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Niruris Indica – A Review

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Abstract:

Niruris indica is a well-known medicinal plant that has been used both traditionally as well as scientifically as a traditional medicine for a variety of diseases all over the world due to its long-standing ethno medical records in Ayurveda, Chinese, and Malay. Niruris indica, contains potent bioactive compounds having vital biological properties. As a result, incorporating such an essential plant into herbal medication formulations may improve treatment effectiveness of various diseases. Anti- microbial metabolites. Niruris indica is an abundant natural resource available in many countries, and it can reduce health-care costs associated with conventional drugs, which are often inaccessible to the majority of the population for long-term treatment. Furthermore, clinical trial studies would benefit from further cheminformatics, toxicological, and mechanistic research. The scientific evidence of Niruris indica has paved the way for more pharmacological research and creation of effective medicines for the treatment of a variety of communicable diseases.

Keywords: Niruris indica, Traditional Medicine, Phytochemical Screening Antimicrobial Activity, Antimicrobial Resistance.

Introduction:

India has one of the world's most extensive traditions for plant medicine, the area where in spite of available modern medicines the interest on herbal medicines has been increasing rapidly in recent years because of many reasons. The Center for Disease Control and Prevention (CDCP) recently issued a warning that the world is approaching a post-antibiotic future, in which common infections would no longer be curable. Furthermore, as a result of significant lifestyle changes, increased pollution, and industrialization, the global population is suffering from a variety of lifestyle disorders. These issues will continue to raise mortality and disease burden until addressed. WHO is also concerned about antimicrobial resistance (AMR), which is jeopardizing the effective prevention and treatment of an ever-widening variety of illnesses caused by bacteria, parasites, viruses and fungi. New resistance mechanisms are evolving and spreading over the world, posing a danger to our ability to cure common infectious diseases, leading to prolonged sickness,

disability, and death. Despite the fact that traditional medical systems have an abundance of medications to address such diseases, it is the time to search for innovative antibiotics with optimal antibacterial activity and low toxicity that has reignited interest in phytochemicals found in common plants. Significant basic and clinical research has been carried out on the medicinal plants and their formulations. Most reports on the biological and pharmacological studies of the plants are based on crude extracts. Network pharmacology in combination with "omics" techniques such as genomics, proteomics, transcriptomics, metabolomics, and metabonomics have recently become possible to examine simultaneous molecular effects of chemical compounds present in plant extract. Niruris indica is a large genus of shrubs, trees and rare herbs of the family Euphorbiaceae, comprising of more than 600 species. Niruris indica also known as "Bhumi amla" is a tropical plant that grows 50- 70cm in height (20–28 in) tall, erect, and bears ascending herbaceous branches. This herb is known as "Bhumi Amla" because it is a small plant present in bhumi (land) usually found in rainy season, its leaves are 7–12 cm long and they are alternate, sessile oblong. It has small off-white-greenish flowers, which are solitary, auxiliary, pedicellate, apetalous and monoecious [1]. This plant is originated in India, and it is native to tropical coastal areas and also it is found in a variety of tropical and subtropical countries around the world. The bark of this plant is light green in color and smooth. The fruits of Bhumi amla are tiny, smooth in capsules form containing seeds. The flowers are numerous pale green in color which are often flushed with red color, the bark is smooth and light green. Bhumi amla is commonly known as Chanca piedra, stone breaker and seed under leaves or gale of the wind. It is also known as bahupatra, tammalaki, and uttama etc. This plant is found in temperate climate all over coastal India. Niruris indica has long played a role in herbal medicine, particularly in treatments for urinary tract stones and ulcers in addition, It has been employed in Indian ayurvedic systems since ancient times (about 2000 years), and however it has a relatively short life span [2]. In South India, the herb is called Bhumyamalaki and is believed to treat constipation, gonorrhoea and syphilis [3]. However, little scientific evidence currently supports the use of Niruris indica. The medicinal value of these plants lies in bioactive phytochemical constituents that produce definite physiological action on the human body [4, 5, 6]. The plant is commonly harvested wildly for local use as a medicine, and is also the source of a dye. The extracts and the compounds isolated from Niruris indica had shown a wide spectrum of pharmacological activities including anti-viral, anti-bacterial, anti-inflammatory, anti- plasmodial, anti-malarial, anti-diabetic, diuretic, hypolipidemic, antioxidant, hepato-protective, nephroprotective and anticancer properties. Many researches report the phytochemical analysis of Niruris indica plant showed the presence of secondary metabolites viz., flavonoids, alkaloids, tannins, saponins, coumarins, polyphenols, terpenoids and steroidal compounds have been identified in the leaf, stem and root of the plant that form the active constituents responsible for the pharmacological activities [7]. Niruris indica has also shown to act as immunomodulator against Covid-19 [8]. The plant has been used for a long period of time (thousands of years) in Ayurvedic traditional medicine for various illnesses [9]. According to the literature, Niruris indica plants are high in antioxidants, vitamins, proteins, carbohydrates, dietary fibres, amino acids, minerals, steroids, alkaloids, antiviral and

