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A pharmacotherapeutic screening of *Artemisia vulgaris* whole plant: A brief review

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Abstract
The common mugwort, or *Artemisia vulgaris* L., is a species that has played a significant role in the history of medicine. Mugwort (*Artemisia vulgaris* L.), essential oil has a variety of uses, including as an insect repellent, antioxidant, antibacterial, and antifungal. The essential oil of mugwort is discussed in this report along with its botanical properties, medical applications, and possible usage in medicine. The main focus of this report is on the botanical description, holistic approaches, ethno medical uses, phytochemical screening, and reported *in vitro*/*in vivo* pharmacological activities of *A. vulgaris* whole plant. In order to learn about this plant's previously unknown ethno medicinal uses and give scientists new insights to enhance their study of this plant, its key phytoconstituents and diversified pharmacology have been fully uncovered. This review emphasises new studies on the chemistry, biological activities, and biotechnological interventions for controlled and continuous synthesis of bioactive chemicals from this plant species.

Keywords: *Artemisia vulgaris*, mugwort, phytochemistry, phytochemicals, biological properties, essential oils

Introduction
Medicine is a substance that has nutritive, curative or preventive properties. The term 'Herbal' refers to a botanical or plant based preparation hence, the plant based substance that consist of nutritive, curative or preventive is known as Herbal Medicine. Herbal medicine is consist of all fields like botany, medicinal plant, research, pharmacognosy, phytochemical, physiotherapy, botanical medicine, Ayurveda, natural chemistry, agriculture science, unnani medicine, Biotechnology and Biochemistry etc. The herbal medicine is deals with the use of plant in the treatment of disease [1].The *Artemisia vulgaris* known as *mugwort*. It is a species with great importance in the history. It is also called as "Mother of Herbs". The *Artemisia vulgaaris* herbs are used as raw material.in *Artemisia vulgaaris* there have many constituents. The Mugwort is native from Europe, Asia, North and South America and Africa. The phytochemical screening show various materials like saponins, glycosides, flavonoids, protein, triterpenoids in leave extract and ascorbic acid is also present. The world health organization conduct a survey and reported the around 80% humans were depends upon traditional medicine. The mugwort plant is also found in the hills of India and it has very unique medicinal value. The *Artemisia vulgaries* plant is belonging from family asteraceae and from genus species. They are belonging from the kingdom Plantae. The mug worth is found in foods and drinks and common ingredients in Chinese, Japanese, and Korean traditional medicine [2].

Botanical characteristics
The *Artemisia vulgaris* shows very high morphological variability depending on occurrence place. The authors found one population bad hairy streams and light green leaves and each leaves with deep notches and that are collected from other ports. *Artemisia vulgaris* is a herbaceous plant. The length of plant is 2.5m and width is 75 cm. it is characteristic released when leaves are crushed and the taste is spicy. The plant have many small, fibrous, lateral roots and also has thick main root. The roots are light brown in color and they are up to 1 cm. They are on the upper layer of soil and 7-18 cm depth forming the vast network at underground level. The streams of plant are slightly wavy, straight or branched having brown color at the lower end. The plant become woody in age appearing green further up and purple at the top. Some streams of plant are hairy. The leaves of plant are 5-10 cm long. The color of leaves at dorsal side is dark green color and the ventral side is whitish in color. In Europe the plant flowering period is from July to September [3].

Fig 1: *Artemisia vulgaris* Plant

Phytochemical Characteristics

A. vulgaris contains Sesquiterpenoid lactones, flavonoids, coumarins, phenolic acids, sterols, polyacetylenes, carotenoids, vitamins, and cyanogenic glycosides are just a few of the several chemical. Another significant component of the plant is essential oil. It is challenging to identify a distinctive phytochemical profile for *A. vulgaris* because of the considerable intraspecific variability and variations in the chemical composition of the plant as determined by utilizing different test methods [4, 5]. Sesquiterpenoid lactones, including psilostachyin, psilostachyin C, and vulgarin (Figure 1.2), are present in this species, and artemisinin has also been also found. Additionally, the presence of flavonoids, including coumarin, quercetin, and kaempferol derivatives, esculin, umbelliferone, and scopoletin are some of the chemicals that make the plant unique [6]. An intriguing feature of *A. vulgaris* is the presence of essential oil. Monoterpenoids (72%) and sesquiterpenoids (26%), which make up a large portion of the oil derived from the aerial portions [7]. The following are the most often found volatile compounds: Caryophyllene oxide, 1,8-cineole, sabinene, camphor, camphene, α-thujone, and β–thujone [8, 9].

