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## KASNI (*CICHORIUM INTYBUS* L.) A PROPITIOUS TRADITIONAL MEDICINAL HERB

Praveen Katiyar<sup>\* 1,2</sup>, Amod Kumar<sup>1</sup>, Arvind K. Mishra<sup>3</sup>, Rakesh K. Dixit<sup>1</sup>, Ajay Kumar<sup>4</sup>, Rahul Kumar<sup>1</sup> and Ajay K. Gupta<sup>5</sup>

Department of Pharmacology & Therapeutics<sup>1</sup>, Department of Internal Medicine<sup>3</sup>, King George's Medical University, Lucknow - 226003, Uttar Pradesh, India.

University Institute of Health Sciences<sup>2</sup>, Institute of Pharmacy<sup>5</sup>, C.S.J.M. University, Kanpur - 208024, Uttar Pradesh, India.

Department of Biochemistry<sup>4</sup>, GSVM Medical College, Kanpur - 208002, Uttar Pradesh, India.

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### Correspondence to Author:

Praveen Katiyar

Assistant Professor & Coordinator,  
University Institute of Health  
Sciences, C.S.J.M. University,  
Kanpur - 208024, Uttar Pradesh,  
India.


E-mail: drpraveenkatiyar@gmail.com

**ABSTRACT:** The Kasni, *Cichorium intybus* of family Asteraceae Class Magnoliopsida, which is also known as Chicory, is well known traditional herb included in many systems of medicine like Ayurveda, Unani and Siddha system of medicine. The genus *Cichorium* has six species with majorly distributed in Europe and Asia. It is cultivated in countries such as the UK, Belgium, France, Netherlands, Germany, South Africa, USA, and India. Kasni is a small aromatic biennial erect perennial herb around 1 m. in height with a fleshy taproot up to 75 cm in length and mainly it contains alkaloids, inulin, sesquiterpene lactones, coumarins, vitamins, chlorophyll pigments, unsaturated sterols, flavonoids, saponins, tannins, carbohydrates, glycosides, fats, gums, and minerals. Fresh chicory typically contains 68% inulin, 14% sucrose, 5% cellulose, 6% protein, 4% ash, and 3% other compounds, while dried chicory contains approximately 98% inulin and 2% other compounds. Kasni is used as antidiabetic, liver tonic, cardiogenic, diuretic, stomachic, cholagogue, depurative, and emmenagogue, etc. The present article reviews the historical, phytochemical, pharmacological, therapeutic and toxicological aspects of Kasni well supported by the available literature based on animal and clinical studies.

**INTRODUCTION:** Kasni commonly known as chicory (*Cichorium intybus* L.), belongs to family Asteraceae (Compositae) and widely distributed in Asia and Europe<sup>1</sup>. All parts of this plant have great medicinal importance due to the presence of some medicinally essential compounds such as alkaloids, inulin, sesquiterpene lactones, coumarins, Vitamins, chlorophyll pigments, unsaturated sterols, flavonoids, saponins and tannins<sup>2,3,4,5</sup>.

It has been reported that fresh chicory typically contains 68% inulin, 14% sucrose, 5% cellulose, 6% protein, 4% ash, and 3% other compounds, while dried chicory contains approximately 98% inulin and 2% other compounds<sup>6</sup>.

Due to this, the medicinal herb has been used in Ayurveda, Unani and Siddha system of medicine for the disease of the hepatobiliary system and renal system. *C. intybus* has been traditionally used for the treatment of fever, diarrhea, jaundice and gallstones<sup>7,8</sup>. The studies on rats have shown that *C. intybus* possesses antihepatotoxic and antidiabetic activities<sup>9</sup>. It has also been reported that *C. intybus* have antibacterial<sup>3</sup>, anti-inflammatory<sup>10</sup>, antihyperglycaemic and antiulcerogenic activities<sup>11</sup>.

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Additionally, it is a useful biomonitor of heavy metals such as Pb, Zn, Cu, and Cd<sup>12</sup>. Forage chicory was used to produce a large quantity of high-quality feed in the warm season under favorable conditions. It has been reported that grazing chicory results in a reduction of some internal parasites in livestock<sup>13</sup> and, therefore, has the potential to reduce the use of antihelminthics. Due to its prevalent distribution, different parts of the plant have been used in traditional medicines globally<sup>14</sup>.

### Botanical Summary:

Chicory belongs to the

Kingdom : Plantae,

Division : Magnoliophyta,

Class : Magnoliopsida,

Family : Asteraceae,

Genus : Cichorium,

Species : *Cichorium intybus* L.  
(Saxena et al. 2014)

Genus *Cichorium* consists of six species<sup>1</sup>. It is an erect fairly woody perennial herb around 1m height with a fleshy taproot of up to 75 cm: length & large basal leaves<sup>1, 15</sup>.

### Parts:

**Leaves:** The leaves are broadly oblong, oblanceolate or lanceolate, crowded at the base, forming a rosette arranged spirally on the stem. The upper leaves are cordate and amplexicaul; the lower leaves are long and pinnate<sup>1</sup>.

**Stems:** The stems are angled or grooved, with spreading branches, bright blue flowers, short pappus and very long, spreading, -toddled ligules<sup>1</sup>.

**Roots:** The roots of chicory are brownish yellow outside and white inside, with thin bark. It is well developed; the central part is mature and contains a portion of xylem including numerous vessels<sup>1</sup>.

**Fruits:** The fruits are dry, indehiscent, 3 mm long, 2 mm broad and crowned with a ring of 0.5 mm long pappus which is usually white but sometimes half white and half straw colored<sup>1</sup>.

**Seeds:** The seed inside the fruits are 2.5 mm long & ovoid, with a pointed apex, brownish tip and while plano-convex cotyledons<sup>1</sup>.

**Cultivation:** The plant can be grown on almost all types of soil and occurs throughout North West India up to 6000 feet Punjab, Kashmir, Andhra Pradesh, Karnataka, and Maharashtra. Other countries which produce Kasni are Baluchistan, Belgium, Europe, France, Germany, Persia, Netherlands, Switzerland, South Africa, Waziristan, West Asia and the United Kingdom<sup>1, 16</sup>. Kasni is also cultivated in Siberia, Turkey, North & Central China, Australia, New-Zealand and Madagascar<sup>17</sup>. Today, it is cultivated in Europe and North America for many commercial uses<sup>1</sup>.

**Historical Perspective:** Historically Chicory was grown by the ancient Egyptians as a medicinal plant<sup>18</sup>, coffee substitute, vegetable crop, and occasionally for animal forage<sup>19, 20, 21, 22</sup>. Greeks and Romans also began to grow chicory as a vegetable crop 4000 years ago<sup>21, 22</sup>. It has a long history of therapeutic use both in areas where it is indigenous and in areas where it has been introduced. The various common or local names describing this plant may be ascribed to the widespread use by different folkloric groups. *Cichorium intybus* is called as Hindubar, Indyba in Arabic, Zral in Baluchistan, Chicory in California, Bunk, Chicory in English, Kichora, Kikori in greek, Kasani in gujrathi, Kasni in Hindi, Kasani in Persian, Gul, Hand in Punjabi, Kasni, Tsikorie, Kashini virai in Tamil, Kasini Bintulu in Telugu, Kasani in Urdu<sup>23</sup>.

Different preparations of this plant are employed to treat various symptoms and ailments. The juice is said to be a folk remedy for cancer of the uterus and tumors<sup>24</sup>. In South Africa, although it is considered a widespread weed, leaves, stems, and roots are made into a tea for jaundice and chicory syrup is used as a tonic and purifying medicine for infants<sup>15</sup>. In Turkey, an ointment is made from the leaves for wound healing<sup>25</sup>. Decoction refers to a preparation that is made by adding cold water to the plant material which is then boiled and allowed to simmer for 5-10 min after which it is strained. Chicory decoctions are traditionally made from individual plant parts and from the plant as a whole

<sup>26</sup>. In India, seeds are used for liver disorders, whole plant for diabetes and preparation of roots for jaundice, liver enlargement, gout and rheumatism <sup>27, 28</sup>. According to the European monograph, the traditional use of chicory roots includes the relief of symptoms related to mild digestive disorders (such as a feeling of abdominal fullness, flatulence, and slow digestion) and temporary loss of appetite <sup>29</sup>. Prior to the wars in Afghanistan, folkloric reports described the use of aqueous root extracts as a light-sensitive plant remedy for malaria. This indigenous knowledge has since been confirmed and the antimalarial compounds of *C. intybus* roots have been identified as the light-sensitive sesquiterpene lactones lactucin and lactucopicrin <sup>30</sup>.

