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KAHU (*LACTUCA SATIVA* LINN.): MORPHOLOGY, PHYTOCHEMISTRY AND PHARMACOLOGICAL PROFILE IN UNANI AND MODERN PERSPECTIVE-A REVIEW

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ABSTRACT

Plant origin drugs have played a vital role in the prevention and management of diseases in Unani medicine and it becomes popular day by day due to its low cost and less adverse effect. One such drug is *Kahu* (*Lactuca sativa* L.*)* belong to the Asteraceae family. *Kahu* (*Lactuca sativa* L.) is a popular salad vegetable and consumption of *Kahu* has many health benefits. The garden *Kahu* is considered to have originated in the warmer temperate parts of western Asia, including eastern Mediterranean region. In Unani System of Medicine two species are used, Kahu Bustani (*Lactuca sativa*) and Jangali Kahu (*L. Scariola* L.). It is and important herbal drug and various parts of the drug such as *Barg-i-Kahu* (leaves), *Tukhm-i-Kahu* (seeds), Afiyun Kahu (latex) are used medicinally to alleviate several ailments, such as cough, pruritus, melancholia, mania, jaundice, fever, insomnia, headache, gonorrhoea etc. it is also used as preventive treatment during epidemic /pandemic spread and also play a role of very useful nutritional material. Several activities such as sedative**,** hypoglycaemic, anti-inflammatory, antioxidant have validated. These activities my occur due to the presence of chemical constituents e.g. lectucin,

lectopicrin, hyoscyamine, palmitic acid, stearic acid, arachidic acid, oleic acid, caproic acid etc. *Kahu* can potentially act as a strong traditional herbal drug due to its multiple pharmacological effects and is therefore generating interest in drug discovery and development of formulations. The present review provides a summary of recent knowledge of significant traditional uses, phytochemical, and pharmacological activities of various parts of the plant.

KEYWORDS: *Kahu*, *Lactuca sativa* L., Phytochemistry, Pharmacology, Unani Medicine.

INTRODUCTION

Kahu is an important vegetable, its seeds and latex are used as important source of medicine and known as *Tukhm Kahu* and *Afiyun Kahu* in Unani System of Medicine. It belongs to the composite family, which has 25 species in India.[1] All the species contain milky latex and the dried latex some of them furnishes the drug lactucarium. Its common name Lettuce is derived from Latin word 'Lactus' (milk), because milky fluid flows, when stems broken or cut.[2,3] *Tukhm-e-Kahu* are the seeds of *Lactuca scariola* L. and commonly known as "Wild Lettuce". In ancient Egypt period, Lettuce was first cultivated to produce oil from its seeds. *Lactuca sativa* is a common or garden variety which is cultivated in many parts of India as a cooking vegetable.[4,5] *Barg-e-Kahu, Tukhm-e-Kahu and Afiyun-e-Kahu* have been used for a long time in Unani System of Medicine. Its medicinal properties were described by Hippocrates (460-375 BC) and Dioscorides. The species were described by Theophrastus (371 BC-375 BC). According to Herodotus (426BC-415BC), they were served at the tables of the Persian Kings more than 400 years before the Christian era. Galen (129-216 AD) gave the idea of its general use. Lettuce has had a number of uses in ancient (even some more modern) folk medicine and religious symbol e.g. ancient Egyptians thought lettuce to be a symbol of sexual power[6] and a promoter of love and childbearing in women. The Romans likewise claimed that it increased sexual potency.[7] In contrast, the ancient Greeks connected the plant with male impotency, and served it during funerals (probably due to its role in the myth of Adonis death), and British women in the 19th century believed it would cause infertility and sterility.[7] Arabian Physicians have described it as an important drug (*Bazrul Khas*) in their books as Rabban Tabri in *"Firdausul Hikmat"*, Razi in *"Al-Hawi"*, Ibn Sina in *"Al-Qanoon"* and Majoosi in *"Kamilus Sena'a.*[8,9] Therefore, *Tukhm-e-Kahu Muqashshar* (*Lactuca scariola* Linn. Peeled seeds) has occupied a special place for its medicinal value since centuries in the Middle East and Southeast Asia. It has been traditionally used in the

treatment of a number of ailments related to respiratory, gastrointestinal, hepatic, renal, circular system and general overall well-being. The latex is sometimes used as the substitute for opium which is not as potent as *Papaver somniferum*.[10]