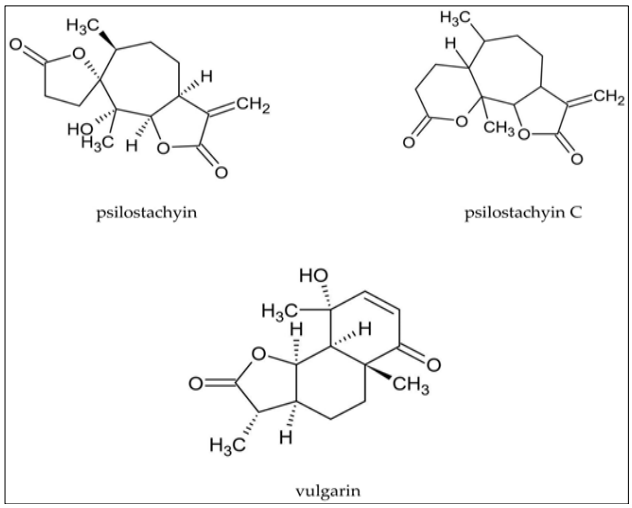

Fig 1: Chemical structure of sesquiterpenoid lactone characteristic of *A. vulgaris*

Plant Profile: *Artemisia vulgaris*

Kingdom	:	Plantae
Order	:	Asterales
Family	:	Asteraceae
Genus	:	Artemisia
Species	:	*Artemisia vulgaris*
Binomial Name	:	*Artemisia vulgaris* [10].

Chemical Constituents

Brazilian *A. vulgaris* leaves were used to extract the essential oil, which was then subjected to GC-MC chromatography (0.5%,V/V) analysis. The researcher studied that the acquired result shows that 18 chemical compound was found with their Refractive Index (RI*) and percentage concentration.

Table 1.1: Chemical Composition of *Artemsia vulgaris*

Sr. No.	Compound	RI*	% CONC.
1	Borneol	1173	6.80
2	Bornyl Acetate	1287	1.46
3	Lovandulyl acetate	1298	2.83
4	Caryophyllene	1420	37.45
5	Humulene	1455	13.66
6	Germacerene D	1482	16.17
7	α Farnesene	1510	3.11
8	Δ – Cadinene	1524	1.23
9	Epiglobulol	1530	0.58
10	Germacerene B	1558	1.39
11	Nerolidol acetate	1570	0.49
12	Germacerene-D-4-ol	1576	0.93
13	Caryophyllene oxide	1583	5.67
14	Viridiflorol	1592	0.48
15	Isoaromadendrene epoxide	1606	2.17
16	Longipinocarveol –trans	1634	0.65
17	α – Cadinol	1655	1.99
18	Phytol	2112	2.94

Which made up to 100% of all components found were present in the chromatogram caryophyllene had the highest content of the compounds (37.5%) followed by germacrene – D (16.17%) and humulene (13.66%). Essential oils from *Artemisia vulgaris* are chemically composed (%). A naturally occurring bicyclic sesquiterpene called caryophyllene (also known as caryophyllene) is frequently present in several essential oils, such as clove, rosemary and cannbis. The substance is frequently combined with isocaryophyllene and humulene s essential oils. Caryophyllene is mostly utilized in chewing gum, soap, detergents, creams or lotions, food goods a drinks as a flavoring or aroma enhancer. Both an aesthetic and anti-inflammatory properties are known to exist in it. According to rasmann and colleagues, the torasmann and colleagues, the sesquiterpene olefin (E) b- caryophyllene is crucial to several distinct pathways of induced defences against herivores. In defense mechanisms against pathogens like *Pseudomonas aeruginosa* Bacteria and bacillus subtilis, caryophyllene can act as an antimicrobial agent. Additionally it is said that caryophyllene [11, 12]

Pharmacological properties of bioactive of *Artemisia* and their potential mechanism of action:

Some plants are now used as standard treatments for a number of diseases. Artemisia species Plants have been used to treat some infectious diseases since ancient times. An enormous amount of focus has been placed on extracts and biologically active compounds isolated from plant species used in herbal medicine due to the negative side effects and pathogenic microorganism resistance to antibiotics and the majority of drugs on the market. A significant perennial shrubby plant Artemisia species has long been used to treat a variety of illnesses [13].

