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Review Article

# THERAPEUTIC VALUE OF *ARCTIUM LAPPA* LINN. – A REVIEW

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**ABSTRACT**

*Arctium lappa* (AL) (Burdock) has been used for centuries to treat a variety of ailments. Extracts of burdock root (BR) are found in a variety of herbal preparations, as well as homeopathic remedies. *Arctium* has been used as medicine and health supplement for hundreds of years in Europe, North America, and Asia. It is popular as a medicinal plant in traditional Chinese medicine where it is extensively used for various ailments. In recent years, immense phytochemical and pharmacological screening of *Arctium* has shown tremendous activity against various diseases. The plant has shown biological activity as anti-inflammatory, antiallergic, antidiabetic, antineoplastic, antimutagenic, antiviral, urolytic, antitoxic, antileukemic, hepatoprotective, growth stimulating, mild laxative, mild diuretic, depurative, diaphoretic, antibacterial, antirheumatic, and antipyretic agent. The present review highlights botanical description, distribution, chemical constituents, and the pharmacological effects of AL. The aim of this review is to correlate active principles of the plant to their pharmacological activity and thus explore the potential of AL as a source of therapeutic agents.

**Keywords:** *Arctium lappa* (burdock), Medicine, Pharmacology.

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## INTRODUCTION

With increase in wealth of developed nations, people have become more conscious about health. A lot of money is being spent on food and medicine. For sustainable health benefits and disease treatment with less side effects, people have shifted to the use of natural herbs and remedies. Food and medicine are perceived to be closely linked as both stems from the same origin with different uses and applications. Burdock has been traditionally used in various communities for various ailments such as sore throat, rashes, boils, and skin infections. The aim of this review is to summarize the currently available scientific information with regard to its therapeutic effects, so as to provide a comprehensive overview of this herb. Furthermore, as Burdock is widely growing and could also be easily cultivated, it could provide a cost effective and viable alternative to costly drugs.

## PLANT PROFILE

*Arctium lappa* (AL) Linn., Sp. Pl. 816. 1753.
Family: Asteraceae.
Common name: Burdock.
English Name: Great Burock.
Other Names: Bardana, Beggar's Buttons, Burr, Burrseed, Cockle Burr, Clod-bur, Clot-bur, Cocklebur, Cockle Buttons, Fox's Clote, Gobo, Grass Burdock, Great Burdock, Greater Burdock, Happy Major, Hardock, Harebur, Hare-Lock, Hurrburr, Loppy major, Lopuh, Love Leaves, Thorny Burr, Turkey Burrseed, Turkey-Bur, Thorny Burr [1].
Morphological features: Herbs, 60–120 cm high. Leaves ovate-cordate, usually cottony beneath, sinuate at margins. Heads subcorymbose, glabrous or cottony; peduncle stout.Involucre globose in bud; bracts slender, subulate, hooked at tip, spreading. Corolla and stamen purple. Style white. Achenes grey, mottled with black, angled and ribbed. Pappus c. 2 mm long [2].
Flowering period: July–September.
Part used: Roots, leaves, and seeds.

### Geographical distribution

This species is native to the temperate regions of the old world, from Scandinavia to the Mediterranean, and from the British Isles through Russia, and the Middle East to India, Nepal, Pakistan, Afghanistan, China, Taiwan, and Japan. It is naturalized almost everywhere and is usually found in disturbed areas, especially in soil rich in nitrogen [1].

### Agroecology

Burdock is a cool climate, temperate crop flourishing best at temperatures of 18–28°C in full sun and is frost sensitive. For quality BR, deep profiled and well-drained sandy loam or fresh, worked soil and well-drained soil rich in humus or nitrogen are preferred. Burdock is responsive to nitrogen fertilizers. It prefers a fresh, worked soil, rich in humus, and should be positioned in full sunlight. Propagation is achieved through sowing the seeds midsummer. The harvest occurs 3–4 months after the seeding until late autumn, when the roots become too fibrous [1].

## THERAPEUTICS AND PHARMACOLOGY

### Anti-inflammatory activity

AL extract (ALE) inhibited interleukin-1β (IL-1β) secretion from NLRP3 inflammasome activated bone marrow-derived macrophages.