It also has nutritional value and used as important salad vegetable next to tomato.[11] Consumption of Kahu is reported to improve health benefits. Due to its higher dietary fibre content it aids in digestion. Higher beta-carotene and lutein content is decreasing risk of cancer, cataracts and heart disease and stroke.[12] Phenolic compounds *responsible for antioxidant scavenging properties*, carotenoids also shows antioxidant properties.[13] Green and red leaf is better sources for Vitamin A and Beta-carotene.[3] The phytochemical content and composition can vary among different varieties and it is important to choose certain type of varieties are rich in phytochemicals. Kahu is preferably grown in hydroponic system, and the growth rate faster and the yield is higher than a soil grown plant produced under the same conditions. Also uses less water due to the constant reuse of nutrient solution and also decreases risk of soil borne diseases.[14] The latex from Kahu (*Afiyun-e-Kahu*) contains 15 oxalyl and 8 sulfate conjugates of the guaianolide sesquiterpene lactones, lactucin, deoxylactucin and lactucopicrin.[15]

Scientific Classification

Kingdom: Plantae – Plants; *Subkingdom:* Tracheobionta – Vascular plants; *Super-division:* Spermatophyta – Seed plants; *Division:* Magnoliophyta – Flowering plants; *Class:* Magnoliopsida –Dicotyledons; Subclass: Asteridae; Order: Asterales; Family: Asteraceae – Aster family; Genus: Lactuca; Species: 1. *Lactuca sativa* L., 2. *Lactuca scariola* Syn. *L. serriola*.[16]

Vernacular names

Arabic: Bazrul Khas; *Assames:* Noniya; *Bengali:* Kahu, Salad; *Danish:* Laktuk; *Dutch:* Latuw; *English:* Garden Lettuce; *Greek:* Thridox; *Gujrati:* Loni, Ghol, Luni; *Hindi:* Kahu, Salad; *Hungarian:* Kertisalata; *Italian:* Guado, Lattuga; *Malta:* Prickly lettuce, Lettuce, Lattuga, Hass, Salvagga; *Persian:* Tukhm-e-Kahu; *Punjabi:* Kahu; *Roumanian:* Laptuc; *Russian:* Laktuk; *Sind:* Kahu; Sindhi: Lunak; *Spanish:* Lactugalarga, Lechugaromana; *Swedish:* Laktuk; *Tamil:* Sallattu; *Telugu:* Kavu, Shallattu; *Unani:* Kahu Bustani, Salad Pattaa, Salad Baghi; *Urdu:* Khurfa.[10, 17,18,19,20,21,22,23]

Habitat

Lactuca scariola is found at the Western Himalaya from Marri to Kunawar, at an altitude of 6.000 to 11.000 feet. Also found in western Tibet, at altitudes of 9.000 to 12.000 feet and distributed to Siberia and westwards to the British islets and Canaries.[21,22,23] Kahu basically has two varieties based on its occurrence

(i) Kahu Bustaani or Baghi (*Lactuca sativa*), "Garden lettuce" which is a cultivated variety;

(ii) Kahu Sahrai or Jungali (*Lactuca scariola*) wild Lettuce a wild *Sahrai* variety, it has longer and thinner leaves than cultivated variety.[10]

Parts used

Tukhm-e-Kahu (seed); *Roghan-e-Kahu* (oil of lettuce); *Afiyun Kahu* (milky latex) and *Barg-e-Kahu* (leaves) are used medicinally.[10, 17, 26, 25]

