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Review Article

Taraxacum officinale: a high value less known medicinal plant

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Abstract: The family Asteraceae, best represented by the species of *Taraxacum officinale*, is known world wide for its manifold uses. It is widely used to cure kidney disease, swelling, skin problems, heart burn, eye inflammation, bone fractures, diabetes mellitus, hypertension, gastrointestinal complaints, warts, liver/gallbladder problems, hepatitis B, cancer, etc., and widely used in modern medicine. Therefore, an attempt has been made to assess the medicinal potential of the species both in traditional and modern medicine system. This paper provides the relevant information about medicinal properties of the high value medicinal plants. Further, we have tried to compile all the possible information regarding the medicinal potential of this plant. So far only limited scientific studies have been conducted on this plant. So further research is required to highlight the potential of the plant.

Key words: *Taraxacum officinale*, Dandelion, Sesquiterpene

Introduction

Taraxacum officinale Weber commonly known as *dandelion* belongs to family Asteraceae. The common name *dandelion* is derived from the French *dent de leon*, meaning "lion's tooth." The herb is similarly named in many Indo-European countries, and also being called "lion's tooth" in German (*Löwenzahn*) and Spanish (*diente de leon*). This is possible due to toothed margins of the leaves. Plant is native to Eurasia. Its distribution extends to Asia, Europe, North America to temperate zone of Northern Hemisphere (Grieve, 1931). In India it is reported through out the Himalayas on Alpine meadows and slopes. It is widely and narrowly distributed at an altitudinal ranges between 1000-4000 m amsl (Hajra *et al.,* 1995) In the Indian Himalayan region it is commonly known Dudal, Radam, Bathur and Haend) (Hajra *et al.,* 1995). Generally, the plant is perennial herb, upto 40 cm in height, having spatula-like leaves and yellow flowers that bloom round the year (Wichtl, 1994). From its thick tap root, dark brown, almost black on the outside though white and milky within, the long jagged leaves rise directly, radiating from it to form a rosette lying close upon the ground, each leaf being grooved and constructed so that all the rain falling on it is conducted straight to the centre of the rosette and thus to the root which is, therefore, always kept well watered (Grieve, 1931).

Parts used

The young leaves of the *Taraxacum* are generally used as a salad and as vegetable also. The dried leaves are also employed as an ingredient in many digestive, drinks and herbal beers. In Canada, Dandelion Beer is generally used as a fermented drink. In Berkshire and Worcestershire, the flowers are used in the preparation of a beverage known as Dandelion Wine. According to them such wine deserved reputation of excellent tonic and extremely good for the blood. Roasted roots are largely used to make Dandelion Coffee. It is believed that Dandelion Coffee is more superior to traditional tea and it helps to improve the nervous and digestive system (Grieve, 1931).

Chemistry

Chemical composition: Dandelion contains abundance of sesquiterpene lactones, also known as bitter elements. Major sesquiterpene lactones, generally occurring as glycosides (sugars) (principally taraxacin and taraxacerin) (Leung *et al.,* 1996). The other related compounds include beta-amyrin, taraxasterol, and taraxerol, as well as free sterols (sitosterin, stigmasterin, and phytosterin). Other constituents include polysaccharides (primarily fructosans and inulin), smaller amounts of pectin, resin, and mucilage, and various flavonoids glycosides-luteolin 7-glucoside and two luteolin 7-

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diglucosides (flavonoids). Hydroxycinnamic acids, chicoric acid, monocaffeyltartaric acid, and chlorogenic acid (Phenylpropanoids) are found throughout the plant, and the coumarins, cichoriin, and aesculin have also been reported Biotin, calcium, choline, fats, gluten, gum, inositol, inulin, iron, lactupicrine, linolenic acid, magnesium, niacin, PABA, phosphorus, potash, proteins, resin, sulfur, vitamins A, B1, B2, B5, B6, B9, B12, C, E, and P, and zinc are also reported (Williams *et al*., 1996).

Leaves: Dandelion leaves are a rich source of a variety of vitamins and minerals, including bitter glycosides terpenoids, beta carotene, non-provitamin A carotenoids, xanthophylls, chlorophyll, flavonoids, vitamins C and D, many of the B-complex vitamins, choline, iron, silicon, magnesium, sodium, potassium, zinc manganese, copper, and phosphorous (Herb Basics). Dandelion leaf is a good source of potassium; 1 analysis found that 100 g (just over 3 oz) of leaf contained 297 mg potassium, putting it in a league with other high potassium-source foods (Hook *et al*., 1993).