ALE significantly reduced the LPS-induced increase of plasma IL-1β in the mouse peritonitis model [3]. Arctigenin (ATG) was able to ameliorate LPS-induced inflammation through accumulating myeloid-derived suppressor cells (MDSCs), especially granulocytic MDSCs, and enhancing the immunosuppressive function of MDSCs *in vivo* and *in vitro* [4]. It was found to

significantly suppress the protein expression of vascular cell adhesion molecule (VCAM)-1 in both the aorta and liver (80% reduction) compared to ATHFR-fed mice [5]. Crude polysaccharide fraction (SAA) resulting from aqueous extraction of AL leaves showed a dose-dependent anti-edematogenic activity on carrageenan-induced paw edema, which persisted for up to 48 h [6]. Arctiidilactone (1), a novel rare butyrolactone lignan with a 6-carboxyl-2-pyrone moiety and 11 new butyrolactone lignans (2–12) were isolated from the fruits of AL L., exhibited stronger anti-inflammatory effects than the positive control curcumin [7]. Upregulated NFE2L2. NFκB1, NFκB2, and tumor necrosis factor-α (TNFα) were downregulated by AL [8]. ATG ameliorates colitis through downregulating the differentiation of Th1 and Th17 cells through mTORC1 pathway [9]. AL L. root tea improves the inflammatory status and oxidative stress in patients with knee osteoarthritis [10]. Subcutaneous administration of AL crude extract significantly decreased carrageenan-induced rat edema and carbon tetrachloride ($CCL_4$) induced liver damage [11].

**Anti-tumerogenic activity**

Arctiin down-modulated diverse oncogenic gene products regulated by STAT3, although the induction of apoptosis by arctiin was abrogated on transfection with pMXs-STAT3C in mouse embryonic fibroblast cells. Arctiin also potentiated bortezomib-induced antitumor effects in U266 cells [12]. ATG may serve as an antitumor compound by suppressing the proliferation and migration of retinoblastoma cells, inducing apoptosis, downregulating the protein expression levels of JAG1, and decreasing the activity of the Notch signaling pathway [13]. ATG was able to abolish the arecoline-induced collagen gel contractility, migration, invasion, and wound healing capacities of BMFs and downregulate the myofibroblast characteristics of fBMFs in a dose-dependent manner. Most importantly, the production of transforming growth factor beta (TGF-β) in fBMFs was reduced after exposure to arctigenin, along with the suppression of p-Smad2, α-smooth muscle actin, and type I collagen A1. In addition, arctigenin was shown to diminish the expression of LINC00974, which has been proven to activate TGF-β/Smad signaling for oral fibrogenesis [14]. Both ethyl acetate and ethanolic root extracts exhibited significant morphological changes in Jurkat T cells, including the detachment from adjacent cells, the appearance of apoptotic bodies, and cells shrinkage. The extracts treated cells also displayed an increase in caspase-3/7 activity and alteration in mitochondrial membrane potential [15].