The flowers of the chicory plant (*Cichorii flows*) are used as a herbal treatment of everyday ailments such as a tonic and appetite stimulant and as a treatment of gallstones, gastro-enteritis, sinus problems, cuts, and bruises <sup>24</sup>. In Italy, the whorls are made into a decoction and used as a depurative <sup>31</sup>. Chicory seeds are one of the main ingredients of Jigrine, a herbal hepatoprotective commercial product, used for the treatment of various diseases of the liver <sup>27</sup>. Other plant parts are also used for liver disorders, namely, aerial parts in Bosnia and Herzegovina <sup>32</sup> and roots in Serbia and India <sup>28, 33</sup>.

**Phytochemical Analysis:** 4.7% of Oil was found on analysis of Kasni seeds, the fatty acid composition: Saturated 21.7%, Unsaturated 78.3%. <sup>34</sup> Preliminary phytochemical screening of *Cichorium intybus* L. seeds revealed the presence of carbohydrates, glycosides, flavonoids, saponins, fats, and gums <sup>35</sup>.

The analysis of the fresh roots of *C. intybus* gave the following values: Moisture- 77. Fat: 0.6gm, Cellulose, Inulin and fiber-9.0gm, Gummy matter- 7.5gm, Glucose- 1.1gm, Bitter extractives- 4.0gm, Ash- 0.8%. The roots contain the sesquiterpene lactones like sonchusides A and C, and, cytokinin, crepidiase B, cichoriolide A, cichoriosides B and C, ribosylzeatin a nucleotidsugar, lactucopicrin, uridine-5'-diphosphoglucose and chlorogenic, neochlorogenic, 8-deoxylactucin, isochlorogenic, lactucin, caffeic and chicoric acids. The carbohydrates present in the roots include a series of glucofructosans between sucrose and inulin

besides glucose, fructose, pentose, dextrose, taraxarcine and levulose. During storage, the inulin is converted into inulide and finally into fructose due to the presence of an enzyme inuloagulase <sup>34</sup>. The roots of *Cichorium intybus* produce latex, inulin 58%, a bitter compound composed of lactucin, lactucopicrin, intybin, cichorin taraxasteral, tannins, fructose, pectin, fixed oils, and alkaloids <sup>36</sup>. The bitter substances are lactucin and lactucopicrin esculetin, esculin, cichoriin, umbelliferone, scopoletin, and 6,7-hydroxycoumarin from the racemes.

The bitter principle is probably a glucoside of fructose and catechuic acid. The presence of stearin, mannites and tartaric acids in the juice of the roots has been reported along with betaine and choline, which are present in small concentrations <sup>17</sup>. The aerial part of Kasni contains inulin, fructose, resin, Cichorium and esculetin <sup>36</sup>.

The phytochemical screening of leaves of *C. intybus* showed the presence of tannins, saponins, flavonoids, and DPPH inhibition. Tannins, the high molecular weight polyphenolic compounds found naturally in many plants and have been found to play a protective role in plants against microorganisms, unfavorable climatic conditions and damage by animals. On the other hand, they can form multiple hydrogen bonds with carboxylic groups of dietary proteins and proteolytic enzymes in the gastrointestinal tract which leads to reduced digestibility of proteins and finally the retardation of animal growth <sup>37</sup>. Saponins are the glycosidic compounds found in most of the plants, possess a bitter taste and foaming properties and are found to be responsible for anticarcinogenic and antifungal activity <sup>38</sup>. Leaves of chicory are good sources of phenols, vitamins A and C as well as potassium, calcium, and phosphorus <sup>39</sup>.

The leaves of chicory contain coumarins, esculetin, cichoriin and sesquiterpene lactones, and recently a new coumarin glucoside ester Cichoriin-6'-*p*-hydroxyphenyl acetate, was isolated from chicory leaves along with cichoriin, similarly new sesquiterpene lactone like cichoridiol, Cichosterol (seco-sterol), Lactucin, Lactucopicrin, 11,13-dihydrolactucopirin were also reported in roots and leaves of *Cichorium intybus* <sup>40, 41</sup>.

The flowers of chicory contain saccharides, methoxycoumarin cichorine, flavonoids, essential oils<sup>24</sup>, and anthocyanins contributing to the blue color of the perianth<sup>42</sup>. Two new anthocyanins have been isolated from flowers of *Cichorium intybus* and identified as delphinidin 3, 5-di-O-(6-O-malonyl-beta glucoside) and delphinidin 3-O-(6-O-malonyl-beta-D-glucoside)-5-O - beta - D-glucoside. Octane, n-nonadecane, pentadecane, hexadecane, and a tentatively identified compound have been found as principal volatile components<sup>24</sup>. Along with inulin and sesquiterpene lactones, chicory also contains vitamins and minerals which make it mild bitter tonic and laxative<sup>43</sup>. Chicory is reported to contain more than 10% of total polyphenols, the most dominant being dicaffeoylquinic acids (71% of total polyphenols) with marked antioxidant and anti-hyperlipidemic activity<sup>44, 45</sup>.

The plant also contains Chicoric acid which was found to stimulate insulin release from INS-1 E insulin-secreting cell lines and rats islet of Langerhans as well as glucose uptake<sup>46</sup>. Compounds namely Lactucin, Sonchuside A, Cichoriolide, Chlorogenic acid, 3,5-Dicaffeoylquinic acid, 4,5Dicaffeoylquinic acid, Crepidiaside A, Cichoralexin, Malic acid, Caffeic acid, 3-Caffeoylquinic acid, 5-Caffeoylquinic acid, 4-Caffeoylquinic acid, Dicaffeoyltartaric acid, (chicoric acid), Cyanidin, Glucoside etc. isolated and identified from the chicory<sup>30, 47, 48, 49, 42, 50, 51, 46, 52, 53</sup>.

Large mass fractions of inulin characterized the root and peel extracts while phenolics, determined as caffeoylquinic acids, made up 0.5 and 1.7 g per 100 g of fresh mass, respectively. The leaf and seed extracts had decidedly lower mass fractions of inulin and higher mass fractions of phenolics, recognized as caffeoylquinic acids, chicoric acid and quercetin glucuronide<sup>44</sup>.

**Pharmacological Studies:** Chicory (*Cichorium intybus*) has a long history of its use, and various studies have revealed its medicinal value viz. hypoglycemic, hypolipidemic, hepatoprotective, antimicrobial, anthelmintic, antimalarial, anti-inflammatory, analgesic antioxidant, tumor-inhibitory, antiallergic and other important activities. It is an excellent mild bitter tonic for the

liver and digestive tract and cleansing the urinary tract. Chicory is also taken as a mild laxative<sup>43</sup>.

**Hypoglycemic and Hypolipidemic Effects:** Based on the traditional use of *C. intybus* in diabetes mellitus, the hypoglycemic and hypolipidemic properties of the ethanol extract of the whole plant were investigated. Diabetes was induced by intraperitoneal administration of streptozotocin in male Sprague-Dawley rats. The ethanol extract, at a dose of 125 mg/Kg body weight, significantly attenuated the serum glucose levels in the oral glucose tolerance test. A marked decrease in the serum triglycerides and cholesterol was also observed in the extract-treated rats. Hepatic glucose-6-phosphatase activity was found to be reduced in extract-treated diabetic rats as compared to untreated diabetic rats<sup>28, 54</sup>.

The antidiabetic effect of the aqueous seed extract of *C. intybus* has also been investigated. Early-stage and late-stage diabetes were differently induced in male Wistar albino rats by streptozotocin-niacinamide and streptozotocin alone, respectively. The treatment with chicory extract prevented weight loss in both early-stage and late-stage diabetic rats. Chicory-treated diabetic animals resisted an excessive increase in fasting blood sugar (assessed by glucose tolerance test). Grossly, normalization of blood parameters, namely alanine aminotransferase, triacylglycerol, total cholesterol, and glycosylated hemoglobin, was seen in these animals. In early-stage diabetic rats, chicory treatment led to the increase in insulin levels pointing toward the insulin-sensitizing action of chicory<sup>55</sup>.