Temperament

Tukhm-e-Kahu (seed): Cold and dry in 2nd degree.[10,25,27]; *Barg-e-Kahu* (leaf): Cold and wet in 2nd degree[10,25,27]; *Afiyun Kahu* (exudate): Cold in 1st degree and dry in 4th degree.[25]

MORPHOLOGY

Lactuca sativa L. is an erect, glabrous, annual herb up to 0.5-1.2 m. Height, widely grown for its crisp, highly developed radical leaves which appear before the flowering starts.[1]

Root: thin tap root and an erect stem 30-100cm tall, branched in the upper part.[28]

Leaves: Appearing of salad leaves in December to February[16]

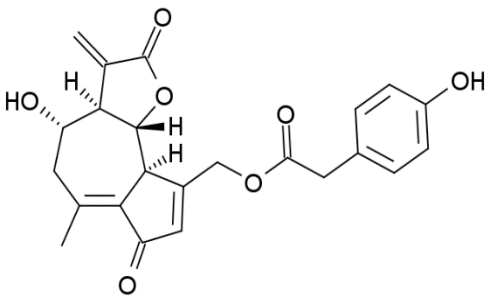
Flower: Flower heads of yellow ray, born on panicle. Achenes dark brown or greyish brown, lenticular-oblong with slender beak and white pappus.[1]

Fruit: Oval oblong compressed often curved, not winged at the edge, with six slender ribs on each face, smooth, pale grey or (black), pappus very white and glistening.[1]

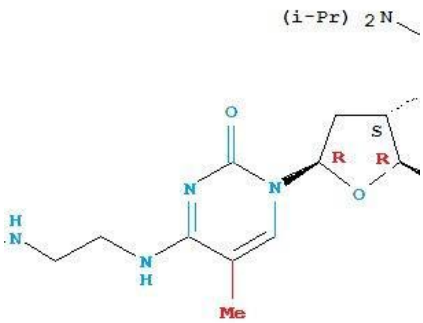
Seeds: Seeds are very small (600-700/g)[2], shiny, tasteless, reddish white or blackish white in colour, the blackish one has less cooling effect.[28]

Latex: All the species contain milky latex.[10]

PHYTOCHEMISTRY: **Organic:** Glycosides, steroids, phenolics, alkaloid (lactucarium, it is mixture of lactocin and three bitter principles lectopicrin, lectucin and lactucic acid), tannins, resin, organic acid (oxalic acid, malic acid, citric acid). *Lactuca sativa* contains antioxidants flavonol, quercetin and caffeic acid, ascorbic acid.[1]



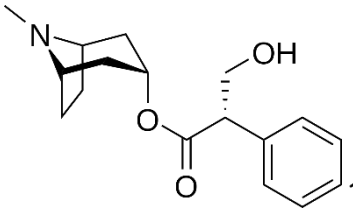
1. lectucin



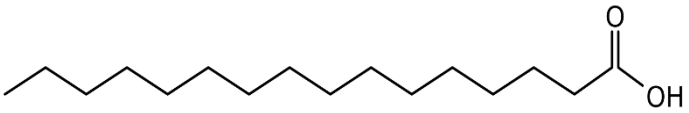
2. lectopicrin

Inorganic: Sodium, potassium, magnesium, iron, copper, chloride, sulphur, and phosphorus, Vitamin A, vitamin B1,vitamin B2, vitamin C, vitamin E, vitamin G, vitamin K, nicotinic acid, folic acid.[1]

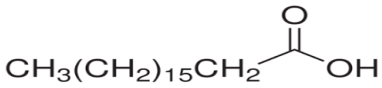
Seeds: Alkaloid (lactucarium, it is mixture of lactocin and three bitter principles Lectucin, lectopicrin and lactucic acid), hyoscyamine, palmatic acid, stearic acid, arachidic acid, oleic acid, linoleic acid, caproic acid.[1]



