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Pharmacological effect of Actiumlappa: A review study

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ABSTRACT

Actium lappa in the sunflower family, is a biennial plant, rather tall, reaching as much as 3 cultivated in gardens for its root used as a vegetable native This species is native to the temperate regions of the old world. It has large, alternating, cordiform leaves that have a long petiole and are pubescent on the underside. The aim of this study was to overview its therapeutic effects of this plant. This review article was carried out by searching studies in PubMed, Medline, Web of Science, and IranMedex databases .The initial search strategy identified about 58 references. In this study, 27 studies was accepted for further screening and met all our inclusion criteria [in English, full text, therapeutic effects of Actium lappa and dated mainly from the year 1996 to 2016.The search terms were "Actium lappa", "therapeutic properties", "pharmacological effects". It is commonly used for its antioxidants and antidiabetic, anti-inflammatory effects, anti-cancers, anti-allergic effect, anti-ulcer effect, antitubercular activity, anti-acne, anti-dermal fibroblast, ,anti-sterility, anti-ulcerogenic, ulcerative colitis, angiostrongyliasis effect, gastroprotective activity, hepatoprotective effects, anti-aging effect, anti-austeric activity, cytotoxicity effect. Different medicinal properties of this plantrequire more studies regarding to other unknown properties of this valuable plant.

Keywords: Actiumlappa, Pharmacology, Pharmacognosy, Phytochemicals

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INTRODUCTION

Actium lappa in the sunflower family[1], is a biennial plant, rather tall, reaching as much as 3 m[2] ,cultivated in gardens for its root used as a vegetable native 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 China and Japan, including India. It has large, alternating, cordiform leaves that have a long petiole and are pubescent on the underside [3].The flowers are purple and grouped in globular capitula, united in clusters. It was traditionally used as: Dried burdock roots are used in folk medicine as a diuretic, diaphoretic, and a blood purifying agent. In form of an ingredient in Essiac tea for the alternative treatment of some cancers. As an oily macerate, it is a component of some cosmetics, shampoos and hair care products. The seeds of greater burdock are employed in traditional Chinese medicine particularly for skin conditions and in cold/flu formulas, under the name niubangzi [4].

Chemical constituents

Burdock roots contain mucilage, sulfurous acetylene compounds, polyacetylenes and bitter guaianolide-type constituents. Seeds contain arctigenin, arctiin, and butyrolactonelignans[5].

Anti-allergic effect
The anti-allergic effects of Arctium lappa fruit extract (AFE) and its fermented form (F-AFE) using immunoglobulin E (IgE)-activated RBL-2H3 cells evaluated. These results suggest that arctigenin plays an important role in the anti-allergic effects of F-AFE. F-AFE containing anti-allergic phytochemicals, including arctigenin, inhibited the activation of the FcεRI receptor induced by the antigen-IgE complex. Such effects may provide further information for the development of a Phytomedicine for allergic diseases [1].

Antioxidant effect
The spectrum-effect relationship between the HPLC fingerprint of Arctium lappa root methanol extract and the total antioxidant activity were examined.The spectrum-effect relationship between the HPLC fingerprint of Arctium lappa root methanol extract and the total antioxidant activity were established, the similarity of fingerprint of all samples was above 0.9. Peaks 1, 6, 9, 12 and 14 were principle components of Arctium lappa root for the total antioxidant activity. This method contributes to the fast comprehensive evaluation of quality of Actium lappa root [2].

The reactive oxygen species (ROS) content and nuclear transcription factor-kappa B expression (NF-kappaB) in renal tissue of diabetic rats and the effect of Astragalus and Arctium in combination on them were investigated. Combined use of Astragalus and Arctium may ameliorate the condition of diabetic nephropathy by inhibiting the activation of the ROS-NF-kappaB signal passage [3].

Anti-diabetes
The effects of its hydro alcoholic extract on gonadotropin, testosterone, and sperm parameters in nicotinamide/ streptozotocin-induced diabetic mice was investigated. The results indicate that applied burdock root extract has anti-infertility effects in nondiabetic mice. Hence, this part of the A. lappa plant has an effect on the health of the reproductive system in order to improve diabetic conditions [4].

Anti-ulcer effect
The protection on gastric mucosa against ulcers, rats were treated with fractions from leaf extract prior to ethanol-induced ulcers was investigated. The original fraction obtained as ethanol soluble fraction from hot aqueous extract was able to protect de gastric mucosa, and this effect was retained in the ethyl acetate fraction, obtained from liquid/liquid fractionation [5].

Antitubercular activity
Arctium lappa and Tussilagofarfara extracts for activity against Mycobacterium tuberculosis was examined and the compound(s) responsible for this reputed anti-TB effect was identified. The results provide for the first time some scientific evidence to support, to some extent, the ethno-medicinal use of Arctium lappa and Tussilagofarfara as traditional antitubercular remedies [6].