Feeding the diabetic Wistar rats with *C. intybus* leaf powder led to a decrease in blood glucose levels to the near normal value. *C. intybus* administration also decreased the malondialdehyde (formed by thiobarbituric acid) levels and increased glutathione content. Anticholinesterase activity was restored to near normal, brain lipopolysaccharide decreased, and catalase activity increased<sup>56</sup>. Caffeic acid and chlorogenic acid have been described as potential antidiabetic agents by increasing glucose uptake in muscle cells. Both compounds were also able to stimulate insulin secretion from an insulin-secreting cell line and islets of Langerhans. Another compound, chicoric

acid, is also revealed as a new potential antidiabetic agent exhibiting both insulin-sensitizing and insulin-secreting properties<sup>50</sup>.

Chicory extract was found to influence the lipid metabolism and the redox balance of pancreatic tissue of rats in experimental dislipidemia<sup>57</sup>. Application of chicory inulin in reducing the risk of non-insulin dependent diabetes was also discussed<sup>58</sup>. It was noticed that feeding on chicory roots decreased the levels of plasma glucose, cholesterol, HDL-cholesterol and also reduced liver cholesterol, triglyceride and total lipids of streptozotocin-diabetic rats<sup>59</sup>.

In a biological experiment, an alcoholic extract of chicory leaf produced a significant decrease in serum triglycerides and total cholesterol, while an increase in high-density lipoprotein (HDL) was detected when compared to the normal control (NC) and high-fat (HF) diet groups<sup>60</sup>. Chicory (inulin) increased HDL-C after its treatment as a hypoglycaemic agent and is concluded as hypolipidemic in diabetic rats<sup>61</sup>. Improvement in lipid profiles by lowering plasma total cholesterol and triglyceride concentrations and elevating HDL-c concentration was found due to the presence of inulin<sup>62</sup>. Further higher serum concentration of HDL-c and lower serum concentration of LDL-c in rats consumed diets containing 1%, 5% chicory extract or 5% inulin for 4 weeks were also recorded<sup>63</sup>. Inulin has been found to decrease the serum triglycerides in rats due to decrease synthesis of triglyceride in the liver. The improved lipid metabolism may be due to an alteration in the absorption and synthesis of cholesterol which might result from the changes in cecal fermentation and by an increase in fecal excretion of lipids, cholesterol and bile acids<sup>63</sup>.

In a study, the effect of *Cichorium intybus* L. on fatty liver induced by oxytetracycline in albino rats, oxytetracycline induced hyperglycemia which may be attributed to its inhibitory action on the absorbing function of the intestine and the retarded glucose utilization in the tissues<sup>64</sup>, treating rats with chicory turned glucose level back to reasonable value. The improvement in glycemic status may be due to inulin (an active substance of chicory) which modulate the hormonal level of insulin and glucagons, thereby regulating

carbohydrate and lipid metabolism by lowering serum glucose level<sup>65</sup>. The experimental results revealed that the hyperlipidemic effect of oxytetracycline was ameliorated with the treatment of rats with chicory. The effect of chicory on lipid profile may be due to the main active compounds of chicory root extract, inulin, which is a polymer of fructose with B (1-2) glycosidic linkage<sup>66</sup>.

Inulin can cause alteration of hormone secretion which affects lipid metabolism. The dietary fibers of Kasni would inhibit cholesterol accumulation in blood and enhance the resistance of vascular walls<sup>67</sup>. The cholesterol-lowering effect of dietary fibers may be related to its viscosity-raising properties, which could reduce fat and cholesterol absorption or bile acid reabsorption from the gastrointestinal tract. HDLc transports cholesterol from tissues to the liver for excretion into bile<sup>68</sup>.

**Hepatoprotective Effect:** The folkloric use of *C. intybus* as a hepatoprotectant has been well documented. It is one of the herbal components of Liv-52, a widely used traditional Indian hepatoprotective tonic. In a randomized, double-blind clinical trial conducted on cirrhotic patients, Liv-52 medication reduced the serum levels of hepatic enzymes, namely, alanine aminotransferase and aspartate aminotransferase; also reduced the Child-Pugh scores and ascites significantly<sup>69</sup>. Another polyherbal formulation, Jigrine, contains the leaves of *C. intybus* as one of its 14 constituents. Jigrine was evaluated for its hepatoprotective activity against galactosamine-induced hepatopathy in rats. The pretreatment of male Wistar-albino rats with Jigrine significantly reduced the levels of aspartate transaminase, alanine transaminase, and urea and increased the levels of blood and tissue glutathione. Histopathological examination of the liver revealed that jigrine pretreatment prevented galactosamine toxicity and caused a marked decrease in inflamed cells<sup>70</sup>. The aqueous-methanolic extract of the seeds of *C. intybus* has been investigated for the hepatoprotective activity against acetaminophen and carbon tetrachloride-induced liver damage in mice, and it was found to decrease both the death rate and the serum levels of alkaline phosphatase, glutamyl oxaloacetate transaminase, and glutamyl pyruvate transaminase<sup>71</sup>.

In analogous studies, the antihepatotoxic activity of the alcoholic extract of the seeds and aqueous extracts of the roots and root callus of *C. intybus* was estimated, and oral administration of these extracts in albino rats led to a marked decrease in the levels of hepatic enzymes; histopathological examination of the liver also showed no fat accumulation or necrosis after the treatment<sup>27,72</sup>. Similar studies have established the hepatoprotective effect of esculetin, a phenolic compound, and cichotyboside, a guaianolide sesquiterpene glycoside reported from *C. intybus*<sup>73,74</sup>.

Aqueous extract of chicory was when mixed with stirred yogurt and estimated for alanine and aspartate aminotransferase (ALT and AST) activities before and after alloxan-induced oxidative stress and diabetes in rats, then it was found that ALT and AST activities of treated rats were nearest to the level of untreated rats fed basal diet (Negative control)<sup>75</sup>. It is known that chicory contains isoflavones, polyphenols and other antioxidants that can reduce the elevation of serum ALT and AST. Antioxidants in chicory extract have not only hepatoprotective activity but also improve liver function<sup>76</sup>.

Hydroalcoholic extract of *Cichorium intybus* significantly suppressed mainly the increase in plasma activities of AST, ALT and ALP concentration and confirmed the hepatoprotective activity<sup>77</sup>. *Cichorium* root extract therapy leads to normalization of some morphofunctional liver features (decreases glycogen content and cell of necrosis and increases the number of cells with pronounced protein synthesis activity) in rats with CCl<sub>4</sub>-induced hepatitis<sup>78</sup>. Chicory has an anti-hepatotoxic effect and significantly lower serum levels of ASAT and ALAT enzymes even in CCL4 intoxicated rats<sup>72,79,27</sup>.

**Antimicrobial Effect:** The antibacterial activity of the organic acid-rich extract of fresh red chicory (*C. intybus* var. *Sylvestre*) was tested against periodontopathic bacteria including *Streptococcus mutans*, *Actinomyces naeslundii* and *Prevotella intermedia*. The compounds identified from the active extract include oxalic acid, succinic acid, quinic acid, and shikimic acid. All of the organic acids were found to decrease biofilm formation and

adhesion of bacteria to the cells, with different levels of efficacy. These compounds also induced biofilm disruption and detachment of dead cells for the cultured substratum<sup>76</sup>.

In other reports on the antimicrobial activity of *C. intybus*, the crude aqueous and organic seed extracts were found to be active against four pathogenic microorganisms, namely, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, and *Candida albicans* and root extracts had pronounced effects on *Bacillus subtilis*, *S. aureus*, *Salmonella typhi*, *Micrococcus luteus* and *E. coli*<sup>80,3</sup>. The leaf extract of *C. intybus* also showed moderate activity against multidrug-resistant *S. typhi*<sup>81</sup>. Guaianolides-rich root extracts of *C. intybus* have shown antifungal properties against anthropophilic fungi *Trichophyton tonsurans*, *T. rubrum*, and *T. violaceum*<sup>82</sup>.