antibacterial phytochemicals all of which help to rejuvenate the immune system and effective against many communicable diseases. This herb has been utilized in traditional treatments throughout the world for thousands of years. This plant has been used in more contemporary medicine in recent years. Recent studies have also revealed antidiabetic, antiviral [10] and antioxidant properties of this herbal extract [11] both in vivo and in vitro. It inhibits membrane lipid peroxidation (LPO), scavenges the 1,1-diphenyl-2 picrylhydrazyl (DPPH) radical, and lowers the elevated levels of SGOT and SGPT, all of which have hepatoprotective properties. In a chemical examination of this plant, flavonoids and tannins were discovered, which may be responsible for hepatoprotective effects due to its antioxidant properties [12].

Historical Characters

Niruris indica has been indexed with various names in the bulk of published phytochemical, pharmacological, ethnobotanical reviews and research publications to date.

Scientific Classification

Domain: Eukaryota

Kingdom: Plantae

Family: Phyllanthaceae

Order: Malpighiales

Clade:Angiosperms, Eudicots, Rosids

Genus: Phyllanthus

Species: Niruris indica

Latin Name: Niruris indica inn

English Name: Gulf leaf flower

Morphology of Niruris Indica

Niruri is bhumi amla, a weed with small leaves that grows upto two feet tall from the ground. These leaves are arranged in rows and alternate. They have a glacous underside and are membranous and very thin. They have an oval form with a thin base and two stipules. The plant's flowers are little, monoecious flowers that come in pairs. Herbaceous branches grow from it, and light green bark is smooth to touch. The plant has pale green blossoms that are frequently flushed with a red colour tone. The bark is bright green and smooth. The fruit is made up of small, silky capsules that contain seeds. The plant can be found in moderate climates all along the coast of India. It is a plant that can be grown easily and grows in most soils in a full sun or partial shade location. The plant propagates mainly by seed. It reaches a height of 50–70 cm. It produces a large number of pale green flowers that are frequently flushed with crimson. The fruits are seed-filled capsules that are small and silky. Occurs in open localities, waste ground, grassy scrub vegetation and dry deciduous forest, usually on humid, sandy soils, from sea-level up to 1000 m altitude


Figure 1. Niruris indica Plant. Source: Wikipedia

FLORAL CHARACTERS

Flowers are small, axillary and yellowish in colour. Pedicels are short and abundant. Male flowers are 1-3 pedicel led; female flowers are solitary, larger, and erect. Sepals are 5-6, ovate-oblong outer acute, coriaceous with pale margins; disc in both sexes of glands. The stamens are three, sessile on a short column didynamous, and the styles are little and reflexed extremely short. The fruit is dehiscent, minute, globose and capsule-shaped. Strong parallel and transverse ribs run across the seeds.