ATG inhibits the growth of various cancer cells such as those of the stomach, lungs, liver, and colon, as well as leukocytes, and regulates numerous intracellular activities, such as antioxidative, anti-inflammatory, and anticancer activities [16]. ATG has an inhibitory activity on mitochondrial complex I. In about half of the patients, transient increase of lactate was observed. ATG inhibition of mitochondrial complex I, plasma lactate concentration, phase I clinical trial of GBS-01, Cori cycle.-NOX2 oxidase-MAPKs signaling pathway [17]. ATG could inhibit liver cancer growth by directly recruiting C/EBPα to the gankyrin promoter. PPARα subsequently bound to C/EBPα, and both had a negative regulatory effect on gankyrin expression [18]. Arctigenin shows preferential cytotoxicity to acidity-tolerant prostate carcinoma PC-3 cells through ROS-mediated mitochondrial damage and the inhibition of PI3K/Akt/mTOR pathway [19]. Arctiin and arctigenin showed strong, time-dependent, cytotoxicity against human hepatoma, and HepG2 cells. ATG cytotoxicity to Chang liver cells was potentiated by BSO, the glutathione synthesis inhibitor [20]. ATG as tumor-specific agent showed cytotoxicity to lung cancer (A549), liver cancer (HepG2), and stomach cancer (KATO III) cells, while no cytotoxicity to several normal cell lines. ATG specifically inhibited the proliferation of cancer cells, which might consequently lead to the induction of apoptosis [21]. ATG and many other chemicals from Arctium were found to have cytotoxic activity against human pancreatic cancer PANC-1 cells in nutrient-deprived medium [22]. Lappaol F from plant AL L. Lappaol F suppressed cancer cell growth in a time- and dose-dependent manner in human cancer cell lines of various tissue types [23]. Six lignans isolated from AL seeds, namely arctigenin, matairesinol, arctiin, (iso) lappaol A, Lappaol C, and Lappaol F were found active against multidrug-resistant cancer cell lines, CaCo2, and CEM/ADR [24]. Dichloromethanic extracts of AL showed selective antiproliferative activity against K562, MCF-7, and 786-0 human cancer cell lines [25]. Aqueous extract of the roots of AL exhibited marked cytotoxic effect on the k562 cell line and lymphocyte at a maximum concentration of 10 mg/ml culture medium [26]. ATG and other lignans isolated from AL fruit. Aliphatic esters (especially n-decanoate) more effective in inducing differentiation of leukemia cell than aromatic esters [27]. ATG, genistein, honokiol, machilin A, and matairesinol inhibit HL6O leukemia cell growth with $IC_{50}$ <100 ng/ml. They reduce incorporation of thymidine, uridine, and leucine [28].

**Antimutagenic activity**

Mutagens are countered by an *Arctium* component of 300,000 MW, which tolerates heat and proteolytic enzymes and is sensitive to $MnCl_2$ [29]. DMBA-induced chromosome damage is reduced by fresh or boiled juice from onion, burdock, eggplant, or cabbage [30]. DIG, a liquid herbal preparation made from a mixture of diluted mother tinctures of *Berberis vulgaris*, *Taraxacum officinale,* and AL, reduced micronuclei levels in mouse erythrocytes and suppressed >80% of DNA strand break [31].

**Anti-viral activity**

ATG (Act) could significantly inhibit the PCV2 proliferation in PK-15 cells [32]. ATG also interferes with the integration of HIV virus [33]. ATG (dibenzylbutyrolactone lignanolide) inhibits HIV-1 integration [34]. ATG and trachelogenin, lignanolides from *Ipomoea cairica* inhibit HIV -1 replication at 500 nM inhibiting topoisomerase II [35].

**Antibacterial activity**

*In vitro* studies showed that Burdock complex treatment significantly inhibited ($p<0.05$) the inflammatory markers and adhesion of *Helicobacter pylori* to AGS cell [36]. The extracts of AL and *A. absinthium* had a significant effect on *Staphylococcus aureus* [37]. Methanol extracts of BR restrained the biofilms ($p<0.05$) on polystyrene and glass surfaces at a biofilm inhibitory concentration of 100 µg/mL [38].

**Anti-osteoclastogenic activity**

ATG significantly suppressed titanium (Ti) particle-induced osteolysis and prevented bone destruction compared with Ti group. ATG inhibited RANKL-induced osteoclastogenesis without any cytotoxicity and suppressed osteoclastic marker genes expression and hydroxyapatite resorption activity in a dose-dependent manner. In addition, arctigenin suppressed receptor activator of nuclear factor κB (NF-κB) ligand-induced NF-κB activation, concomitant with retarded IκBα degradation and inhibition of p65 nuclear translocation, leading to impaired osteoclastogenesis [39].

**Hypoglycemic activity**

Experiments on rats with diabetes mellitus model induced by streptozotocin and high (30%) fat diet showed that the daily treatment with aqueous extracts of great nettle leaves (100 mg/kg) and common BR (25 mg/kg) for a period of 10 days led to a decrease in the glycemic index and triglyceride level and produced protective action on erythrocytes both in animals kept on a fat-rich diet and on the background of a low-caloric ration [40]. Oral administration of BR ethanolic extract (EET) significantly decreased blood glucose and increased insulin level in diabetic rats compared to the control diabetic group [41].