Roots: According to the (Herb Basics) roots contain bitter glycosides namely taraxacin and taraxacerin, tannins, triterpenes, sterols, volatile oil, choline, asparagin and inulin. Taraxacin is the main constituents known for its bitter taste

Medicinal and Traditional uses

The first mentioned use of Dandelion as a medicine is in the works of the Arabian physicians of tenth and eleventh centuries, who speak of it as a sort of wild Endive, under the name of *Taraxcacon* (Grieve, 1931). In the past, dandelion roots and leaves were used to treat liver problems (Grieve, 1931). Native Americans used boiled dandelion to treat kidney disease, swelling, skin problems, heartburn, and upset stomach (Bensky *et al.,* 2004). In French, dandelion is known for its diuretic activity. In India, dandelion is used in whole Himalayan belt. In Kashmir Himalaya, paste of boiled leaves with small quantity of salt and turmeric (haldi) is generally used to treat bone fractures (Malik *et al., 2011*). It is also used as a vegetable in Kashmir (personal experience). In Himachal Pradesh, the roots are used in kidney and liver complaints. The whole plant is crushed into a paste and given orally in snakebites and paste is also applied externally on wound. The leaves are effectively used for fomentation in swollen parts, boils and sprains. The sheep and goats browse it as a potent fodder (Sharma, *et al.,* 2005).

Pharmacology

Digestive Effects: Since ancient times the digestive effect of dandelion are well known that's why it is widely used to stimulate digestion (Pizzorno *et al.*, 1999). In this process, sesquiterpene lactones impart a bitter taste to the plant, which is especially notable in the leaf but also in the root (particularly when spring-harvested) (Kuusi *et al.*, 1985). According to the (Faber*,* 1958) these compounds also believes to increase in bile production.

Gastrointestinal Complaints: The use of dandelion leaf for indigestion or other gastrointestinal complaints is also largely unverified by modern studies. However, a case series of 24 patients with nonspecific, chronic colitis treated with a formula consisting of dandelion (specifically, *T. officinal*), St John's wort (*Hypericum perforatum*), lemon balm (*Melissa officinalis*), calendula (*Calendula officinalis*), and fennel (*Foeniculum vulgare*) demonstrated remarkable symptomatic improvement in terms of stool normalization and pain reduction. (Chen, 1990).

Colitis: As per the Bulgarian clinical trial dandelion root in combination with other herbs might be an effective in chronic colitis. A group of 24 patients suffering from chronic nonspecific colitis were treated with an herbal combination consisting of dandelion root, St. John's wort (*Hypericum perforatum*), lemon balm (*Melissa officinalis*), calendula flower (*Calendula officinalis*), and fennel seed (*Foeniculum vulgare*). Spontaneous and palpable pains along the large intestine disappeared in 96 percent of the patients by the 15th day of treatment (Chakurski *et al.*, 1981).

Warts: The traditional use of fresh dandelion stem latex to treat warts has not been evaluated (Yarnell *et al.,* 2009).

Inflammatory effects: According to the (Kashiwada *et al.,* 2001) sesquiterpene lactones contributed to the inflammation-modulating properties of dandelion root. Other studies showed that crude extracts of both root and flower modulated inflammation,

and some evidence suggests that phenylpropanoids might be key to this activity (Hu *et al.,* 2005, Yasukawa e*t al*., 1998). Further, as per (Jeon *et al*., 2008) ethanol extracts of the dried aerial parts have also been used to reduce inflammation in rodents.

Hypoglycemic Effects: As per (Akhtar *et al*., 1985, Petlevski *et al.,* 2001) dandelion root and leaf have hypoglycemic properties and the exact mechanisms of action are poorly understood. As per report it stimulates pancreatic beta-cell to release insulin (Hussain *et al*., 2004). Further, water extract of *Taraxacum officinale* (aerial parts) is reported to inhibit a-amylase by 20-45%. This may be due to the possible positive action on diabetes mellitus Type 2 (Funke *et al*., 2006). It is well known that several enzymes take part during the carbohydrate digestion process (starch and sugar produces glucose), which primarily includes α-glucosidase. The inhibition of α- glucosidase can be effective treatment for Diabetes mellitus (Prabhakar *et al.,* 2008). According to (Onal *et al*., 2005) water infusion from a non-specified plant part (s) of *Taraxacum officinale* inhibited three types of a-glucosidase (from baker's yeast, rabbit liver and rabbit intestine) – IC_{50} (mg plant/ml): 2.3, 3.5 and 1.83, respectively. For comparison, IC_{50} values for acarbose were 0.5, 0.75, and 0.25 mg/ml. The infusion may be a weak *in vitro* α-glucosidase inhibitor.

