted, the scientific name of the plant, model of the test (*in vitro*/*in vivo*), experimental dose, and outcome of the experiment.

### RESULTS

One hundred seventy-six (176) articles were found related to medicinal plant and Neospora activity on the database. Of this, 135 excluded after looking for the title and published other than the English language. Of 41 articles selected for full abstract reading and 35 articles excluded removing the duplicates and eligibility to the main aim of the review. After thoroughly reading the full article, six (6) studies were included for the review (figure 1). Through these six studies, 11 medicinal plants were evaluated for the effectiveness of anti-Neospora. Two studies [18,19] conducted both *in vitro* and *in vivo*. The rest nine [20-23] plants were conducted only *in vitro* testing. Our review indicated that two [18] out of 11 plant extracts not effective for Neospora *in vitro* testing. The rest 9 plant extracts effective inhibiting growth of Neospora of this 2-plant extract conducted for *in vivo* on Mice in which the mice survived after treatment with these plant extracts.

### DISCUSSION

Many evidence-based studies supported the use of an extract of medicinal plants in harmonizing and protective medicine to facilitate the treatment of various infections or syndromes. Considering the adverse effects of chemical drugs, increasing antibiotic resistance, and lack of access to many of these medicines, the use of medicinal plants could be beneficial in the treatment of infectious diseases [24].

In livestock, that lacks effective treatment or vaccine in cattle infected with Neospora medicinal plant extract might help for supportive treatment [25].

Our review indicates that there is a medicinal plant conducted *in vitro* as well as *in vivo* all that they recommend the clinical trial for further usage of this medicine in livestock's, that suffer more due to this Neosporosis infection that leads to abortion. A study from Thailand that extracted from the leave and seed of Thai Piperaceae (*Piper betle*, *P. nigrum*, and *P. sarmentosum*) [18] studied its effect *in vitro* and *in vivo*. Piper betle treatment *in vitro* against Neospora parasite with an amount of 21.1 µg/ml and 25 µg/ml in which both effectively inhibit parasite growth in human foreskin fibroblast cells. Similarly, this extract was injected into lab mice, which infected with Neospora with 100 mg/KG and 400 mg/Kg, in the former 66.6%, and in the later 100% of mice survived after a month of treatment. In this study, they tried to investigate for additional two-plant extract named *P. nigrum* and *P. sarmentosum*) at a mass of 50 µg/ml *in vitro* but they are not effective. Another study conducted in Japan extracted from plant hormone investigated against Neospora activity first *in vitro* than *in vivo* [19]. In *in vitro* treatment, it inhibited parasites growth whereas *in vivo* it prevents the death of mice. Studies conducted in South Korea at a different time in the same plant root, fruit, leaf, and steam extracts of *Sophora flavescens* and *Torilis japonica* with different mass [20,22,23] inhibited the proliferation of Neospora *in vitro*. This indicates the strength of the trial and the activity of the extract efficacy at different gradients in different periods. In Chinese study [21], it elaborates a medicinal plant from steam & leaf of *Ancistrocladus tectorius* with 35 mg amount treated for anti-Neospora activity had a moderate activity for Neospora. Here the limitation of this study is



the study conducted with a single mass that may indicate performing in gradient testing may increase the moderate activity to high activity.

## CONCLUSION

Our review indicated that there are medicinal plants that have anti-Neospora activities in different parts of the world. It also noted different medicinal plant extracts investigated in a different place. Most of the investigations tested *in vitro* and some of them advance *in vivo*. Therefore, considering medicinal plants as optional treatments may help to fulfill the scarcity of treatment of Neospora in livestock. Finally, we can recommend that more studies on advanced clinical trials may improve medical plants to convince pharmaceutical companies.

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