**Anti-influenza activity**

Extracts from AL were found to have a potent effect on influenza [42].

**Hepatoprotective activity**

ATG remarkably reduced the congestion and necroinflammation of livers, and improved hepatic function (ALT and AST) in Concanavalin A (ConA)-induced acute hepatitis *in vivo*. The infiltration of CD4 T, NKT, and macrophages into the livers was found to be reduced with arctigenin treatment. ATG suppressed ConA-induced T lymphocyte proliferation that might have resulted from enhanced IL-10 production by macrophages and CD4 T cells [43]. ATG inhibited OA-induced lipid accumulation, lipid peroxidation, and inflammation in WRL68 hepatocytes, as determined using oil red O staining, thiobarbituric acid reactive substance assay, and inflammation antibody array assays [44]. Total lignans from Fructus Arctii (TLFA) has dual effects of hypoglycemia and weight loss, and administration of TLFA in KKAy mice could decrease fasting blood glucose, glycated hemoglobin, and body weight; improve oral glucose tolerance; increase high-density lipoprotein (HDL) cholesterol; and decrease triglycerides and free-fatty acid in mice serum [45]. Histopathologic examination revealed that the degree of acetaminophen-induced hepatotoxicity was mediated by treatment with ALE [46]. Arctiin protects against acetylaminofluorene induced liver damage in rats [47]. The morphological analysis did not reveal histopathological alterations in liver tissue. Both biochemical and morphological data did not indicate AL toxicity [48].

**Antioxidant activity**

Fractions of AL L. (ALPs)-ALP40-1, ALP60-1, and ALP80-1 exhibited strong scavenging activities on 1,1diphenyl2picryhydrazyl, hydroxyl, and superoxide radicals [49]. AL L. possessed strong antioxidant activity ($IC_{50}$; 0.113±0.007 mg/ml) and exhibited more active than the ascorbic acid ($IC_{50}$; 0.142±0.002 mg/ml). The histological examinations revealed that the coadministration of ethanol and AL extract inhibits the testicular injuries, alterations in superoxide dismutase activity, and $H_2O_2$ and malondialdehyde (MDA) levels were observed in ethanol-treated rats in comparison to the control group [50]. Treatment with the ethanol extract of AL L. roots improved working and reference memory in mice in the Y-maze and passive avoidance tests. The bioactive compound was identified as quinic acid, which is a powerful antioxidant agent [51]. Arctii phenolic glycoside A exhibited stronger antioxidant activity than the positive control of ascorbic acid at a concentration of 10 μM [52]. AL L. has some antioxidant on rapeseed oil, peanut oil, butter, and lard [53]. In vitro, antioxidant assays demonstrated that water-soluble polysaccharide (ALP1) possessed moderate $ABTS^+$ scavenging activity, strong hydroxyl radical scavenging activity, and strong ferrous ion chelating activity. In in vivo antioxidant assays, ALP1 administration significantly enhanced antioxidant enzyme activities and total antioxidant capacity, as well as decreased the levels of MDA in both the serum and liver of aging mice [54].

**Neuroprotective activity**

1,5-O-dicaffeoyl-3-O-(4-malic acid methylester)-quinic acid (MQA), extracted from AL L., induced effects in cerebral ischemic injury in rats, by downregulating MDA, glutathione peroxidase, and nitric oxide synthase levels. Treatment with MQA significantly reduced infarcted sections. In addition, caspase-3 and Iba1 protein expression were evaluated with immunohistochemistry, and cortical cell apoptosis was assessed with terminal deoxynucleotidyl transferase UTP nick-end labeling assays [55]. Compound MQA – a natural caffeoylquinic acid derivative isolated from AL L. roots showed neuroprotective effects against hydrogen peroxide ($H_2O_2$)-induced oxidative stress in SH-SY5Y neuroblastoma. Protective effects of MQA against $H_2O_2$-induced apoptosis might be associated with mitochondrial apoptosis, ERK1/2, and AKT/GSK-3β pathway [56].