Immunity: As per the (Koo *et al*., 2004, Kim *et al*., 2000), dandelion extracts inhabit stimulation of tumor necrosis factor. This may suggest that dandelion extract has various effects on different lymphocyte populations or body tissues, or it may indicate that dandelion can modulate immune reactions.

Antiplatelet action: No effect on ADP induced-platelet aggregation in platelet-rich plasma from healthy volunteers was found for a water infusion from dandelion leaves (Lynn *et al.,* 2005).

Antioxidative action: Effects of dandelion water lyophilisates on Wistar rats liver microsomes were studied. The malondialdehyde products were decreased by folium extracts, in a dose-dependent manner. The extract from leaves exerted a more effective membrane protection, (IC_{50}=0.55 mg/ml), compared with the root extract (IC_{50}=1 mg/ml). Root and leaf extracts did stimulate the NADPH-cytochrome P-450 reductase activity even without NADPH cofactor, but at a smaller rate. The lyophilisate from leaves proved to be more effective in both systems. The same authors described also the hydrogen-donating ability, reducing power property and radical scavenging capacity of lyophilisates. The higher hydrogen donor, reducing agent and hydrogen peroxide scavenger capability of the extract from leaves correlates with the approximately 3 times higher polyphenol content as compared to extract from roots. The leaf was more antioxidant than the root in vitro (Hagymasi, *et al*., 2000, Cho Ung, et al., 2010).

Demulcent and Prebiotic Activity: Dandelion roots have a distinct demulcent action and prebiotic properties due to their content of inulin8; fall-harvested roots have the highest inulin content (Trojanová *et al*., 2004).

Clinical Applications

Diuretic Activity: In experimental research on mice, high amounts of an aqueous extract of dandelion leaf (2g/ kg body weight) has been shown to have diuretic activity comparable to furosemide (Racz-Kotilla *et al*., 1974). Since dandelion is also a rich source of potassium, some think it is capable of replacing potassium lost through diuresis. The data from human trial demonstrate that an ethanolic extract of *T. Officinale* fresh leaf (1 g: 1 mL), increases the frequency and excretion ratio of fluids in healthy human subjects. (Bevin et *al.,* 2009(13). As a diuretic it may also benefit those with suffering with hypertension. The German Commission E approves the use of dandelion as a diuretic and also for use in anorexia, dyspepsia, and biliary abnormalities (Blumenthal *et al.,* 1998).

Detoxification: Dandelion root has a long history of use for supporting liver function and treating various dermatologic and systemic disorders, based on the theory that the herb improves the liver's ability to detoxify. These ideas have received little research attention (Yarnell et *al.,* 2009). In regard to hormone detoxification, a recent study compared the effects of an herbal formula containing dandelion (Specifically, *T. officinalis*), turmeric (*Curcuma longa*), artichoke (*Cynara scolymus*), rosemary

(*Rosmarinus officinalis*), schisandra (*Schisandra chinensis*), and milk thistle (*Silybum marianum*), a healthy diet, and placebo on hormone levels in 40 premenopausal women (Greenlee *et al.,* 2007) and the treatment repeated for 4 cycles. Compared with other 2 treatments, herbal formula caused significant declines in early follicular-phase androgens with no effect on levels of any other sex steroid hormone. The implications of this study are hard to determine, but it does suggest that dandelion and other herbs may have some role in enhancing detoxification of androgens. Recently, an animal study showed that a dandelion extract upregulated estrogen, progesterone, and follicle-stimulating hormone receptors in mice (Zhi *et al*., 2007).

Liver/Gallbladder Stasis: Because of dandelion root's cholagogue (Vogel, 1977) and choleretic effects (Bohm, 1959) it has been traditionally recommended for people with sluggish liver function due to alcohol abuse or poor diet. The increase in bile flow may help improve fat (including cholesterol) metabolism in the body; however, there are no clinical studies to support these uses. Patients with increased phase I metabolism coupled with impaired phase II activity may especially benefit from *Taraxacum* supplementation (Maliakal *et al.*, 2001).