ADAPTIONS

For its magnificent development, the plant prefers a tropical or subtropical environment with well-drained sandy, loam soil. Like most tropical plants, Niruris indica has evolved various adaptations that allow it to live in a tropical environment. The form of its leaves is one of these adaptations. Niruris indica must be able to shed excess water due to the heavy rains in the rainforests. A "drip tip" is used to do this. The leaves have a pointed form that allows water to easily drain off them. It's critical for Niruris indica to shed this excess of water to prevent fungal and bacterial development. The robust roots of Niruris indica are another essential adaptation. Because its roots are powerful enough to fracture stone, Niruris indica is known as "stonebreaker." For Niruris indica, these exceptionally robust roots are quite useful. When it rains heavily, the roots. keep it attached to the forest floor and prevent it from being carried away. They also allow it to grow in a variety of environments. Stonebreaker may utilize its powerful roots to crawl deep below and obtain water in locations where there aren't many rains.

AGRO –TECHNIQUE OR NURSERY TECHNIQUE

Raising Propagules: Seeds are seeded in raised nursery beds following rains in June, and seedlings are later transplanted on ridges in well-planned plots.

Seed Rate and Pretreatment: For producing seedlings for planting on one hectare of

land, around 4 kg seed may be required. Seed should not be pretreated in any way.

PLANTING IN THE FIELD

Fertilizer Application and Land Preparation: The soil should be ploughed,

harrowed, and plucked into a fine tilth. During land preparation, 20 tonnes of farm yard manure (FYM) are used. Farm yard manure is mixed in the soil at a rate of 10 t/ha for nursery beds, together with 100 g each of Azospirillum, Phosphobacter and Trichoderma as a basal medium. Before transplantation, 25-30 t/ha of FYM is administered as a basal medium, together with 2.5 kg Azospirillum and 2.5 kg Phosphobacter.