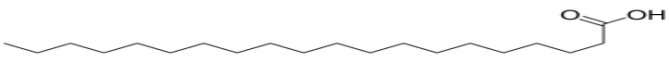
1. Hyoscyamine



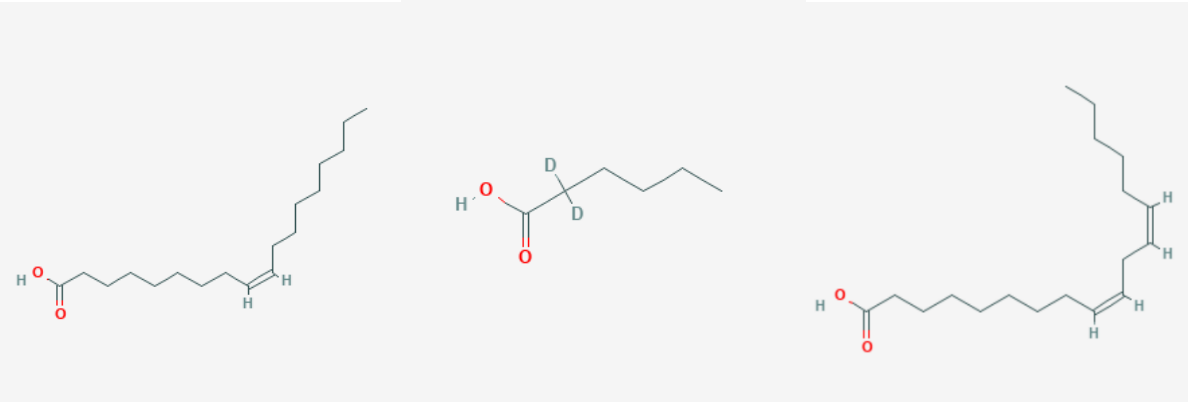
2. Palmitic acid



3. Stearic acid



4. Arachidic acid



5. Oleic acid **6. Caproic acid** **7. Linoleic acid**

Leaves: Starch, sugar, gum, cellulose, lignose, fat, calcium, phosphorus, iodine, florine, thiamine, riboflavin, niacin, carotene.[17, 29]

Roots: Glycosides (lactoside A, lactoside C, macro-cliniside.[29]

Action and Uses

Table 01: Showing action and uses of Kahu according to Unani literature.

Action	Uses
Musakkin (sedative),[30, 31,32,33] *Munawwim* (hypnotic),[8, 9, 34,35,30,31] *Munaffith Balgham* (expectorant),[10,34,36,37,33] *Mubarrid* (refrigerant), *Mudirr-i-Bawl* (diuretic),[19, 10, 35] *Musaffi Khoon* (blood purifier),[38] *Mohallil-i-waram* (resolvent),[10] *Mushtahi* (appetizer),[8, 33] *Mujaffif* (desiccative),[33] *Dafi' Tashannuj* (antispasmodic)[8,19] *Mukhaddir* (anaesthetic),[10, 34, 36, 37] *Muhallil* (anti-inflammatory),[8, 31, 33] *Dafi' Humma* (antipyretic)[19 35, 32,33]	*Sahar* (insomnia),[18,19,10,37,30,33,39] *Suda* (headache),[18,10,34,37,39] *Diq al-Nafas* (asthma), *Khafaqan* (palpitation), *Waj' al-Qalb* (chest pain),[9,36, 37,33] *Warm Sho'b-i-Muzmin* (chronic bronchitis),[31] *Taqtirul Bawl* (dribbling of urine),[34,33] *Sozish-I-Bawl* (burning micturition),[10, 37] *Iltihab-i-Had* (acute inflammation),[8, 31, 33, 39] *Humma* (fever),[35,32] *Nazla Wa Zukam* (cold and coryza),[10, 34, 36, 37, 33] *Ishal* (dysentery),[32] Sunstroke (*Zarbatus Shams*),[39]*Malikhuliya*(melancholia), *Kathrat-i-Ihtilam* (nightfall),[10] *Dafi' Atash* (relief of excessive thirst)[10, 30, 33,34] *Su'al* (cough)[35,31]