Hepatitis B: A formula called *jie du yang gan gao* (JY) was significantly more effective than another botanical formulation (the main ingredients of which were charred hawthorn [*Fructus Crataegi*], charred germinated barley [*Fructrus Hordei Germinatus*], and wheat bran) in lowering elevated liver enzymes and curing patients with hepatitis B in a 96-person, double-blind trial. *Cure* meant that serum hepatitis B virus (HBV)-DNA become negative (Chen, 1990).

*Listed ingredients of *jie du yang gan gao* : *Artemisia capillaris, Taraxacum mongolicum, Plantago* seed*, Cephalanoplos segetum, Hedyotis diffusa, Chrysanthemi indicum, Smilax glabra, Astragalus membranaceus, Salviae miltiorrhiza, Polygonum orientalis, Paeonia alba, Polygonatum sibiricum*

Antibiotic Actions: According to (Fang, 1991), a herbal formula known as *fu zheng qu xie*** was as effective as antibiotic gentamycin in 75 cases of gastric disease caused by *Helicobacter pylori* (formerly known as *Campylobacter pyloridis* or CP)
**Listed ingredients of *fu zheng qu xie*: *Astragalus membranaceus, Atractylodes macrocephala, Paeonia lactiflora, Taraxacum monogolicum, Oldenlandia diffusa*

Anticancerous property: In vitro and rodent studies consistently show that various parts of dandelion have antineoplastic activity (Sigstedt *et al*., 2008). As per (Baba *et al.,* 1981) aqueous extract was prepared from the leaves of *Taraxacum officinale*, and investigated on tumour progression related processes such as proliferation and invasion. The results showed that the water extract of dandelion leaf (DLE) decreased the growth of MCF-7/AZ breast cancer cells in an ERK-dependent manner (ERK = extra cellular signal-regulated kinases relevant to many cancers types development). Furthermore, dandelion root extract was found to block invasion of MCF-7/AZ breast cancer cells while DLE blocked the invasion of LNCaP prostate cancer cells, into collagen type I. Inhibition of invasion was further evidenced by decreased phosphorylation levels of FAK-src as well as reduced activities of matrix metalloproteinases, MMP-2 and MMP-9(Sigstedt *et al*., 2008). Another study, suggested that *Taraxacum officinale* induces cytotoxicity through TNF-alpha and IL-1alpha secretion in Hep G2 cells (Koo *et al.,* 2004).
Recent studies expose that luteolin (flavonoid present in *Taraxacum officinale*) has a anti-cancer ability, due to its action on a remarkable amount of cellular enzymes. Even more important, luteolin shows a specific cytotoxicity, limited to cancer cells (Lin *et al*., 2008).

Unexplored Effect: Recently, 4-hydroxyphenylacetate ester conjugates to myo-inositol moiety (4-PIEs) were identified as a novel class of secondary metabolites in the latex of *T. officinale* roots. Despite their high abundance and reactivity in the insect gut, their biosynthesis and potential role as herbivore defenses remains unexplored (Daniella, 2014).

Ill Effects and Toxicity: Dandelion is a commonly available food with a long history of human use and as such poses little risk of harm. Dandelion extracts are listed on the US Food and Drug Administration's "generally recognized as safe" (GRAS) list for foods and supplements. Allergy to dandelion can occur

but is rare. Patients sensitized Dandelion is a commonly available food with a long history of human use and as such poses little risk of harm. Dandelion extracts are listed on the US Food and Drug Administration's "generally recognized as safe" (GRAS) list for foods and supplements. Allergy to dandelion can occur but is rare. Patients sensitized to other members of the *Asteraceae* plant family are sometimes cross-sensitized to dandelion (Lee *et al.,* 2007).

Conclusion

Taraxacum officinale is reported as King of the Weeds in literature because of its unlimited virtues (http://www.survivalinfo.co.uk/blog/entry/dandelion-king-of-the-weeds). Each part of the plant, leaves, flower and root, is used for different purposes. It is widely being used in traditional and Ayurvedic system of Medicine. The use of *Taraxacum officinale* in various mentioned disorders is considered credible on the basis of pharmacological data. The main aim of this article is to gather the medicinal potential of this amazing plant which can be best done by creating a link between our research and ethnic knowledge. So that we could link its medicinal properties to its active principle(s), while isolating/characterizing them. And we could also discover its unexplored properties. Furthermore, we should also try to identify the active compounds responsible for each and every property, and identify if they act singly or in combination with other compounds present in the plant.

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