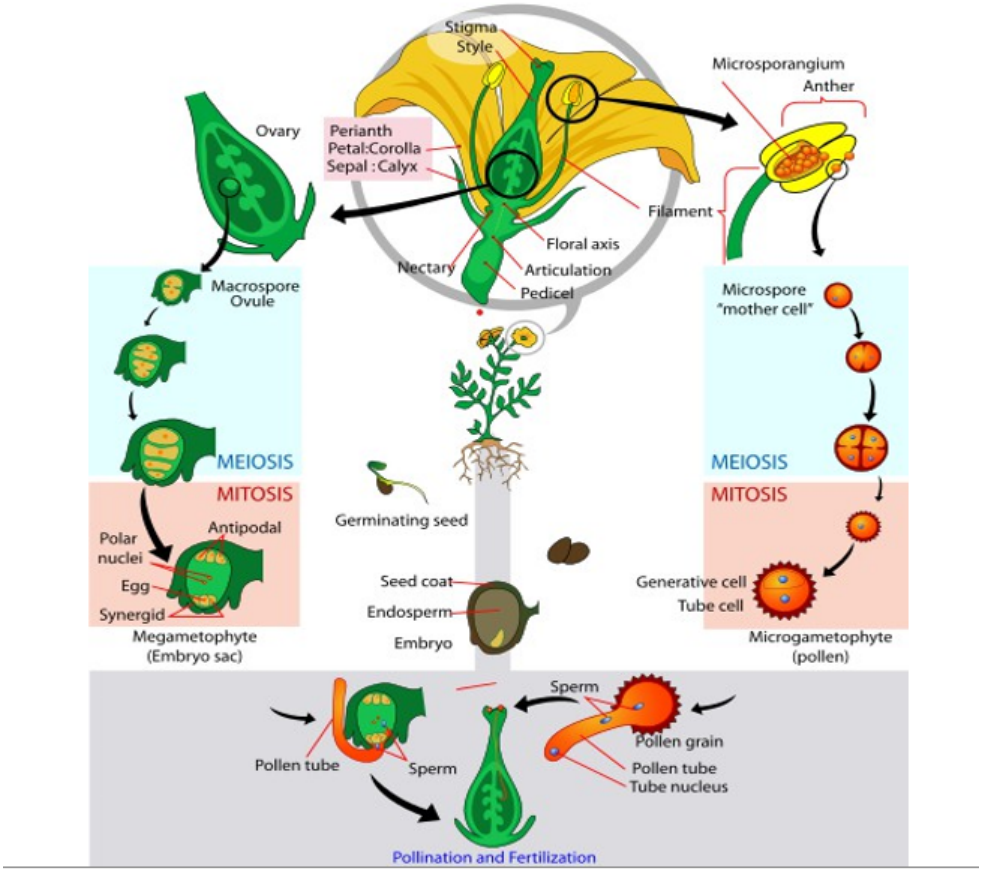

Figure 2. Reproduction in Niruris indica (Sam Zwernik, Organismal Biology)

Transplanting and Optimum Spacing: After the first monsoon shower, 15-20 day old seedlings of 8-10 cm height are transplanted in rows in the field at 30 cm spacing. If it does not rain, the field should be irrigated as soon as possible after transplanting. For a one-hectare area, around 4.0 lac seedlings at a spacing of 25 X 25 cm are required. Niruris indica, like other plants, goes through a generational cycle. The sporophytic (diploid) stage of Stonebreaker's lifecycle is dominating, whereas the gametophyte (haploid) stage is diminished. The flowers are monoecious, which means they have both male and female parts on the same plant. Microspores, which are gametophytes that mature into pollen grains (sperm) during meiosis, are also seen in Niruris indica. Megaspores are also present, which will grow into female parts through meiosis. The microsporangium forms microspores on the anther of each flower,

which are transferred to the ovule in the megasporangium through wind pollination or cross-pollination with insects. The two gametophytes merge together after pollination to generate a diploid zygote. The zygote matures into an embryo, which is enclosed in a seed with a food supply. The embryo will go through mitosis until Niruris indica reaches adulthood after the seed germinates.

CHEMICAL CONSTITUENTS

The plant consist many of the active constituents that are attributed biologically active lignans, glycosides, flavonoids, alkaloids, ellagitananis, phenyl proponoids, amarin, gernanin, corilagin found in the leaves, stem and root of the plant showing wide spectrum of pharmacological activities including antiviral, antibacterial, antiplasmodial, anti-inflammatory, antimalarial, antimicrobial, anticancer, antidiabetic, hypolipidemic, antioxidant, antigonococcal, hepatoprotective, nephroprotective and diuretic capabilities. In a number of studies over the last 30 years, there have been more than 50 compounds identified from all most all parts of this plant, including classes of flavonoids, terpenes, coumarins, lignans, tannins, saponins and alkaloids [13]. Among all the constituents, alkaloids, lignans, terpenes and tannins are the most abundant compounds contained in this plant. Common lipids, sterols and flavonoids also occur in the plant. Niranthin nirtetralin phyltetralin is isolated from leaves, Kaemferol-4 rhamnopyranocyte and criodictol-7 rhamnopyranoside, lup 20(29)-en-3 beta-ol and its acetates are extracted from roots.

MECHANISM OF ACTION OF THE ISOLATED COMPOUNDS

Despite the vast spectrum of medicinal activity of Niruris indica crude extracts and the large number of secondary metabolites discovered in this plant, there are only a few papers that describe the mechanism of action of the medicinal compounds isolated from this plant known to date.