Among the various root extracts of *C. intybus* against *E. coli*, *S. aureus*, *B. subtilis* and *P. multocida* strains, where all the tested extracts showed antibacterial activity, the ethyl acetate extract is the most active antibacterial<sup>83</sup>. Overall *C. intybus* seeds showed mild antibacterial and poor antifungal activity.

During the study of antimicrobial activity of *Cichorium intybus*, it was experimentally proved that the whole plant contains some medicinally important compounds such as inulin, esculin, volatile compounds (monoterpenes and sesquiterpenes), coumarins, flavonoids, and vitamins. Root extracts showed more inhibitory action on *Bacillus subtilis*, *Staphylococcus aureus* and *Salmonella typhi* than *Micrococcus luteus* and *Escherichia coli*<sup>3</sup>.

**Anthelmintic Effect:** Many studies have been conducted on grazing animals to determine the anthelmintic potential of secondary metabolites present in *C. intybus*. Grossly, it has been concluded that the animals grazing on chicory has a higher performance index and lower incidence of gastrointestinal nematode infestations. In the majority of the experiments, the condensed tannins and sesquiterpene lactones were responsible for anthelmintic activity<sup>84</sup>. Anthelmintic activity of chicory has also been noticed in the case of lambs wherein the total number of abomasal helminths

was found to be lesser in the lambs grazing on this plant<sup>85</sup>. The condensed tannin and sesquiterpene-rich extracts of *C. intybus* were evaluated for their efficacy against the larvae of deer lungworm, *Dictyocaulus viviparus* and other gastrointestinal nematode larvae using a larval migration inhibition assay. A dose-dependent decrease in the larval motility was observed in both lungworm and gastrointestinal nematodes<sup>2</sup>. The sesquiterpene lactone-rich extracts of *C. intybus* was also found to inhibit egg hatching of *Haemonchus contortus*<sup>86</sup>.

**Antimalarial Effect:** The infusion of fresh roots of *C. intybus* has a history of use as a remedy for malarial fever in some parts of Afghanistan. The bitter compounds in the plant, namely, lactucin, lactucopicrin, and the guaianolide sesquiterpenes, isolated from aqueous root extracts of chicory were concluded to be the antimalarial components of the plant. Lactucin and lactucopicrin completely inhibited the HB3 clone of strain Honduras-1 of *Plasmodium falciparum* at concentrations of 10 and 50 µg/mL, respectively<sup>30,47</sup>.

**Gastroprotective Effect:** *Cichorium intybus* has been used in Turkish folklore for its antiulcerogenic potency. The aqueous decoction of *C. intybus* roots was orally administered to Sprague-Dawley rats, 15 minutes before the induction of ulcerogenesis by ethanol. More than 95% inhibition of ulcerogenesis was observed in the test group<sup>87</sup>.

**Anti-Inflammatory Effect:** The inhibition of TNF- $\alpha$  mediated cyclooxygenase (COX) induction by chicory root extracts was investigated in the human colon carcinoma (HT 29) cell line. The ethyl acetate extract inhibited the production of prostaglandin E<sub>2</sub> (PGE<sub>2</sub>) in a dose-dependent manner. TNF- $\alpha$  mediated induction of COX-2 expression was also suppressed by the chicory extract<sup>10</sup>.

**Analgesic Effect:** Lactucin, lactucopicrin, and 11 $\beta$ , 13-dihydro-lactucin found in *C. intybus* exhibited analgesic action in mice in the hot plate and tail-flick tests. In the hot plate test, all three compounds exerted an analgesic effect, with lactucopicrin being the most potent compound. In the tail-flick test, the antinociceptive effects of all the tested compounds (30 mg/kg dose) were comparable to

that of ibuprofen (60 mg/kg dose). Lactucin and lactucopicrin were also established to have some sedative action (which may contribute to the analgesic effect in part) as evident from the decreased spontaneous locomotor activity in mice<sup>88</sup>.

**Antioxidant Effect:** The flavonoids and phenolic acids present in leaves of *C. intybus* are known to possess antioxidant activities due to the presence of hydroxyl groups in their structures and their contribution to defense system against the oxidative damage due to endogenous free radicals are extremely important<sup>9</sup>. Phenolics or polyphenols are secondary plant metabolites that are ubiquitously present in plants and their products. Many of them have been shown to contain high levels of antioxidant activities<sup>89</sup>. Due to their redox properties, these compounds contribute to the overall antioxidant activities of plants. Usually, the mechanisms of their antioxidant activity are neutralizing lipid free radicals and preventing decomposition of hydroperoxides into free radicals<sup>90</sup>.

Chicory supplemented diet is reported to have free radical scavenging and antioxidant properties by restoring glutathione, GSP, SOD and catalase levels. These findings may be due to the presence of antioxidant compounds such as anthocyanins, flavonoids, polyphenols and vitamin C that could contribute to protection against free radicals generation and carcinogenic effects of nitrosamines<sup>91,39</sup>.

The antioxidant properties of *Cichorium intybus* were evaluated *in-vitro* as antioxidant activity and *in-vivo* as protective activity against rat liver cell microsome lipid peroxidation<sup>76</sup>. The obtained results proved that chicory contained both biological antioxidant and prooxidant compounds. An antioxidant, antimicrobial & phytochemical analysis of *Cichorium intybus* seeds extract and various organic fractions, it was concluded that methanolic extract & ethyl acetate fraction of seeds exhibited good antioxidant activity<sup>92</sup>.

**Tumor-Inhibitory Effect:** The crude ethanolic extract of *C. intybus* roots caused a significant inhibition of Ehrlich tumor carcinoma in mice. A 70% increase in the life span was observed with a

500 mg/kg/day intraperitoneal dose of the tested extract<sup>93</sup>. The aqueous-alcoholic macerate of the leaves of *C. intybus* also exerted an antiproliferative effect on amelanotic melanoma C32 cell lines<sup>94</sup>. Magnolialide, a 1 $\beta$ -hydroxyeudesmanolide isolated from the roots of *C. intybus*, inhibited several tumor cell lines and induced the differentiation of human leukemia HL-60 and U-937 cells to monocyte or macrophage-like cells<sup>95</sup>.

**Antiallergic Effect:** The aqueous extract of *C. intybus* inhibited the mast cell-mediated immediate allergic reactions *in-vitro* as well as *in-vivo*. This extract restrained the systemic anaphylactic response in mice in a dose-dependent manner. It also significantly inhibited passive cutaneous anaphylactic reaction caused by anti-dinitrophenyl IgE in rats. Other markers of allergic reaction, namely, plasma histamine levels and histamine release from rat peritoneal mast cells, decreased significantly whereas the levels of cAMP increased after the treatment with *C. intybus* extract<sup>96</sup>.

**Cardioprotective Effects:** The cardioprotective effects of the aqueous extracts of the leaves of *Cichorium intybus* have been examined in the ageing myocardium of albino rats. Shade-dried powdered leaves of *C. intybus* were fed to the senescent animals for 30 days. The effects of chicory extract on malondialdehyde level on taurine, glutathione and catalase activity of the heart have been studied. Aging caused peroxidative damage, increase in taurine and glutathione levels in the heart. Catalase activity decreased in the ageing myocardium. Kasni was found to ameliorate the age-induced injury and offered protection to the heart from oxidative damage, suggestive of age<sup>97</sup>. It was also found that chicory is one of the medicinal plants used for the treatment of cardiovascular diseases in the Unani system of medicine<sup>98</sup>.

**Antifungal Effect:** Extracts from roots of the common vegetable *Cichorium intybus* L., highly appreciated for its bitter taste to investigate their possible biological activity on fungi from a variety of ecological environments: some are parasites on plants (phytopathogens) or of animals and humans (zoophilic and anthropophilic dermatophytes), others live on the soil and only seldom parasitize

animals (geophilic dermatophytes). The extracts were ineffective on geophilic species and tested phytopathogens, except *Pythium ultimum*, whereas they inhibited the growth of zoophilic and anthropophilic dermatophytes, in particular *Trichophyton tonsurans* var. *sulfureum*, whose treatment caused morphological anomalies, here observed by scanning electron microscopy. This behavior is discussed by the presence in the chicory extract of the two main sesquiterpene lactones, 8-deoxylactucin and 11 $\beta$ ,13-dihydro-lactucin<sup>82</sup>.