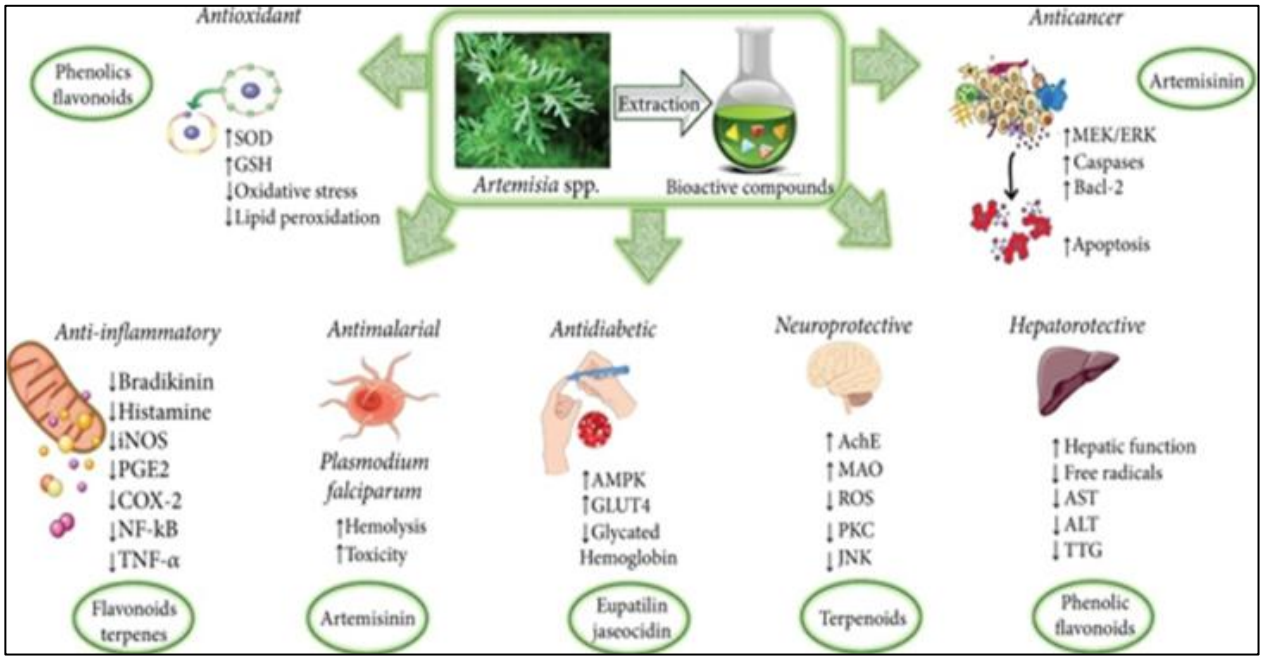

Fig 1.3: Pharmacological properties of bioactive of Artemisia and their potential mechanism of action.

Table 2.2: Extraction of oil from different origin and parts of Mugwort (*Artemisia vulgaris*) [14].

Origin/ Parts	Procedure	Equipment	Yield%
China/Leaves stems	Hydro distillation	Clevenger	-
Sebia/Leaves stem	Hydro distillation	Clevenger	-
North Lithuania/aerial parts	Hydrodistillation with hexane diethyl ether combination	-	0.2-0.4
Turkey/Aerial parts	Hydrodistillation	Clevenger	0.40
Italy/aerial parts	Hydrodistillation	Likens-Nickerson appratus	-
Iran/Aerial parts	Steam distillation	Clevenger	1.4
Nepal/Leaves	Steam distillation	Clevenger	-
Cuba/aerial parts	Hydrodistillation	Clevenger	0.1
Indian/aerial parts	Hydrodistillation	Clevenger	0.16-0.5
Vietnam/aerial parts	Hydrodistillation	Clevenger	0.32-1.14
Indian/stem	Hydrodistillation	Clevenger	-
Iran/aerial parts	Hydrodistillation	Clevenger	0.25