Toxicity and adverse effect: Excessive use can cause sexual weakness,[10] *Nisyaan paida karta hai*,[10] Leaves: Urticarial eruption, milk sap: irritant, produce only negative responses when tested for mutagenicity using ames test (*Salmonella typhimurium* TA 100, TA 98).[40]

Correctives: Podeena (*Mentha arvensis*), Karafs (*Apium graveolens*), Mastagi (*Pistacia lentiscus*), Shahad Khalis (pure honey), Zeera Siyah (*Carum carvi*), Ajmood (*Ptycotis ajwan*), Shalgham (*Brassica rapa*), Murabba Haleela (*Terminalia chebula* Jam)[41,42,34].

Taste: Mucilaginous.[22]

Therapeutic dose: Seed**:** 6-12 Masha (1 Masha=1 gm)[10], Leaves juice: 2 to 4 Tola (1 Tola=12gm)[25]; Afiyun Kahu (exudate): 2 Chawal-1 Ratti (Chawal=17gm; Ratti=125mg)[25]

Substitute: Tukhme khashkhash, Damul akhwain, Kasni, Roghane maghz tukhme kaddu, Roghane badam[43]

Compound Formulations

Arqe Kahu, Qurse Tabasheer, Roghane Kahu, Qurse Musallas, Qurse Tabasheer Kafoori,[25, 42] *Roghan Labob Sab'a Barid*, Qurs Ziyabitus, Triyaq Nazla, Qurs Sartan.[42,44] (See **Table 02** for detail).

Table 02L: Showing dose and method of administration and indication of compound formulation having Kahu seeds as one of the important ingredient.

S.N.	Name of compound formulations	Form of compound	Dose and method of administration	Indication
01.	Dimad-i-Mubarrid	Ointment	External use	Refrigerant, analgesic; used in acute meningitis[45]
02.	Habb-i-Mumsik Tilai	Pills	One pill OD (600mg)/orally	It is used in sexual weakness, premature ejaculation and nerve weakness[46]
03.	Habb-i-Nazla	Pills	Pills (500-750mg)/ orally	Analgesic, hypnotic effect it is used in cough, catarrh and insomnia.[47]
04.	Habb-i-Sandal Mutalla	Pills	External use	It has analgesic effect and useful for headache[48]
05.	Habb-i-Sual Musakkin	Pills	2 pills with milk at bed time/orally	Premature ejaculation[49]
06.	Habb-i-Yarqan	Pills	2 pills twice a day/ orally	Due to Qati‘ Safra effect it is used in Jaundice[49]
07.	Itrifal Muqawwi-i-Dimagh	Confection	5-10gm/orally	Due to brain tonic property it is used in chronic cold and cerebral weakness[50]
08.	La‘uq Aab Tarbooz Wala	Confection	10gm thrice a day/ orally	Due to its expectorant property it is used in tuberculosis and dry cough
09.	La‘uq Diq al-Nafas	Confection	10gm/orally	Due to expectorant action it is used in asthma[48]
10.	Ma ‘jun Falaksair	Confection	250-500mg	Due to anaesthetic and sedative effect, this is used in acute pain, premature ejaculation and night fall[45]
11.	Maj‘un Muqawwi-wa-Mumsik	Confection	1.5 gm with milk, before coitus	Due to general tonic, retentive and aphrodisiac properties it is used in premature ejaculation, loss of libido and night fall[46]
12.	Mufarrah Shaikh ur Rais	Confection	5gm/orally	Cardiac tonic effect makes it potent drug for cardiac diseases e.g. Palpitation and cardiac weakness.[46, 48]
13.	Mufarrih Barid	Confection	5-10gm.orally	Nerve tonic, cardiac weakness, palpitation, nerve weakness[45]
14.	Mufarrih Barid Jawahr wala	Confection	5-10gm.orally	General tonic, antipyretic, palpitation, pyrexia due to black bile, tuberculosis[45]
15.	Mufarrih Yaqooti Mo‘tadil	Confection	5gm/orally	Due to tonic effect on vital organs and as a general tonic it is used in cardiac, brain and liver disorders.[46]