**Prebiotics Effect:** Chicory is rich in fibrous polysaccharide inulin; it is a soluble dietary fiber and resistant to the digestive enzyme. It reaches to large intestine or colon essentially intact, where it is fermented by resident bacteria. Lactobacilli and bifidobacteria agent digest inulin and feed themselves on it. Hence prebiotics act as fertilizers for these symbiotic bacteria. Inulin serves the role of dietary fiber; safety of inulin has been evaluated and accepted by FDA of United States<sup>99</sup>.

**Appetizer effect:** It is reported that chicory contains many essential lipids, vitamins and a variety of sugar and thus useful as a tonic for digestive tract<sup>28, 66, 100</sup>. The root and the leaves of chicory are an appetizer, cholagogue, depurative, digestive, diuretic, hypoglycaemic, laxative and tonic. Chicory extract contains inulin and fructooligosaccharides. Inulin behaves like a soluble fiber to increase the viscosity of the stomach content and slow down the rate of gastric emptying of water, nutrients and lipids. A study of Urias-Silvas *et al.* concluded that inulin-type fructans extracted from chicory regulate appetite and lipid/glucose metabolism. It has also promising effects on the body weight and fat mass development<sup>101</sup>.

**Other Important Pharmacological Effects:** The ethanol extract of the roots of *C. intybus* is reported to prevent the immunotoxic effects of ethanol in ICR mice. It was noted that body weight gains were markedly decreased in mice administered with ethanol. However, the body weight was not affected when ethanol was co-administered with the ethanol extract of *C. intybus*. Similarly, the weights of the liver and spleen were not affected when ethanol extract was given along with ethanol. A considerable restoration in the other markers of



immunity, namely, hemagglutination titer, plaque forming cells of spleen, secondary IgG antibody production, delayed-type hypersensitivity reaction (in response to subcutaneous administration of sheep red blood cells to paw), phagocytic activity, number of circulating leucocytes, natural killer cell activity, cell proliferation, and production of interferon- $\gamma$ , was registered<sup>102</sup>. The immunoreactive potential of an aqueous-alcoholic extract of the roots was established by a mitogen proliferation assay and mixed lymphocyte reaction (MLR). The extract showed an inhibitory effect on lymphocyte proliferation in the presence of phytohemagglutinin and a stimulatory effect on MLR<sup>103</sup>.

Chicoric acid has shown vasorelaxant activity against nor-epinephrine-induced contractions in isolated rat aorta strips<sup>104</sup>. A pronounced anticholinesterase activity of the dichloromethane extract of *C. intybus* roots was seen in the enzyme assay with Ellman's reagent. Two sesquiterpene lactones, namely, 8-deoxylactucin and lactucopicrin, also exhibited a dose-dependent inhibition of anticholinesterase<sup>105</sup>. The methanolic extract displays wound healing effect, and  $\beta$ -sitosterol was determined as the active compound responsible for the activity, possibly due to its significant anti-inflammatory and antioxidant effects, as well as hyaluronidase and collagenase inhibition<sup>14</sup>.

**Medicinal Uses According to Unani System of Medicine:** *Cichorium intybus* removes the visceral, hepatic and vascular obstruction. It is a good but not very strong astringent. Application of paint prepared from its juice with white lead and vinegar elicits a remarkable cooling effect on the organs. It is used as plaster in case of gout. It is useful in chronic conjunctivitis. The latex of the wild variety removes opacity of the cornea. It is plastered on the chest with barley flour in cases of palpitation. It strengthens the heart; Purging cassia is dissolved in its juice and used as a gargle in pharyngitis. It relieves nausea and counteracts the ill effects of excessive yellow bile, it strengthens the heart, and it is one of the best drugs for the stomach having a hot temperament.

The wild endive is better than the cultivated variety for stomach diseases, endive is said to be suitable for all kinds of temperaments of the liver, the drug

is particularly suitable for hot-tempered livers, and however, it is not harmful to cold tempered organs, unlike some cold vegetables. Oral intake of endive, especially of its wild variety along with vinegar, causes constipation. Endive is useful in quartan fevers and also in fevers attributed to cold exposure. Plaster of the roots of endive as well as its roasted flour is beneficial against the bites of scorpion, insects, wasps, snakes etc.<sup>106</sup>

**Toxicological Studies:** While Kasni has a long history of human use, the high levels of secondary metabolites have shown toxicological effects. To evaluate the safety of the root extract of *C. intybus*, Ames test, and subchronic toxicity assessment were conducted. The sesquiterpene-rich extract was evaluated for potential mutagenic properties (Ames test) using *Salmonella typhimurium* strains TA97a, TA98, TA100, and TA1535 and *Escherichia coli* strain WP2 *uvrA*. Though cytotoxicity was observed at high extract doses in some strains, mutagenicity was not observed. A 28-day (subchronic) oral toxicity study, conducted in CRL: CD (SD) IGS BR rats, concluded that there was no extract-related mortality or any other signs of toxicological significance<sup>107</sup>. The toxicity evaluation of *C. intybus* extracts has also been done by *Vibrio fischeri* bioluminescence inhibition test (Microtox acute toxicity test). This bacterial test measures the decrease in light emission from the marine luminescent bacteria *V. fischeri*, when exposed to organic extracts. The tested extracts showed less than 20% inhibition of bioluminescence and hence were concluded to be safe for human use<sup>94</sup>.

**CONCLUSION:** Kasni (*Cichorium intybus*) has a long record of its traditional use globally. Historically, Kasni was grown by the ancient Egyptians as a medicinal plant, coffee substitute, and vegetable crop and was occasionally used for animal forage. This multipurpose plant contains high amounts of proteins, carbohydrates, and mineral elements<sup>18</sup>. Inulin from chicory roots is considered a functional food ingredient as it affects physiological and biochemical processes resulting in better health and decreasing the risk of many diseases<sup>109</sup>. Till date, chicory remains an extremely versatile plant, open to genetic management, and there is interest shown in genetically engineered chicory to obtain higher yields and create new

potentials<sup>1</sup>. The documented indigenous knowledge relating to the various medicinal uses of chicory has been supported by phytochemical isolation and investigations into biological activity.

Nonetheless, many of its constituents have not been explored for their pharmacological potential, and further research is necessary to gain a better understanding of the phytochemicals against various diseases<sup>18</sup>; herb-drug interactions *in-vivo* and clinically with major phytochemicals of Kasni<sup>110</sup> and specific ingredient responsible and to determine the precise molecular mechanism of action of Kasni (*C. intybus*)<sup>111</sup>. Studies about the toxic effect of *C. intybus* are limited; however, considering that the Asteraceae family is a known source of allergic problems, a contraindication for hypersensitivity should be included in the safety data<sup>29</sup>. New studies recommend the use of *C. intybus* as a biomonitor for heavy metals<sup>11, 109</sup>; since Kasni enters the food chain, this plant should be used with caution.

The magnitude of the Kasni is now no more limited to preclinical level but stretched to clinical level as reflected in a study on beta-thalassemia patients where chicory reduced serum ferritin<sup>110</sup> and confirmation of the relationship between the level of liver enzymes and onset of type 2 diabetic patients<sup>110</sup>. Therefore, it's alleged that Kasni is a propitious traditional medicinal herb which could be of a great benefit to mankind if investigated properly.