Some of the biological activities of plant

The antimicrobial effect

The reviews demonstrated that**,** by micro dilution in BHI broth, the antimicrobial activity of *A. vulgaris* essential oil was determined and expressed as Minimum Inhibitory Concentration (MIC), Minimum Bactericidal Concentration (MBC), and Minimum Fungicidal Concentration (MCF). The essential oil's *MIC Escherichia coli* ATCC 25922, *Staphylococcus aureus* (ATCC 25923), and *Candida* all contain *A. vulgaris* leaves. The dilution titres of albicans ATCC 90028 were found to be 1:64, 1:16, and 1:32, respectively. MIC is seen as the lowest concentrations for identifying bacteria' susceptibility to antimicrobial and is used to assess how well the other susceptibility testing techniques perform. By sub-culturing to agar plates media that do not contain the test agent, it can be determined via MIC studies **[14]**. MFC titer values for *C. albicans* were 1:8. The results showed that the inhibitors had varying degrees of inhibition against *C. albicans, S. aureus,* and *E. coli*. The increase in concentration of the essential oil extracted from *A. vulgaris* leaves made the antimicrobial activity obvious. According to reports, *A. vulgaris* essential oil had the least amount of bactericidal potential for *E. coli* [15].

The anti-oxidant effect

The reviews said that, In Egypt the scientist evaluated first time for an antioxidant effect in 2008, firstly they for aq. extract of herbs. *A. vulgaris* exhibits anti-oxidant activity and it is helpful to treat oxidative stress releated diseases **[2]**.Utilizing DPPH radical scavenging and reducing power activities, the essential oil and methanol extract of *A. vulgaris* and *G. fragrantissima* were evaluated for their antioxidant properties. The DPPH radicals were found to be effectively scavenged by the crude methanol extract of A. vulgaris. It was discovered that the DPPH radical scavenging abilities depended on concentration. At 20, 40, 60, 80, and 100 g/mL of methanol extract, the *A. vulgaris* was found to have inhibition levels of 33.12%, 43.47%, 56.40%, 68.27%, and 82.80%, respectively. With a rise in extract concentration, it was discovered that the percentage inhibition of this radical rose. At 20 g/mL, ascorbic acid inhibited methanol extracts of *A. vulgaris* and *G. fragrantissima* by 33.12% and 25.34%, respectively. Larger antioxidant activity results from a higher scavenging capacity. Ascorbic acid was found to have an IC50 value of 35.05 0.11 g/mL, while the methanolic extracts of *A. vulgaris* and *G. fragrantissima* had values of 48.77 0.11 g/mL and 65.02 0.12 g/mL, respectively. Results showed that the methanol extract of *A. vulgaris* had the highest antioxidant activities. Similar to this, it was discovered that the IC50 values for the essential oils of *A. vulgaris* and *G. fragrantissima* were (63.82 0.08 g/mL) and (78.09 0.13 g/mL), respectively **[15]**.

The hypolipemic effect

The review demonstrated that, an extract made from the root of A. vulgaris. They looked at the rats whose hyperlipidemia had been brought on by being given a high-fat diet for 30 days. The rodents were fed a typical diet for the following month. The group discovered that there was a sizable lipid profile-normalizing activity in the *A. vulgaris* root extract. Total cholesterol (TC) was decreased to 180 mg/dL, triglycerides (TG) to 147.2 mg/dL, low-density lipoprotein (LDL) cholesterol was decreased to 126.3 mg/dL, and very low-density lipoprotein (VLDL) cholesterol was decreased to 28.2 mg/dL, while the levels of high-density lipoprotein (HDL) cholesterol and atherogenicity indicator (AI) increased to 68 and 2.Rats were given an 8-week high-fat diet that contained 3% cholesterol in oleic oil to cause hypercholesterolemia[16]. In contrast to the healthy control group, this resulted in a significant rise in the serum levels of triglycerides, TC, LDL cholesterol, malondialdehyde, NO, and tumor necrosis factor and a significant fall in the levels of HDL cholesterol, the liver enzyme hydroxymethylglutaryl-CoA reductase, and the enzyme paraoxonase-1. In contrast to animals given a high-fat diet, rats given an extract of *A. vulgaris* at a dose of 100 mg/kg per day for four weeks had their serum lipid profiles normalized, their paraoxonase-1 activity significantly increased, and their levels of malondialdehyde, NO, and tumour necrosis factor- decreased. In addition, the extract reduced the activity of hydroxymethylglutaryl-CoA reductase in comparison to both mice treated with a high-fat diet and control animals [17].