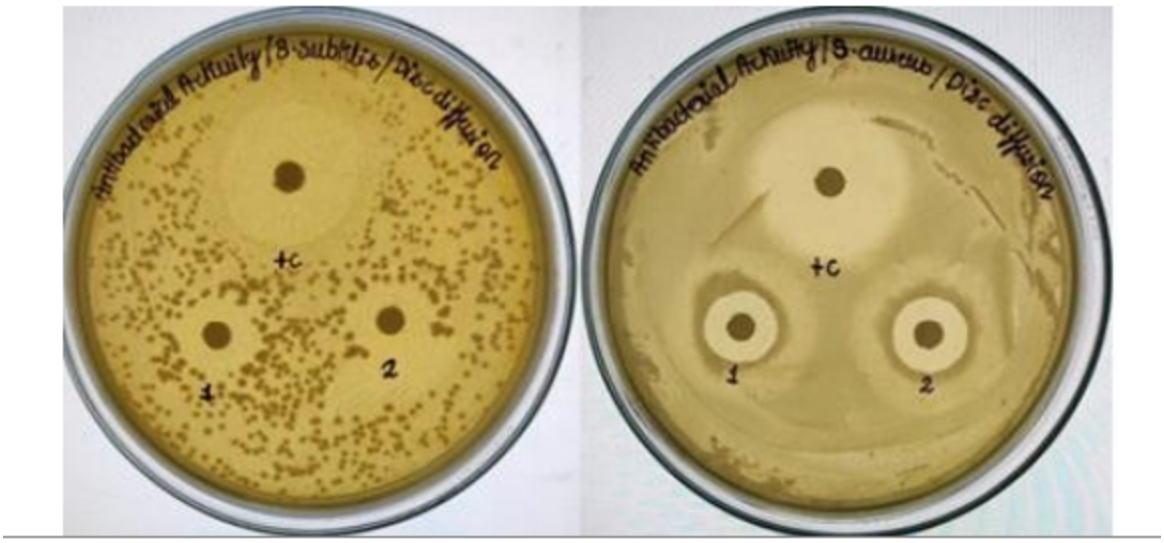

Figure 3. Antibacterial activity of extract of Niruris indica against bacteria Source: Singh & Ahmad 2020.

The isolated compounds were also evaluated for their antimicrobial potential against bacteria and fungi [14]. The overall result showed the presence of potent bioactive compounds in extracts of Niruris indica, such as quercetine, rutin, phyllanthin, and ellagic acid. The extract also showed effective antimicrobial potential against both bacteria and fungi. The presence of such essential phytochemicals in the extract is the reason behind its historical and traditional use in medicines.

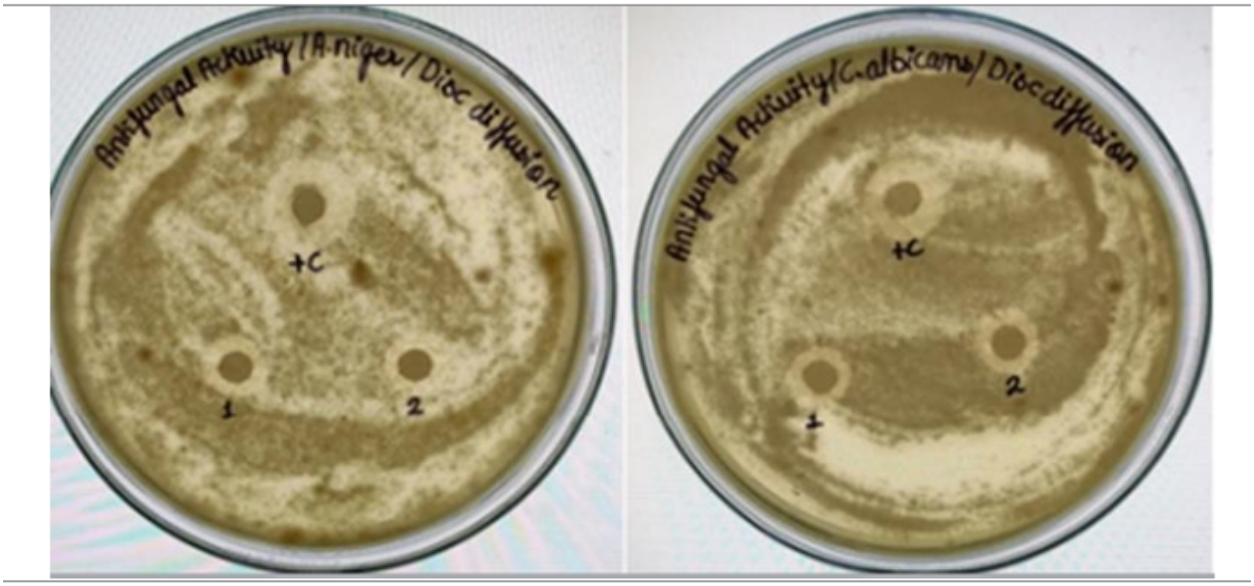

Figure 4. Antifungal activity of extract of Niruris indica against fungi Source: Singh & Ahmad 2020