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## REFERENCES:

- Bais HP and Ravishankar GA: *Cichorium intybus* L. cultivation, processing, utility, value addition and biotechnology, with an emphasis on current status and prospects. *J Sci Food Agric* 2001; 81: 467-484.
- Molan AL, Duncan AJ, Barry and TN and McNabb WC: Effect of condensed tannins and sesquiterpene lactones extracted from chicory on the motility of larvae of deer lungworm and gastrointestinal nematodes. *Parasitol Int* 2003; 52: 209-218.
- Nandagopal S and Ranjithakumari BD: Phytochemical and antibacterial studies of chicory (*Cichorium intybus* L.) – a multipurpose medicinal plant. *Adv Biol Res* 2007; 1(12): 17-21.
- Muthusamy VS, Anand S, Sangeetha KN, Sujatha S, Arun B and Lakshami BS: Tannins present in *Cichorium intybus* enhance glucose uptake and inhibit adipogenesis in 3T3L1 adipocytes through PTP1B inhibition. *Chem Biol Interact* 2008; 174(1): 69-78.
- Atta AH, Elkoly TA, Mounair SM, Kamel G, Alwabel NA and Zaher S: Hepatoprotective effect of methanolic extracts of *Zingiber officinale* and *Cichorium intybus*. *Indian J Pharm Sci* 2010; 72(5): 564-570.
- Meehye K and Shin HK: The water-soluble extract of chicory reduces glucose uptake from the perfused jejunum in rats. *J Nutr* 1996; 126(9): 2236-2242.
- Afzal S, Afzal N, Awan MR, Khan TS, Gilani A, Khanum R and Tariq S: Ethnobotanical studies from Northern Pakistan. *J Ayub Med Coll Abbottabad* 2009; 21(1): 52-57.
- Abbasi AM, Khan MA, Ahmad M, Zafar M, Khan H, Muhammad N and Sultana S: Medicinal plants used for the treatment of jaundice and hepatitis based on socioeconomic documentation. *Afr J Biotechnol* 2009; 8(8): 1643-1650.
- Saggu S, Sakeran MI, Zidan N, Tousson E, Mohan A and Rehman H: Ameliorating effect of chicory (*Cichorium intybus* L.) fruit extract against 4 tertoctylphenol induced liver injury and oxidative stress in male rats. *Food Chem Toxicol* 2014; 72C: 138-146.
- Cavin C, Delannoy M, Malnoe A, Debefve E, Touche A, Courtois D and Schilter B: Inhibition of the expression and activity of cyclooxygenase2 by chicory extract. *Biochem Biophys Res Commun* 2005; 327(3): 742-749.
- Rifatuz Z, Akhtar MS and Khan MS: *In-vitro* antibacterial screening of *Anethum graveolens* L. Fruit, *Cichorium intybus* L. leaf, *Plantago ovata* L. seed husk and *Polygonum viviparum* L. root extracts against helicobacter pylori. *Int J Pharmacol* 2006; 2: 674-677.
- Aksoy A: Chicory (*Cichorium intybus* L.): possible biomonitor of metal pollution. *Pak J Bot* 2008; 40(2): 791-797.
- Heckendorn F, Haring DA, Maurer V, Senn M and Hertzberg H: Individual administration of three tanniferous forage plants to lambsartificially infected with *Haemonchus contortus* and *Cooperia curticei*. *Vet Parasitol* 2007; 146: 123-134.
- Suntar I, Akkola EK, Kelesb H, Yesiladac E, Sarkerd S and Baykala T: Comparative evaluation of traditional prescriptions from *Cichorium intybus* L. for wound healing: stepwise isolation of an active component by *in-vivo* bioassay and its mode of activity. *Journal of Ethnopharmacology* 2012; 143(1): 299-309.
- Van BE, Oudtshoorn Van B and Gericke N: Medicinal Plants of South Africa, Briza Publications, Pretoria, South Africa 1997.
- Anonymous, Standardisation of Single drugs of Unani Medicine Part I, CCRUM, New Delhi 1987: 156-161.
- Apte KG, Saxena R and Belemkar S: Antiulcerogenic and antioxidant activity of hydro alcoholic extract of the root of *Cichorium intybus* L. in experimentally induced ulcer in rats. *Inventi Rapid Ethnopharmacology* 2011: 21-4.
- Wang Q and Cui J: Perspectives and utilization technologies of chicory (*Cichorium intybus* L.): a review. *African Journal of Biotechnology* 2011; 10(11): 1966-1977.
- Munoz CLM: Spanish medicinal Plants: *Cichorium intybus* L. *Boletín de la Real Sociedad Espanola de Historia Natural* 2004; 99: 41-47.
- Deshusses J: The content of formic acid in roasted coffee, chicory, soluble extracts of coffee and coffee substitutes. *Mitt Geb Lebensmittelunters Hyg* 1961; 52: 428-430.
- Grieve M: *A Modern Herbal* Dover Publications, Mineola, N.Y. 1971

22. Plmuier W: Chicory improvement. Revuede Agric 1972; 4: 567-585.
23. Kirtikar KR and Basu BD: Indian medicinal plants, Vol I,II,III, IV and VI , Periodical experts book agency Delhi, 649 -651, 1048-1055, 1140-1146, 1199-1206, 1210-1213, 1228-1231,1980- 1982, 2133-2135, 2141-2142, 2149-2150, 2171-2172, 2462-2463, 2<sup>nd</sup> reprint Edn 1987.
24. Judžentienė A and Budienė J: Volatile constituents from aerial parts and roots of *Cichorium intybus* L. (chicory) grown in Lithuania. *Chemija* 2008; 19: 25-28.
25. Sezik E, Yes ilada E, Honda G, Takaishi Y, Takeda Y and Tanaka T: Traditional medicine in Turkey X. Folk medicine in Central Anatolia. *Journal of Ethnopharmacology* 2001; 75(2-3) : 95-115,.
26. Gurib-Fakim A: Medicinal plants: traditions of yesterday and drugs of tomorrow. *Molecular Aspects of Medicine* 2006; 27(1): 1-93.
27. Ahmed B, Al-Howiriny TA and Siddiqui AB: Antihepatotoxic activity of seeds of *Cichorium intybus*. *Journal of Ethnopharmacology* 2003; 87(2-3): 237-240.
28. Pushparaj PN, Low HK, Manikandan J, Tan BKH and Tan CH: Anti-diabetic effects of *Cichorium intybus* in streptozotocin-induced diabetic rats. *Journal of Ethnopharmacology* 2007; 111(2): 430-434.
29. European Medicines Agency, "Community herbal monograph on *Cichorium intybus* L., radix," EMA/HMPC/121816/2010, 2012.
30. Bischoff TA, Kelley CJ, Karchesy Y, Laurantos M, Nguyen- Dinh P and Arefi AG: Antimalarial activity of Lactucin and Lactucopicrin: sesquiterpene lactones isolated from *Cichorium intybus* L. *Journal of Ethnopharmacology* 2004; 95(2-3) : 455-457.
31. Pieroni A: Medicinal plants and food medicines in the folk traditions of the upper Lucca Province, Italy. *Journal of Ethnopharmacology* 2000; 70(3): 235-273.
32. Hanlidou E, Karousou R, Kleftoyanni V and Kokkini S: The herbal market of Thessaloniki (N Greece) and its relation to the ethnobotanical tradition. *Journal of Ethnopharmacology* 2004; 91(2-3): 281-299.
33. Jarić S, Popović Z and Maćukanović-Jocić M: An ethnobotanical study on the usage of wild medicinal herbs from Kopaonik Mountain (Central Serbia). *Journal of Ethnopharmacology* 2007; 111(1): 160-175.
34. Anonymous, The Wealth of India, Vol I, II,III, IV, V, VIII, X, CSIR, New Delhi 1992: 78-79, 87, 170, 88, 179, 370, 389, 391, 52, 195, 120-122, 93, 267, 555-561.
35. Fathalla N, Bishr M, Singab AN and Salama O: Phytochemical and biological evaluation of *Cichorium intybus* L. Seeds. *IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)* 2015; 10(1): 70-76.
36. Kokate CK: Pharmacognosy, Nirali Prakashan, 41, Budhwar Peth, Jogeshwari mandir lane, Pune 411002, 544 36<sup>th</sup> edn; 2006.
37. Reed JD, Soller H and Woodward A: Fodder tree and straw diets for sheep: intake, growth, digestibility and the effect of phenolics on nitrogen utilization. *Anim Feed Sci Technol* 1990; 30: 39-50.
38. Rao AV and Sung MK: Saponins as anticarcinogens. *J. Nutr.* 1995; 125(3): 717-724.
39. Mulabagal V, Wang H, Nougajio M and Nair MG: Characterization and quantification of health beneficial anthocyanins in leaf chicory (*Cichorium intybus*) varieties. *Eur Food Res Technol* 2009; 230: 47-53.
40. Mukherjee PK: Quality Control of Herbal Drugs. 133, 176, 177, 189, 193, 380, 384, 492). 12. Kokate, 1<sup>st</sup> edition; 2002.
41. Wagner H and Bladt S: *Plant Drug Analysis; Thin Layer Chromatography*, Springer. 2<sup>nd</sup> edition; 1996; 196-7, 353.
42. Norbak R, Nielsen K and Kondo T: Anthocyanins from flowers of *Cichorium intybus*. *Phytochemistry* 2002; 60(4): 357-359.
43. Chevallier A: *Encyclopedia of medicinal plants*, D.K. Publishing Book, New York 1996: 187.
44. Juskiewicz J, Zdunczyk Z, Zary-Sikorska E, Krol B, Milala J and Jurgonski A: Effect of the Dietary polyphenolic fraction of Chicory root, peel, seed and leaf extracts on Caecal fermentation and blood parameters in rats fed diets containing prebiotic fructans. *Br J Nutr* 2011; 105(5): 710-20.
45. Milala J, Grzelak K, Kroll B, Juskiewicz J and Zdunczyk Z: Composition and Properties of Chicory extracts rich in Fructans and Polyphenols. *Pol J Food Nutr* 2009; 59(1): 35-43.
46. Carazzone C, Mascherpa D, Gazzani G and Papetti A: Identification of phenolic constituents in red chicory salads *Cichorium intybus* by high-performance liquid chromatography with diode array detection and electrospray ionisation tandem mass spectrometer. *Food Chemistry* 2013; 138: 1062-71.
47. Leclercq E: Determination of lactucin in roots of chicory (*Cichorium intybus* L.) by high-performance liquid chromatography. *Journal of Chromatography A* 1984; 283: 441-444.
48. Kisiel W and Zielińska K: Guaianolides from *Cichorium intybus* and structure revision of *Cichorium* sesquiterpene lactones. *Phytochemistry* 2001; 57(4): 523-527.
49. Pyrek JS: Sesquiterpene lactones of *Cichorium intybus* and *Leontodon autumnalis*. *Phytochemistry* 1985; 24(1): 186-188.
50. Tousch D, Lajoix AD and Hossy E: Chicoric acid, a new compound able to enhance insulin release and glucose uptake *Biochemical and Biophysical Research Communications* 2008; 377(1): 131-135.
51. Malarz J, Stojakowska A, Szneler E and Kisiel W: A new neolignan glucoside from hairy roots of *Cichorium intybus*. *Phytochemistry Letters* 2013; 6: 59-61.
52. Monde K, Oya T, Shirata A and Takasugi M: A guaianolide phytoalexin, cichoralexin, from *Cichorium intybus*. *Phytochemistry* 1990; 29(11): 3449-3451.
53. Tousch D, Lajoix AD and Hossy E: Chicoric acid, a new compound able to enhance insulin release and glucose uptake. *Biochemical and Biophysical Research Communications* 2008; 377(1): 131-135.
54. Hardeep FM and Pandey DK: Anti-diabetic activity of methanolic extract of chicory roots in streptozocin-induced diabetic rats. *International Journal of Pharmacy* 2013; 3(1): 211-216.
55. Ghamarian A, Abdollahi M, Su X, Amiri A, Ahadi A and Nowrouzi A: Effect of chicory seed extract on glucose tolerance test (GTT) and metabolic profile in early and late stage diabetic rats. *DARU Journal of Pharmaceutical Sciences* 2012; 20: 56-65.
56. Ahmad M, Qureshi R, Arshad M, Khan MA and Zafar M: Traditional herbal remedies used for the treatment of diabetes from district attock (Pakistan). *Pakistan Journal of Botany* 2009; 41(6) : 2777-2782.
57. Kok N, Roberforid M and Detzenne N: Dietary oligofructose modifies the impact of fructose on hepatic triacylglycerol metabolism. *Metab Clin Exp* 1996; 45: 1547-1550.
58. Roberfroid MB and Delzenne NM: Dietary fructans *Annual Review of Nutrition* 1998; 18: 117-43.