The antispasmodic effect

The reviews says that, the UK scientist studied and prepared the extract from herbs of *A. vulgaris* plant for their amino receptor in smooth muscles of gastrointestinal tract and respiratory tract in Guinean pig. In Brazil the scientist studied antinociceptive activity of *Artemisia vulgaris* and observed antispasmodic effect. The demonstred that mice. With 500 mg/kg hydrorthanolic extract, a 48% or 59% inhibition of abdominal conc. was caused the acetic acid solution [2].According to an *in vivo* investigation; *A. vulgaris* has the ability to relax smooth muscle, which is presumably due to a combination of anticholinergic and Ca2+ antagonist processes [18].

The analgesic effect

According to reviews, the tails flip method, involves exposing a rat tail to hot nicrome wire and measuring the animal's reaction time. The phrase "interval between exposure to heat and the tail flick" defines reaction time. As shown in the prescreened animals were split into five groups. As the conventional medication, 300 mg/kg of acetylsalicylic acid suspended in saline was supplied orally. This method involved taking three consecutive readings for each rat, then taking the mean of those readings to be the individual reading. So, it was possible to determine the average reaction time for each group. During the screening process, animals with reaction times of greater than 10 seconds were disqualified. In the current study, acetylsalicylic acid—a well-known peripheral analgesic—was used as a positive control. The hot-plate test was conducted for a predetermined time of 30 seconds at a set temperature of 550.5 °C. After an 18-hour fast, the animals (each group had six animals) were given oral doses of the plant extract, saline, and acetyl salicylic acid. After the extract, standard medication, and saline had been administered, all of the animals in each group were put on a hot plate for 30 minutes [19].

The antitumor effect

The reviews says that, Artemisinin's anticancer activities have been tested *in vitro* since the date 1980's. Following more through research, it was shown that artemisinins like artesunate were effective against a wide range of unrelated tumor cell lines, including the most prevalent cancers including colon, breast and lung cancer as well as leukemia and pancreatic cancer. Studies have also shown possible broad pathways, such as normalization of the colorectal cancer-associated elevated Wnt/-catenin pathway. Inhibiting the increased angiogenesis linked to tumors is one of the additional mechanisms for anticancer action. Artemisinins decreases the progression of human ovarian cancer by lowering the expression of the VEGF receptor KDR/flk-1 in tumor and endothelial cells [20].

The MAO inhibitory effect

The reviews demonstrated that, in Asia the leaves are used to flavor tea, rice cakes and stuffing. In western cultures, the leaves are used as a culinary herbs for pork and poultry. It is used to support regular menstruation and digestion. Mugwort has been used as an analgesic and an antibacterial in the east. We recently isolated several phenolic compounds from mugwort that have inhibitory activity against monoamine oxidase (MAO) during our hunt for potent MAO inhibitors from various plant materials. Due to its crucial part in the metabolism of monoamine neurotransmitters, MAO is of great pharmacological interest. In the central nervous system as well as in peripheral tissues, MAO catalases the oxidation of endogenous neurotransmitter monoamines and different foreign primary, secondary and tertiary amines.it is well established that a lack of monoamines at key synapses, including norepinephrine, epinephrine, dopamine and serotonin contributes to depression. According to substrate specificity and susceptibility to particular inhibitors, MAO is divided into categories A and B. Some naturally phenolic substances, including xanthones, isocoumarins and flavonoids, have been found to have strong inhibitory effects on mouse brain MAO. In this study, we extracted and identified many phenolic compounds from 80% aqueous ethanol (aq. EtOH) extracts of the entire mugwort plant that inhibited the activity of mouse brain MAO [19].