MEDICINAL PROPERTIES AND USES

Rasa (Taste) – Tikta (bitter), Kashaya (Astringent), Madhura (Sweet) Guna (qualities) - Laghu (Light for digestion), Ruksha (Dry in Nature) Veerya (Potency) - Sheeta (Cold)

Vipaka (After digestion taste conversion) - Madhura (Undergoes sweet taste after digestion)

Karma (actions) - Kaphapitta Shamaka (Reduces Kapha and Pitta dosha)

NIRURIS INDICA HAS NUMEROUS HEALTH ADVANTAGES (ACCORDING TO AYURVEDA).

- Pandu- The herb is very effective for anemic patients
- Raktapitta- bhumi Amla is beneficial in bleeding disorders like heavy periods & nasal bleeding etc
- Visha- Effective herb in toxic conditions
- Rochani- Bhumi Amla improves taste and beneficial in excessive thirst condition
- Kaphaja Kushta- In all types of skin diseases the herb is beneficial
- Trushna- Not only in anorexia but also beneficial in excessive thirst condition
- Swasha- Effective herb for asthma and chronic respiratory disorder patients
- Daha- Give effective results in burning sensation problems
- Kasa- Bhumi Amla is used in cough and cold problem
- Hidhma- helps to get rid of hiccups

MEDICINAL USES

Phyllanthus has been used in Indian Ayurvedic system of medicine for over 2,000 years and has a wide number of traditional uses. Seed is an important part of the plant which is used in the problems of stomach, genitourinary system, liver, kidney and spleen. It is bitter, astringent, stomachic, diuretic, febrifuge and antiseptic. The whole plant is used in gonorrhea, menorrhagia and other genital infections. It is useful in hepatitis C virus by inhibiting viral entry and replication. Furthermore, in silico screening against COVID-19 was performed by analyzing the activity of phyllanthin and hypophyllanthin from Niruris indica by inhibiting the spike glycoprotein (6LZG) and major protease (5R7Y), both of which are COVID-19 target receptors [15].

Table 1. Antimicrobial Activity of Niruris indica

Extract	Effect	Part used	References
Ethanolic	Inhibit the growth of microorganism	Plant	19
Alkaloids	Increase concentration of WBC, neutrophils and decreased hemoglobin, lymphocytes	Plant	20
Alkaloids	65% growth inhibition in mycoplasma galisepticum	30% Plant	21
Hydro alcoholic	Noncompetitive urease inhibition	Plant	22
Ethanolic	Effective against E.coli, staphylococcus	Plant	23
Ethanolic and aqueous	Inhibitory activity against gram positive	Plant	24
Ethanolic	Inhibited the growth of HBV – infected HepG2/C3A cells	Plant, leaves	08
Alkaloid	Inhibitory effect on HIV -1 replication	Plant	22
Source. Chandana G etal.			

Table 2. List Plants Identified From Leaves And Fruit Part Of Phyllanthus Nirui Through Comparison With A. Thaliana Database

Label	Protein	pI	MW	Accession No
1	Ribonucleo protein	4.66	29181	Q92UU4
2	Ribulose Bisphosphate carboxylase small chain	6.07	17609	P99057
3	Nucleoside diphosphate kinase 1	6.19	19999	P39207
4	Vegetative storage protein	6.47	29849	082122
Source. Ainul Mardhiah Mohd Nail & Noor Hasniza Md Zin, 2015.				