**Aphrodisiac activity**

Aqueous extract of AL L. roots enhances sexual behavior in male rats. The aphrodisiac effects of the plant extract may be related to the presence of flavonoids, saponins, lignans, and alkaloids, acting through a multitude of central and peripheral mechanisms [57]. Hydroalcoholic extract (300 mg/kg) enhanced sperm viability only in diabetic mice ($p<0.01$). In addition, this dose of extract increased sperm count, luteinizing hormone, follicle-stimulating hormone, and testosterone in nondiabetic animals compared with the control group ($p<0.05$) [58]. Alcoholic extract of AL leaves and pentoxifylline has a significant influence to reduce the side effect of gentamicin infertility. On the other hand, the extract of AL leaves leads to improve the effect of pentoxifylline in enhancement fertility in rats [59].

**Anti-depressant activity**

The behavioral results showed that repeated ATG (ARC) (10, 30mg/kg) administration significantly relieved the antidepressant- and anxiolytic-like effects and repeated ARC administration at the dose of 10 and 30mg/kg could significantly block depressive- and anxiety-like behaviors caused by CMS. Finally, ELISA results showed that ARC administration increased the serum levels of angiogenin, thrombopoietin, and vascular endothelial growth factor [60].

**Anti-ulcerogenic activity**

Oral administration of EET (1, 3, 10, and 30 mg/kg) reduced the gastric lesion area in 29.2%, 41.4%, 59.3%, and 38.5%, respectively, and at 10 mg/kg promoted significant regeneration of the gastric mucosa, which was confirmed by proliferating cell nuclear antigen immunohistochemistry [61]. Antiulcerogenic action of AL L was evaluated in mice at doses of 50, 100, or 200 mg/kg. AL L showed elevated gastroprotective action in all *in vivo* experimental models but did not interfere with gastric secretion [62].

**Anti-colitis activity**

ALP-1, a kind of fructan, could significantly ameliorate the dysregulation of pro-inflammatory cytokines (IL-1β, IL-6, and TNF-α) and anti-inflammatory cytokine (IL-10) caused by colitis. Besides, as compared with the model group, the abundance of *Firmicutes*, Ruminococcaceae, *Lachnospiraceae,* and *Lactobacillus* was significantly increased with ALP-1 treatment. Moreover, ALP-1 could significantly inhibit the levels of *Proteobacteria*, *Alcaligenaceae*, *Staphylococcus,* and *Bacteroidetes* [63]. ATG markedly recovered the loss of intestinal epithelial cells (E-cadherin-positive cells) and decreased the infiltration of neutrophils (MPO-positive cells) and macrophages (CD68-positive cells). ATG could downregulate the expressions of TNF-α, IL-6, MIP-2, MCP-1, MAdCAM-1, intercellular adhesion molecule (ICAM)-1, and VCAM-1 at both protein and mRNA levels in colonic tissue [64].

**Anti-allergic activity**

F-PASA, including both arctigenin and emodin-8-O-β-d-glucoside dose-dependently, inhibited the phosphorylation and expression of proteins that are related to the FcεRI and arachidonate cascades. Consistent with *in vitro* studies, F-PASA from 25 to 100 mg/kg also suppressed IgE/Ag-induced passive cutaneous anaphylaxis (PCA) reaction more than PASA did in mice [65]. The butanol fraction of AL showed potential anti-allergic and anti-inflammatory effects by decreasing β-hexosaminidase release in mast cells and the secretion of IL-4 and IL-5 in Con A-induced T cells [66]. The release of β-hexosaminidase and the production of pro-inflammatory mediators, such as TNF-α and prostaglandin E2 in the cells treated with or without the AL fruit extract showed positive results [67]. Ethanol extract (90%) of AL (ALE, 100 μg/mL) inhibited the degranulation rate by 52.9%, determined by the level of β-hexosaminidase. ALE suppressed PCA in rats and attenuated anaphylaxis and histamine release in mice [68].