The antihypertensive effect

The reviews demonstrated that, *Artemisia vulgaris* L. is widely used for its anti-inflammatory properties. After the plates was grown, mature leaves were gathered and cleaned. With distilled water and chloroform, the dried leaves were extracted. Using a Varian unity 500MHz spectrophotometer, NMR data were collected. On a Finnegan MAT 96 high resolution gas chromatograph/mass spectrophotometer with a MAT ICIS operating system, high and low resolution mass spectra were acquired. Two sesquiterpene lactones and a brand-new fragment chemical were produced from the leaves. Male Sprague-Dawley rats were utilized to investigate two partition fractions from water extract and four partition fractions from chloroform extracts using both the in situ mesenteric circulation and the isolated perfused mesentery. 10% w/v solution of the water extracts fractions FGN63-1 and FGN 63-2 of *A. vulgaris* were very effective at countering the hypertensive action brought on by norepinephrine in the isolated perfused rat mesentery, but when administered at

baseline, they had no effect on the regional mesenteric pressures. Injections of 10mg/ml of FGN 63-1 and FGN 64-2, which are chloroform extracts, did not significantly change the baseline blood pressure in the intact rat but were able to counteract the rise in mean systolic and diastolic pressures brought on by norepinephrine [20].

The anti-inflammatory activity

The literature reviews studied, mammal cells and tissues respond locally to damage, infection and chemical or allergic irritation by inducing inflammation. Increased levels of certain endogenous biological substances. Such as nitric oxide (no), reactive oxygen species (ROS), prostaglandin E2 (PGE2), and cytokines are linked to the development of inflammation. Inflammation can be eitheracute or chronic in nature, depending on the stimulus type and the effectiveness of the inflammatory response in eliminating damaged tissue and harmful stimuli. Release of antimicrobial substance and cellular signaling molecules during inflammation is the hallmark of macrophages main defense mechanism. Rheumatism, encephalitis, pneumonia, esophagitis, cancer, cardiac issues, and fibrosis are a few disorders that might develop from the inflated release of cellular mediators by macrophages. Salicylates are currently used to treat pain and inflammation, along with narcotic analgesics like opioids and no steroidal anti-inflammatory medicines like cortisteroids. They do, however harmful unfavorable and poisonous effects have. Additionally, developing a synthetic new medication comes at a very high cost overall. A different approach to solving this issue is to screen possible anti-inflammatory medications with less detrimental effects on natural plant sources [20. 21].

Future Scope

Herbal plants and the derivatives of them play important roles in the creation of contemporary medicines, as has been well-documented. The natural resources used in the creation of new medications are medicinal plants. Despite the previous two to three decades' worth of fruitful drug development research with medicinal plants, future efforts still face numerous obstacles. A major problem for the herbal sector is the standardization of raw materials as the quality of a herbal product is questioned. During growth, processing, and harvest, herbal plants are easily polluted. The biological activities of the *A. vulgaris* raw material proven so far have raised hopes for a renaissance of the interest of contemporary medical world. Hence there is wide scope to formulate the medicine from the active constituent from the plant *Artemisia vulgaris* for the various diseases.

Conclusion

Numerous illnesses have long been treated with *Artemisia vulgaris* L. Additionally, numerous studies using the experimental animal have shown that it has uses beyond those of ethno medicine. Numerous parts of the plant have been studied for their potential pharmacological effects, including antifertility, hepatoprotective, antidiuretic, analgesic and anti-inflammatory, hypolipidemic, antioxidant, antihypertensive, anti-allergic, antispasmodic and anticancer, immunomodulatory, and many more. According to the claims, the presence of atomistic acid, artemisinin B, camphene, camphor, 1,8-cineole, β-caryophyllene, αβ-thujone, germacrene D, quercetin, isohamnetin, and luteolin may be the cause of the various biological effects. The main plant components discussed in this review include hydroxybenzoic acid, rutoside, camphen, 1, 8-cineole, and α-thujone, all of which have biological properties like analgesia, antifungal and antibacterial effects that have been well documented. However, additional research is required to pinpoint the chemical components and understand their mode of action for the alleged ethno medicinal uses. Additionally, it is anticipated that the review will include the most recent knowledge regarding the use of *Artemisia vulgaris* in complementary and alternative medicine.