Another clinical evaluation result shows that Niruris indica has a low toxicity and no genotoxic or cytotoxic potential in bone marrow cells, as well as chemo protective effects againstgastropathy, diarrhoea, dysentery, intermittent fevers, ophthalmopathy, scabies, ulcers and wounds. Recent studies shows that Niruris indica is an immunomodulator and also reports to possess an antiviral activity

against several RNA viruses, such as hepatitis B and cyclophosphamide-induced damage. This supports the use of the plant as a medicine in human doses [16]. Another report revealed that silver nanoparticles mediated by Niruris indica were followed by antioxidant activity as measured by DPPH activity and antibacterial activity against the pathogen lactobacillus, S. mutans, C. albicans showed a significant activity with very high potency [17]. The antimicrobial activity of this compound has been investigated in vitro, in vivo, and in humans. In rabbits infected with E.coli, in- vivo investigations revealed increased WBC, neutrophils, and decreased haemoglobin, lymphocytes infected with E.coli, but no changes in enzyme concentration when given Niruris indica as a dose to overcome antibacterial action [18].

GENOMIC AND PROTEOMIC INFORMATION

The book chapter includes research from 1980 to 2021 that is available on PubMed about

Niruris indica's evidence-based medicinal potential. The proteomic part of P.niruri was studied to determine the bioactive peptides that is responsible for specific characteristics. Based on the literature little study has been done focusing on the proteomics of Niruris indica and information about bioactive peptides or proteins from this medicinal plant is yet to be established. Furthermore, genomic, proteomic, and metabolomic fingerprinting studies of Niruris indica are required to investigate bioconsitituents' functions in the treatment of various disorders.

RESEARCH GAP

Due to a lack of research, there is insufficient evidence of its safety and effectiveness. However, little research supports any of these uses. Further research can confirm whether the plant has this effect in humans. However, researchers will need to further explore the effects in live animals and humans before drawing conclusions. Mechanisms research is expected to pave the path for the development of new drugs with better and more fascinating pharmacological effects. There is limited information about adverse effects of Niruris indica. This is due to a lack of research in humans so far, nearly all the relevant studies have been in rodents or cell cultures. The scant research that exists has largely involved animals or cell cultures. It is not possible to guarantee the effectiveness or safety of Niruris indica until scientists conduct more research in humans, focus of our future investigation.

Conclusion

Natural products have shown to be a rich source of medicinal chemicals in the field of medication discovery and development. In the last 30 years, a large number of novel natural-derived drugs have been found, primarily as a result of intensive research done by pharmaceutical companies and researchers. Niruris indica is a small herb that has a long history of being used to treat a wide range of ailments since from ancient times and it is used widely across the world. Some of the medical uses have been demonstrated in experimental settings, implying that the plant's extracts have a variety of pharmacological activities. As a result, a lot of research initiatives have been undertaken in order to learn more about the pharmacological activity of Niruris indica, resulting in a huge number of papers referencing its pharmacological effect. However, the plant's numerous contents have yet to be properly explored, particularly in terms of the biological activity of the chemicals. Nonetheless, the plant's diverse contents have yet to be thoroughly investigated, particularly in terms of the nature of the compounds'

biological activity. More importantly, despite many years of research on this plant, there have been no reports of side effects or toxicity. Despite the fact that this herb has received a lot of attention, there is still a lot of room for more research, particularly into the mechanisms of biological activity of phytochemicals from Niruris indica, with a focus on anti-HIV and other STD diseases. In addition, Niruris indica, and a number of reports have been published mentioning its pharmacological effect, the rich constituents of this plant have yet to be comprehensively studied, particularly in terms of the nature of the biological activities that the compounds have, the rich constituents of this plant have yet to be comprehensively studied. Consolidation of scientific evidence and relevant knowledge gaps must be addressed in order to permit more targeted future study on this species. Incorporating such an important plant into herbal drug formulations may boost therapeutic effectiveness, according to the literature and study findings.

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