**Anti-aging activity**

Lignans arctigenin and matairesinol isolated from AL seeds have been found to have potential use in anti-aging therapies [69].

**Immunomodulatory activity**

ATG (ARG) remarkably increased the expression and secretion of the two cytokines including TNF-α and TGF-β1 in a dose-dependent manner with the concomitant enhancement of phagocytosis, which are the indicators of macrophage activation. ARG also elevated the intracellular reactive oxygen species (ROS) production by activating NOX2-based NADPH oxidase. Furthermore, inhibition of

ROS generation by diphenyliodonium and apocynin significantly suppressed ARG-induced cytokine secretion and phagocytosis increase, indicating the requirement of ROS for the porcine alveolar macrophage activation. In addition, TLR6-My88 excitation, p38 MAPK, and ERK1/2 phosphorylation were all involved in the process. Blocking of TLR6 receptor dramatically attenuated the NOX2 oxidase activation, cytokine secretion and phagocytosis increase. Inhibiting ROS generation almost abolished p38 and ERK1/2 phosphorylation, and the cytokine secretion could also be remarkably reduced by p38 and ERK1/2 inhibitors (SB203580 and UO126) [70]. Immunomodulatory compounds ajoene, arctigenin, β-carotene, curcumin, epigallocatechin-3-gallate, ginsan, glabridin, and quinic acid were found in regulating the immune system potentially applicable in breast cancer treatment through anti-inflammatory (curcumin, arctigenin, glabridin, and ajoene) and lymphocytes activation (β-carotene, epigallocatechin-3-gallate, quinic acid, and ginsan) properties [71]. *Allium sativum*, *Echinacea*, *Curcuma longa*, AL, *Camellia sinensis*, *Panax ginseng*, Flax *Withania somnifera*, *Amoora rohituka*, *Dysoxylum binectariferum,* and *Vaccinium macrocarpon*, seed extracts and juices are used as anti-breast cancer. The volatile oils and extracts of these herbs and plants inhibit the synthesis of mevalonate that lessens the tumor growth and cholesterol synthesis [72]. ATG-treated mice were found to be resistant to autoimmune encephalomyelitis. ATG activates AMPK and inhibits phosphorylated p38, in addition, upregulates PPAR-γ, and finally suppresses ROR-γt [73].

**Hypolipidemic activity**

High-fat diet significantly deteriorated the lipid profile and antioxidant status in Quails (*Coturnix coturnix*) serum. Arctium extracts significantly reverted the changes similar to simvastatin. Aorta lipid profile assessment revealed similar results. Among the different extracts, flavones fraction exerted best protective effects [74].

**Anti-hypertensive activity**

ATG increased the NO production by enhancing the phosphorylation of Akt and eNOS (Ser 1177) and inhibiting the expression of NADPH oxidase in thoracic aorta of SHRs. Data suggested that antihypertensive mechanisms of arctigenin were associated with enhanced eNOS phosphorylation and decreased NADPH oxidase-mediated superoxide anion generation [75].

**Vasodilatory and vasculoprotective activity**

ATG exerts dural effects in preventing SAH-induced vasospasm through upregulating e NOS expression through the PI3K/Akt signaling pathway and attenuate endothelins after SAH. ATG shows therapeutic promise in the treatment of cerebral vasospasm following SAH [76]. Treatment with low or high doses of extract of AL L. (EAL) markedly attenuated plasma levels of triglycerides and augmented plasma levels of HDL in high-fat/cholesterol diet (HFCD)-fed rats. Chronic treatment with EAL markedly reduced impairments of acetylcholine (ACh)-induced relaxation of aortic rings. Furthermore, chronic treatment with EAL significantly lowered systolic blood pressure and maintained smooth and flexible intimal endothelial layers in HFCD-fed rats. Chronic treatment with EAL suppressed upregulation of ICAM-1, VCAM-1, and E-selectin in the aorta. Chronic treatment with EAL also suppressed increases in matrix metalloproteinase-2 expression. These results suggested that EAL can inhibit HFCD-induced vascular inflammation in the rat model [77].