59. Bothayna MA: Production of bakery products using two sources of inulin. *Ann Agric Sci Moshtohor* 2000; 38(1): 361-378.
60. Nessrien MN, Ashoush IS and EL-Hadidy EM: Antioxidants content of chicory leaves extract and its effect as hypolipidemic agent in experimental rats. *Ann of Agric Sci Cairo* 2007; 52(1): 177-184.
61. Azorin OM, Urban C, Ceron JJ, Tecles F, Allende A, Tomas BF and Espin JC: Effect of low inulin doses with different polymerization degree on lipid absorption and intestinal microbiota in rats with fat-metabolism, mineral supplemented diet. *Food Chem* 2009; 113(4): 1058-65.
62. Yassin MN, Ashoush IS and El-Hadidy EM: Antioxidants content of chicory leaves extract and its effect as the hypolipidemic agent in experimental rats. *Ann Agric Sci* 2007; 52: 177-186.
63. Kim M and Shin HK: The water-soluble extract of chicory influences serum and liver lipid concentrations, short chain fatty acids and fecal lipid excretion in rats. *J Nutr* 1998; 128: 1731-1736.
64. Storozhuk P and Shamsutdinova V: Effect of certain antibiotics of tetracycline series on the level of blood sugar and the role of insulin in the mechanism of its regulation. *Probl. Endokrinol* 1998; 22(6): 106-110.
65. Narinder K and Anil K: Effect of a long-chained fructan raftiline HP on blood lipids and spontaneous atherosclerosis in low-density receptor knockout mice. *Nutrition Research* 2002; 22(4): 473-480.
66. Kocsis I, Hagymási Á, Kéry E, Szóke E and Blázovics A: Effects of chicory on pancreas status of rats in experimental dislipidemia. *Acta Biologica Szegediensis* 2003; 47: 143-146.
67. Abd El-Ghanny M, Farouk M, Mohamed A, Hatem M and Hanaa F: Effect of some vegetables intake on the precarcinogenic risk resulting from extreme grilled meat on experimental rats. *Basic Clinical Pharmacology Toxicology* 2007; 97: 958-982.
68. Keys A: Alpha lipoprotein (HDL) cholesterol in the serum and the risk of coronary heart disease and death. *Lancet* 1980; 2: 603-608.
69. Huseini Fallah H, Alavian SM, Heshmat R, Heydari MR and Abolmaali K: The efficacy of Liv-52 on liver cirrhotic patients: a randomized, double-blind, placebo-controlled first approach. *Phytomedicine* 2005; 12(9): 619-624.
70. Najmi AK, Pillai KK, Pal SN and Aqil M: Free radical scavenging and hepatoprotective activity of jigrine against galactosamine-induced hepatopathy in rats. *Journal of Ethnopharmacology* 2005; 97(3): 521-525.
71. Gilani AH and Janbaz KH: Evaluation of the liver protective potential of *Cichorium intybus* seed extract on acetaminophen and CCl<sub>4</sub>-induced damage. *Phytomedicine* 1994; 1(3): 193-197.
72. Zafar R and Mujahid Ali S: Anti-hepatotoxic effects of root and root callus extracts of *Cichorium intybus* L. *Journal of Ethnopharmacology* 1998; 63(3): 227-231.
73. Gilani AH, Janbaz KH and Shah BH: Esculetin prevents liver damage induced by paracetamol and CCL<sub>4</sub>. *Pharmacological Research* 1998; 37(1): 31-35.
74. Ahmed B, Khan S, Masood MH and Siddique AH: Antihepatotoxic activity of cichotyboside, a sesquiterpene glycoside from the seeds of *Cichorium intybus*. *Journal of Asian Natural Products Research* 2008; 10(3-4): 223-231.
75. Al-Wabel NA, Mousa HM, Orner OH and Abdel-Salam AM: Biological evaluation of aqueous herbal extracts and stirred yoghurt filtrate mixture against alloxan -induced oxidative stress and diabetes in rats. *Intr J Pharmacol* 2008(2): 135-139.
76. Gazzani G, Daglia M, Papetti A and Gregotti C: *In-vitro* and *ex-vivo* anti and prooxidant components of *Cichorium intybus*. *J Pharm Biomed Anal* 2000; 23: 127-133.
77. Sadeghi H, Nikbakht M, Ghaitasi I and Sabzali S: Hepatoprotective effect of *Cichorium intybus* on CCl<sub>4</sub>-induced liver damage in rats. *African Journal of Biochemistry Research* 2008; 2(6): 141-144.
78. Krylova SG, Efimova LA and Zueva EP: The effect of chicorium root extract on the morphofunctional state of liver in rats with CCl<sub>4</sub> induced hepatitis model. *Eksp Klin Farmacol* 2006; 69(6): 34-6.
79. Mitra S, Venkataranganna M, Gopumadhavn, S, Anturlikar S and Udupa U: The protective effect of HD-03 in CCl<sub>4</sub>-induced hepatic encephalopathy in rats. *Phytotherp Res* 2001; 15: 493-496.
80. Shaikh T, Rub RA and Sasikumar S: Antimicrobial screening of *Cichorium intybus* seed extracts. *Arabian Journal of Chemistry* 2012.
81. Rani P and Khullar N: Antimicrobial evaluation of some medicinal plants for their anti-enteric potential against multi-drug resistant *Salmonella typhi*. *Phytotherapy Research* 2004; 18(8) : 670-673.
82. Mares D, Romagnoli C, Tosi B, Andreotti E, Chillemi G, and Poli F: Chicory extracts from *Cichorium intybus* L. as potential antifungals. *Mycopathologia* 2005; 160(1): 85-91.
83. Petrovik J, Stanojkovic A, Comic LJ and Curcic S: Antibacterial activity of *Cichorium intybus*. *Fitoterpia* 2004; 75: 737-739.
84. Miller MC, Duckett SK and Andrae JG: The effect of forage species on performance and gastrointestinal nematode infection in lambs. *Small Ruminant Research* 2011; 95(2-3): 188-192.
85. Marley CL, Cook R, Keatinge R, Barrett J and Lampkin NH: The effect of birds foot trefoil (*Lotus corniculatus*) and chicory (*Cichorium intybus*) on parasite intensities and performance of lambs naturally infected with helminth parasites. *Veterinary Parasitology* 2003; 112(1-2): 147-155.
86. Foster JG, Cassida KA and Turner KE: *In-vitro* analysis of the anthelmintic activity of forage chicory (*Cichorium intybus* L.) sesquiterpene lactones against a predominantly *Haemonchus contortus* egg population. *Veterinary Parasitology* 2011; 180(3-4): 298-306.
87. G'urb'uz I, Ust'un O, Yes'ilada E, Sezik E and Aky'urek N: *In-vivo* gastroprotective effects of five Turkish folk remedies against ethanol-induced lesions. *Journal of Ethnopharmacology* 2002; 83(3): 241-244.
88. Wesolowska A, Nikiforuk A, Michalska K, Kisiel W and Chojnacka-W'ojcik E: Analgesic and sedative activities of lactucin and some lactucin-like guaianolides in mice. *Journal of Ethnopharmacology* 2006; 107(2): 254-258.
89. Razali N, Razab R, Mat Junit S and Aziz A: Radical scavenging and reducing properties of extracts of cashew shoots (*Anacardium occidentale*) *Food Chem* 2008; 111: 38-44.
90. Javanmardi J, Stushnoff C, Locke E and Vivanco JM: Antioxidant activity and total phenolic content of Iranian Ocimum accessions. *Food Chem* 2003; 83: 547-550.
91. Ilaiyaraja N and Farhath K: Evaluation of antioxidant and toxicological properties of chicory leaves. *International Journal of Pharmaceutical and Biological Archives* 2010; 1(2): 155-163.
92. Mehmood N, Zubair M, Rizwan K, Rasool N, Shahid M and Ahmad UV: Antioxidant, antimicrobial and phytochemical analysis of *Cichorium intybus* seeds extract