References

1. https://en.m.wikipedia.org/wiki/Herbal_medicine
2. FarooqAnwar,NaveedAhmad,KhalidM,Alkharfy,Anwar-ul-HassanGilani"Mugwort (*Artemisia vulgaris*) Oils"
3. Halina Ekiert, Joanna Pajor *et al.*, Significance of *Artemisia vulgaris* L. (Common Mugwort) in the History of Medicine and Its Possible Contemporary Applications Substantiated by Phytochemical and Pharmacological Studies, 2020, pg no. 5-6
4. https://www.verywellhealth.com/sherry-christiansen-442791)
5. https://en.m.wikipedia.org/wiki/Mugworthttps://encyclopedia.pub/entry/2750
6. Jitendra Pandey, Sushma Bhusal, Lexman Nepali. Anti-inflammatory Activity of *Artemisia vulgaris* Leaves, Originating from Three Different Altitudes of Nepal. The Scientific World Journal, 2021, Pg no. 2-3.
7. Agnieszka Szopa. *Artemisia vulgaris* L. (common mugwort) Plant Sciences. Pg no- 10-11.
8. Sanjog Kumar Pal, Yogeshwar Shukla. Herbal medicine current status and the future, 2003, Pg no- 1-2
9. The Plant list *Artemisia vulgaris*, The Plant profile For *A. vulgaris*.
10. Deepalisiwan, Dipali Nandave, Mukesh Nandave. *Artemisia vulgaris* Linn: an updated review on its multiple biological activities, 2022, Pg no 1-2.
11. Sonia Malik, Lumillasantos, Silvade Mesquita M. Costa Junior, Chemical profile and Biological activities of essential oil from *Artemisia vulgaris* L- Cultivated in Brazil, 2019, Pg no 4-6.
12. https://static-02.hindawi.com/articles/omcl/volume 2022/5628601/figures/5628601.fig.002.jpg
13. Dheeraj Bisht, Deepak Kumar, Dinesh Kumar. Chellappan, Phytochemistry and pharmacological activity of the genus Artemisia, 2021, Pg no- 5-6.
14. Bishnu Prasad Pandey, Rupak Thapa, Anil Upreti. Chemical composition, antioxidant and antimicrobial activities of essential oil and methanol extract of *Artemisia vulgaris* from collected from Nepal, 2017, Pg no- 7-8.
15. Zainab Zubir, Ismath Shameem, Mohamed Noorul Seyed, Ameen. A Comprehensive Review With Pharmacological Potential of Mother of Herbs-*Artemisia vulgaris* Linn, Pg no- 247
16. Ashok PK, Kumud Upadhyaya. Evaluation of Analgesic and Anti-inflammatory Activities of Aerial Parts of *Artemisia vulgaris* L. in Experimental Animal Models, Journal of Biologically Active Products from Nature, 2013, Pg no 102-103.
17. Sanjeev Krishna, Leyla Bustamante, Henry M. Staines, Artemisinins their growing importance in medicine, 2008, Pg no – 524-525.
18. Sang-Jun Lee, Ha-Yull Chung, In-Kyung Lee. Phenolic with inhibitory activity on mouse Brain Monoamine

Oxidase (MAO) from Whole parts of *Artemisia vulgaris*. 2009;(9):179.
19. Tigno XT *et al*. F de Guzman, AM Flora, Phytochemical analysis and hemodynamic actions of *Artemisia vulgaris*, Pg no: 75.
20. Nurpen Meitei Thangjam, Jasmina Taijong, Awadhesh Kuma. Phytochemical and pharmacological activities of methanol extract of *Artemisia vulgaris* L. leaves Thangjam *et al*. Clinical Phytoscience, 2020, Pg no.6.
21. Antoaneta Trendafilova, Laila Moujir M, Pedro Sousa MC, Ana ML. Seca' Essential oils in food preservation and flavor and safety. Research Advances on Health Effects of Edible *Artemisia* Species and Some Sesquiterpene Lactones Constituents, 2021.