**Renoprotective activity**

ATG (ATG) administration significantly reduced blood glucose, urine albumin excretion, and urine albumin to creatinine ratio, and attenuated renal pathological injury when compared with untreated db/db mice. These changes were accompanied by decreased expression of both ER stress-related markers and caspase 12 levels in the kidneys of db/db mice. *In vitro*, high glucose activated ER stress signal transduction pathway and induced cell apoptosis in HK2 cells, which were blocked by ATG [78]. Treatment with arctiin significantly decreased the levels of 24-h urinary albumin, prevented the sclerosis of glomeruli and effectively restored the glomerular filtration barrier damage by upregulating the expression of nephrin and podocin and downregulating HPSE level [79].

**Anti-constipation activity**

A new pectin (ALP-2) was extracted from the roots of AL L. with the dosages of 200mg/kg and 400mg/kg exhibited strong anti-constipation activity *in vivo*. ALP-2 treated groups could improve small intestinal movement rate and increase the weight of feces significantly in constipation mice [80].

**Urolytic activity**

Kidney stones found to be inhibited in rats by *Verbena*, *Lithospermum*, *Taraxacum*, *Equisetum*, *Arctostaphylos uva-ursi*, *Arctium,* and *Silene*; possibly by some disinfectant action and/or saponins [81].

**Antitoxic activity**

Burdock fiber alleviates toxicity of amaranth in rats [82]. Amaranth inhibition of jejunal sucrase is alleviated by gobo dietary fiber [83]. Bad effects of rancid soyabean oil in the diet prevented by Gobo dietary fiber [84]. Gobo dietary fiber at the 0.04% level prevents sucrase releasing effect of detergent in rat diet. Fecal excretion of toxic furans was stimulated by Burdock [85].

**Anti-odontagic activity**

ALE showed antimicrobial properties which were used herbal medicaments in endodontics [86].

**Growth stimulating activity**

Growth retardation caused by mineral oil ingestion is prevented by including 10% water-insoluble gobo fiber from AL L. or cotton cellulose due to inhibiting absorption in the intestine [85].

**Anti-acne activity**

ALEs were found effective against acne vulgaris [87].

**Antitubercular activity**

AL and *Tussilago farfara* (Asteraceae) extracts were used for activity against *Mycobacterium tuberculosis.* N-hexane extracts of both plants, the ethyl acetate extract of *T. farfara* and the dichloromethane phase derived from the methanol extract of AL displayed antitubercular activity (minimum inhibitory concentrations 62.5 μg/mL) [88].

**Antitussive activity**

AL-R, a dominant polysaccharide component of AL, administered perorally caused a noticeable decrease in parameters characterizing cough-suppressing activity against a mechanically induced cough in adult non-anaesthetized cats. AL-R showed 30.1% inhibition of cough, whereas the most frequently used opioid codeine inhibited it 61.8%, the inhibitory effect of AL-R was higher than that of non-narcotic antitussives dropropizine with 28.3% and prenoxdiazine with 24.7% inhibition of cough reflex [89].

**Contraindications**

Burdock, in some cases, causes allergic contact dermatitis [90]. BR tea sometimes causes anticholinergic poisoning [91]. It caused ophthalmia [92]. Hot aqueous extract of AL inhibits binding of platelet activating factor to rabbit platelets [93]. Besides, the effect of pesticides on the *Arctium* need to be taken into consideration as it has a deleterious effect on the endocrine system of organisms [94]. As AL grows in wastelands and near wetlands, cadmium and mercury poisoning has also been a cause of concern in some Arctium plants and such poisoning effects have already been established in other organisms [95].

## CONCLUSIONS

The present review has shown that AL contains many active ingredients which have therapeutic effects against various ailments. Clinical observations on traditional remedies have shown the efficacy of AL as safer, cheaper, and much effective alternative to other costly

drugs for various ailments. It is expected that further investigations will lead to a better understanding of the mechanism of its action against various ailments as well as potential adverse effects and toxicity of the herb.

**AUTHOR'S CONTRIBUTION**

Gowher Guna participates in data collection, drafting, and revising critically for important intellectual content.

**CONFLICTS OF INTEREST**

The author has none to declare.

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