16.	Mufarrih Yaquti Barid	Confection	3-5gm.orally	Cardiac tonic; cardiac weakness[45]
17.	Qurs Kafoor	Tablet	4 tablet (775 mg)/ orally	Due to its refrigerant effect it is used in tuberculosis and acute pyrexia[45, 46]
18.	Qurs Munawwim Barid	Tablet	External use	Due to analgesic and sedative effect it is useful in insomnia[45]
19.	Qurs Muthallas	Tablet	Tablet (850 mg)/ orally	Due to analgesic effects it is used in migraine and other types of headache[45,46]
20.	Qurs Khashkhaash	Tablet	5-10gm	Due to antitussive, and antipyretic effect it is used in cough, pyrexia, tuberculosis etc.[47]
21.	Qurs Tabasheer Kafuri Lulvi	Tablet	3-5gm	Due to refrigerant, moist, exhilarant, analgesic, astringent and styptic effects, it is useful in tuberculosis, acute fever and palpitation etc.[45]
22.	Qairooti Akhzar	Liniment	Local application	Anti-inflammatory, antitussive properties it is used locally in pleurisy, pneumonia and non-productive cough.[47]
23.	Qurs Sartan-Kafoori	Tablet	3-5 gm/orally	Haemostatic, antipyretic, properties it is used in acute pyrexia, tuberculosis, cough etc.[47]
24.	Qurs Ziyabitus Sada	Tablet		It has alterative effect and used for diabetes mellitus
25.	Qurs Anjbar	Tablet	3-5gm	Due to styptic property it is used in dysentery, hematemesis, menorrhagia, haemoptysis.[45]
26.	Qurs Tabasheer Afiyuni	Tablet	250-500mg	Due to astringent and styptic properties it is used in diarrhoea, chronic dysentery.[49]
27.	*Roghan Labub Sab'a Barid*	Oil	Local application	Febrifuge and moist and used for insomnia and headache.[45]
28.	Roghan Labub-i-Sab'a	Oil	Local application	Due to refrigerant property it is used locally cerebral weakness, degeneration, insomnia etc.[46]
29.	Safoof Tabasheer Murakkab	Powder	3 g twice a day	Due to antacid, stomachic properties it is used in gastritis, stomach weakness and Irritable Bowel Syndrome.[46]
30.	Safoof Ziyabitus Sada	Powder	5-10gm	Renal weakness, Diabetes insipidus.[45]

PHARMACOLOGICAL STUDIES

Sedative and hypnotic effect: Alcoholic extract causes sedative effect, reduction of motor activity and behaviour in toads and flaccid paralysis, on higher dose antispasmodic effect on isolated smooth and striated muscle was also observed, in-vitro negative chronotropic and inotropic effect on normal and tachycardia (stressed) heart was observed.[40] The seed oil of *Lactuca sativa* L. showed sedative effect in locomotor activity test. Potentiation of the hypnotic effect of barbiturates, analgesic effect in acetic acid-induced writhing test and anticonvulsant activity against pentylenetetrazole induced convulsion were also observed.[35]

Hypoglycaemic activity: Lactucin and lactupicrin, isolated from *Lactuca scariola* have shown hypoglycaemic effect.[51]

Analgesic, anti-inflammatory: According to a study done by Adesso *et al.* (2015) polyphenolics extract from *Lactuca sativa* L. were able to reduce both the inflammatory and oxidative stress in LPS-stimulated J774A.1 murine monocyte macrophage cells by lowering the release of nitric oxide (NO) and reactive oxygen species (ROS)[52] In another preclinical study analgesic, anti-inflammatory effect of the *Lactuca virosa* was reported by Ahmad, *et al.* (1992)[53], and Sayyah, *et al.* (2004)[54]