- and various organic fractions. Iranian Journal of Pharmaceutical Research 2012; 11(4): 1145-1151.
93. Hazra B, Sarkar R, Bhattacharyya S and Roy P: Tumour inhibitory activity of chicory root extract against Ehrlich ascites carcinoma in mice. *Fitoterapia* 2002; 73(7-8): 730-733.
  94. Conforti F, Ioele G, Statti GA, Marrelli M, Ragno G and Menichini F: Antiproliferative activity against human tumor cell lines and toxicity test on Mediterranean dietary plants. *Food and Chemical Toxicology* 2008; 46(10): 3325-3332.
  95. Lee KT, Kim JI, Park HJ, Yoo KO, Han YN and Miyamoto KI: Differentiation-inducing effect of magnolialide, a 1 $\beta$ -hydroxyeudesmanolide isolated from *Cichorium intybus*, on human leukemia cells. *Biological and Pharmaceutical Bulletin* 2000; 23 (8): 1005-1007.
  96. Kim HM, Kim HW and Lyu YS: Inhibitory effect of mast cell-mediated immediate-type allergic reactions by *Cichorium intybus*. *Pharmacological Research* 1999; 40(1): 61-65.
  97. Nayeemunnisa and Rani MK: Cardioprotective effects of *Cichorium intybus* in ageing myocardium of albino rat. *April Curr Sci* 2003; 84(7): 941.
  98. Khan HA, Asif M and Athar M: Medicinal plants as potential sources of drugs for cardiovascular diseases: traditional and mineral approaches. *Hamdard Medicus* 2006; 49-(2): 75-80.
  99. Chopra RN, Nayar SL and Chopra IC: The glossary of Indian medicinal plants, CSIR, New Delhi 2002: 44.
  100. Cani, PD, Neyrinck AN, Maton N and Delzenne NM: Oligofructose promotes satiety in rats fed a high-fat diet: Involvement of glucagon-like peptide-1. *Obes Res* 2005; 13: 1000-1007.
  101. Urias-Silvas JE, Cani PD, Delmee E, Neyrinck A, Lopez MG and Delzenne MN: Physiological effects of dietary fructans extracted from *Agaves tequilana* and *Dasylyrion* spp. *Br J Nutr* 2007; 99: 254-261.
  102. Kim JH, Mun YJ, Woo WH, Jeon KS, An NH and Park JS: Effects of the ethanol extract of *Cichorium intybus* on the immunotoxicity by ethanol in mice. *International Immunopharmacology* 2002; 2(6): 733-744.
  103. Amirghofran Z, Azadbakht M and Karimi MH: Evaluation of the immunomodulatory effects of five herbal plants. *Journal of Ethnopharmacology* 2000; 72(1-2): 167-172.
  104. Sakurai N, Iizuka T, Nakayama S, Funayama H, Noguchi M and Nagai M: Vasorelaxant activity of caffeic acid derivatives from *Cichorium intybus* and *Equisetum arvense*. *Yakugaku Zasshi* 2003; 123(7): 593-598.
  105. Rollinger JM, Mock P, Zidorn C, Ellmerer EP, Langer T and Stuppner H: Application of the in combo screening approach for the discovery of non-alkaloid acetylcholinesterase inhibitors from *Cichorium intybus*. *Current Drug Discovery Technologies* 2005; 2(3): 185-193.
  106. Azmi WA and Kuliyaat A: Ajaz publishing house 1997: 138.
  107. Schmidt BM, Ilic N, Poulev A and Raskin I: Toxicological evaluation of a chicory root extract. *Food and Chemical Toxicology* 2007; 45(7): 1131-1139.
  108. Kaur N and Gupta AK: Applications of inulin and oligofructose in health and nutrition. *Journal of Biosciences* 2002; 27(7): 703-714.
  109. Yakupoğlu D, Güray T, Yurtsever Sarica D and Kaya Z: Determination of airborne lead contamination in *Cichorium intybus* L. in an urban environment. *Turkish Journal of Botany* 2008; 32(4): 319-324.
  110. Shahvazian N, Hashemi A, Shakiba M, Farahzadi MH and Mahmoodabadi F: Efficacy of chicory in decreasing serum ferritin and liver enzymes in major beta thalassemia patients. *Iranian Journal of Pediatric Hematology and Oncology* 2010; 1(1): 4-7.
  111. Philip R, Mathias M, Kumari NS, Gowda KMD and Shetty KJ: Evaluation of the relationship between markers of liver function and the onset of type 2 diabetes. *NUJHS* 2014; 4(2): 90-93.

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