Hepatoprotective effect
The effects of Arctium lappa (Al) to protect against cadmium damage in the rat liver was determined. The hepatocyte nucleus density reduced in Cd and increased in the Al group. After 56 days, there was no alteration in the Cd group. In Al and CdAl groups, the nuclear proportion increased without cytoplasmic proportion variation, but the sinusoid capillary proportion was reduced. The hepatocyte nucleus density decreased in the Cd group and increased in the Al and CdAl groups. In conclusion, the liver function indicators showed that A. lappa protected the liver against cadmium toxicity damage [7].

Anti-acne
The effectiveness of homeopathic medicine Lappa in treatment of acne vulgaris was determined. Lappa has shown positive effects in the treatment of acne especially of inflammatory type. Further controlled, randomized studies with larger sample size are desirable. Trial is registered at ClinicalTrials.gov Identifier [8].

Anti-dermal fibroblast
The effect of a root extract of burdock on molecular responses in canine dermal fibroblasts with H2O2 stimulation (H group), with burdock treatment (B group) and with H2O2 stimulation and burdock treatment (BH group), using RNAseq technology was analyzed. The result suggested that burdock has implications in cell adhesion and gene

expression with the modulation of Wnt/β catenin signaling and Chondroitin Sulphate Biosynthesis that are particularly important for the wound healing process [9].

Anti-inflammatory

The effect of Burdock root tea on inflammatory markers and oxidative stress indicators in patients with knee osteoarthritis was examined (OA).The results showed that burdock root tea significantly decreased the levels of serum IL-6 ($P = 0.002$), hs-CRP ($P = 0.003$) and malondialdehyde ($P < 0.001$), while the levels of serum TAC ($P < 0.001$) and activities of SOD ($P = 0.009$) were significantly increased. GPX activities increased but not significantly. The results suggested that Arctium lappa L. root tea improves inflammatory status and oxidative stress in patients with knee osteoarthritis [10].

the effects of the lactone sesquiterpene onopordopicrin enriched fraction (ONP fraction) from Arctium lappa in an experimental colitis model induced by 2,4,6 trinitrobenzene sulfonic acid and performed experiments to elucidate the underlying action mechanisms involved in that effect was investigated. The result indicated that the ONP fraction obtained from Arctium lappa exert marked protective effects in acute experimental colitis, confirming and justifying, at least in part, the popular use of this plant to treat gastrointestinal diseases[11].

The anti-inflammatory mechanism of arctigenin was investigated. These results indicated that potent inhibition on NO, TNF-alpha and IL-6, but not COX-2 expression and COX-2 activity, might constitute the anti-inflammatory mechanism of arctigenin. Arctigenin suppressed the overproduction of NO through down-regulation of iNOS expression and iNOS enzymatic activity in LPS-stimulated macrophage [12].

Anti-sterility

the effects of aqueous extract of Arctium lappa L. roots on sexual behavior in normal male rats was investigated. The results of this study demonstrate that aqueous extract of Arctium lappa 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 via a multitude of central and peripheral mechanisms. These results thus support the traditional use of Arctium lappa L. root extract for treating impotence and sterility [13].

Anti-ulcerogenic effect

The mechanisms involved in the anti-ulcerogenic activity of the sesquiterpene onopordopicrin (ONP)-enriched fraction (termed the ONP fraction), obtained from A. lappa leaves, were studied. These results suggest an antisecretory mechanism involved with the antiulcerogenic effect of the ONP fraction. However, only endogenous sulfhydryls play an important role in gastroprotection of the ONP fraction[14].

Anti-ulcerative colitis

the possible protective role of Arctium lappa L. (AL) in a murine model of ulcerative colitis (UC) was evaluated. There were significant differences in mean body weight values and disease activity indices between controls and AL-treated animals. Moreover, the histological findings showed that AL treatment can prevent mucosal edema, submucosal erosions, ulceration, inflammatory cell infiltration and colon damage. In addition, immunohistochemistry analysis showed that the levels of the inflammatory cytokines, IL-6 and TNF-alpha were also decreased in AL-treated groups. It was suggested that AL can prevent intestinal damage and decrease inflammatory cytokines in mice with DSS-induced colitis. Thus, AL could prove to be a useful food for UC[15].

Angiostrongyliasis effect

The effect of betamethasone and Arctium lappa on the evolution of intestinal lesions induced by this parasite was evaluated. The presence of eosinophilic infiltration and granuloma was evaluated (1-mild; 2-moderate; 3-severe). Betamethasone allowed the lesions to evolve into more severe forms, while the extract did not interfere with disease progression. The substances applied were ineffective for protection against the lesions induced by Angiostrongyluscostaricensis in mice. These findings discourage the use of betamethasone and Arctium lappa for humans affected by abdominal angiostrongyliasis[16].

the reactive oxygen species (ROS) content and nuclear transcription factor-kappa B expression (NF-kappaB) in renal tissue of diabetic rats and the effect of Astragalus and Arctium in combination on them was investigated.Combined use of Astragalus and Arctium may ameliorate the condition of diabetic nephropathy by inhibiting the activation of the ROS-NF-kappaB signal passage[3].