A**nti-depressant and anticoagulant properties:** Aqueous extracts of leaf exhibited highest analgesic and anti-inflammatory activities followed by leaf Methanol and chloroform MC (methanol and chloroform; 1:1) and aqueous extracts of seed and leaf of *Lactuca sativa* along with cell suspension exudate were prepared and explored for their analgesic, anti-inflammatory, antidepressant and anticoagulant effects. The extracts and the cell suspension exudate showed dual inhibition by reducing pain and inflammation.[55] In another preclinical study anti-depressant effect of the *Lactuca sativa* was reported by Javed *et al.* (2009).[56]

Anti-inflammatory activities: 3,14-Dihydroxy-11,13-dihydrocostunolide (compound 1) and 8-Tigloyl-15-Deoxylactucin (compound 2) were isolated from extract of *Lactuca sativa shows* significant anti-inflammatory activity in Wistar rats (160–240 g) of both sexes induced by carrageenan at a dose 5 and 10mg/kg.[57]

Anxiolytic effect: In male mice weighing 25–30 g extract *Lactuca sativa* at doses of 200 and 400 mg/kg ($P < 0.001$) significantly increased the number of entries and time spent in the open-arms, with associated decrease in closed-arms when compared to the control treated

group. In a preclinical study conducted by[15] extract of *Lactuca sativa* can afford significant protection against anxiolytic activity. The anxiolytic effects of hydro alcoholic extract of leaves of *Lactuca sativa* was investigated on mice.[15] In another preclinical study anti-anxiolytic effect of the *Lactuca virosa* was reported by Gromek *et al.* (1992).[58]

Antioxidant/Antiaging effect: Methnolic leaf extract was investigated for in vitro inhibition of oxidative damage induced by UV-radiations to the *Salmonella typhi* bacteria and in vivo effect on the production of body enzymes i.e. catalase and superoxide dismutase. The plant extract has shown significant antioxidant potential both in vitro and in vivo.[59] Ethanolic extract of *Lactuca sativa* significantly decreased D-galactose induced mimetic ageing in female albino mice.[60] In another study antioxidant effect of *Lactuca sativa* L. was reported.[61]

Neuroprotective effect: Intermediate polarity fraction of *L. sativa* ethyl acetate fraction exerts neuroprotection against glucose/serum deprivation (GSD)-induced cell injury, an in vitro model of brain ischemia can be used in common neurodegenerative disorders such as stroke.[62] Ethyl acetate fraction of *Lactuca sativa* L. exerts neuroprotective effect through decrease of oxidative stress and inhibition of proapoptotic pathways against glucose/serum deprivation (GSD) – induced neurotoxicity. Would be used for the management of ischemia induced neuronal damage.[63]

Protective effects: Ethanolic extract of lettuce (*Lactuca sativa* L. var. *longifolia*) leaves against the toxicity caused by carbon tetrachloride (CCl4) in reproductive system of rats augments the antioxidants defence mechanism. It may have a therapeutic role in free radical mediated diseases.[64]

Protective against radiation effect: Study conducted to clarify the potential role of lettuce oil against damages due to exposure to gamma radiation induced in rats. Exposure caused a significant increase in the level of glucose, total cholesterol (TC), triglycerides (TG), malondialdehyde (MDA) and follicle stimulating hormone (FSH) while a significant decrease was recorded in glutathione content (GSH), superoxide dismutase (SOD) and catalase activities, white blood cells (WBCs), red blood cells (RBCs), haemoglobin content (Hb), haematocrit percentage (Hct%), mean corpuscular volume (MCV), platelets (PLT), leutinizing hormone (LH) and testosterone hormone. Whereas rats treated with lettuce oil when exposed to radiation, the results showed an improvement in all previous parameters.

Study concluded that lettuce oil might reduce the biological hazards in rats induced by gamma irradiation.[65]

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