Gastroprotective activity
The effect and the possible mechanisms involved in the gastroprotective effects of a chloroform extract (CE) of the roots from A. lappa and its fractions was evaluated. Oral pretreatment with CE (10, 30 and 100 mg kg (-1)) significantly reduced gastric lesions induced by ethanol by 61%, 70% and 76%, respectively. the results show that the CE protects animals from gastric lesions by reducing gastric acid secretion via inhibition of gastric H+, K+ -ATPase[17].

Hepatoprotective effects
In an animal study, the hepatoprotective effects of A. lappa was investigated. it was suggested that A. lappa could protect the liver cells from CCl4 or acetaminophen-induced liver damages, perhaps by its antioxidative effect on hepatocytes, hence eliminating the deleterious effects of toxic metabolites from CCl4 or acetaminophen[18].

The effects of Arctium lappa L. (root) on anti-inflammatory and free radical scavenger activity were investigated. The free radical scavenging activity of its crude extract was also examined by means of an electron spin resonance (ESR) spectrometer. The IC50 of A. lappa extract on superoxide and hydroxyl radical scavenger activity was 2.06 mg/ml and 11.8 mg/ml, respectively. These findings suggest that Arctium lappa possess free radical scavenging activity. The inhibitory effects on carrageenan-induced paw edema and CCl4-induced hepatotoxicity could be due to the scavenging effect of A. lappa[19].

In a study, it was examined that whether a butanol extract of A. lappa (ALBE) had previously unreported anti-allergic or anti-inflammatory effects. These results suggest that ALBE inhibits the expression of IL-4 and IL-5 by downregulating MAPKs and NF-κB activation in ConA-treated splenocytes and supports the hypothesis that ALBE may have beneficial effects in the treatment of allergic diseases, including atopic dermatitis[20].

Anti-aging effect
An active ingredient of this plant with anti-inflammatory (i.e., reduction of interleukin-6 and tumor necrosis factor-alpha) and matrix-stimulating efficacy which improves the clinical signs of skin aging in vivo was screened. Result was shown that topical treatment with a natural A. lappa fruit extract significantly improves the metabolism of the dermal extracellular matrix and leads to a visible wrinkle reduction in vivo. In conclusion, A. lappa fruit extract represents a targeted means to regenerate dermal structures and, thus, offers an effective treatment option for mature skin[21].

The inhibitory effects of AL on degranulation and the release of mediators as well as on inhibition of cys-leukotriene biosynthesis by basophils were investigated. The extract had no effect in this model when administered orally. In conclusion, the active component present in the active HPLC fraction of the AL extract was able to significantly reduce the release of inflammatory mediators through inhibition of degranulation and cys-leukotriene release in vitro. In addition, this active component was able to inhibit acute skin response in mice in vivo, indicating that AL is a very promising natural component for use in anti-allergic treatment[22].

The antioxidant and antiaging properties of the isolated lignans were studied using Caenorhabditiselegans as a relevant animal model. All lignans up-regulated the expression of jnk-1, indicating that lignans may promote the C. elegans longevity and stress resistance through a JNK-1-DAF-16 cascade. Our study reports new antiaging activities of lignans, which might be candidates for developing antiagingagents[23].

Anti-cancer effect
The MDR reversal potential of the isolated lignans and the underlying mechanism of action were studied using two MDR cancer cell lines.it showed that lignans can inhibit the activity of P-gp. Our study provides a first insight into the potential chemosensitizing activity of a series of natural lignans, which might be candidates for developing novel adjuvant anticancer agents[24].

New anticancer constituent, Lappaol F, from plant Arctium Lappa L was evaluated. Lappaol F suppressed cancer cell growth in a time- and dose-dependent manner in human cancer cell lines of various tissue types. Results also demonstrate that Lappaol F exhibited strong growth inhibition of xenograft tumors in nude mice. Lappaol F was well tolerated in treated animals without significant toxicity. Taken together, our results, for the first time, demonstrate that Lappaol F exhibits antitumor activity in vitro and in vivo and has strong potential to be developed as an anticancer therapeutic[25].

Anti-austeric activity

the in vitro preferential cytotoxic activity of these pure compounds and 1:1 mixtures, together with enterodiol and enterolactone against human pancreatic cancer PANC-1 cells in nutrient-deprived medium was evaluated .By comparing their structures and PC50 values, the following structural moieties could be concluded to be important for the preferential cytotoxicity of 1: 1) the 3-hydroxy-4-methoxyphenyl group at the 2-position on the gamma-butyrolactone ring, 2) the less polar substituent at the 3-position on the gamma-butyrolactone ring, and 3) the gamma-butyrolactone ring[26].

Cytotoxicity effect

The cytotoxicity profiles of 364 herbal plant extracts, using various cancer and normal cell lines evaluated. The screening found occurrence of A549 (human lung adenocarcinoma) specific cytotoxicity in nine species of herbal plants, especially in the extract of Arctium lappa L. Moreover, purification of the selective cytotoxicity in the extract of Arctium lappa L. resulted in the identification of arctigenin as tumor specific agent that showed cytotoxicity to lung cancer (A549), liver cancer (HepG2) and stomach cancer (KATO III) cells. this study found that arctigenin was one of cancer specific phytochemicals, and in part responsible for the tumor selective cytotoxicity of the herbal medicine[27].

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