Review Article

Therapeutic Uses of *Daucus carota*: A Review

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ABSTRACT

Plants have been the basis for medical treatments through much of human history, and such traditional medicine is still widely practiced today. The herbal products which have been used in traditional medicine have become an attractive. The herbal products have important role throughout the world in treating and preventing a human disease. Common advantages of herbal medicines are effectiveness, safety, affordability and acceptability. Medicinal plants and their products have been used in the Indian traditional system of medicine and have shown experimental or clinical radioprotection activity. Medicinal plants are a rich source of natural antioxidant products. Modern medicine recognizes herbalism as a form of alternative medicine, as the practice of herbalism is not strictly based on evidence gathered using the scientific method. Modern medicine, does, however, make use of many plant-derived compounds as the basis for evidence-tested pharmaceutical drugs, phytotherapy, and phytochemistry works to apply modern standards of effectiveness testing to herbs and medicines that are derived from natural sources.

INTRODUCTION

The scope of herbal medicine is sometimes extended to include fungal and bee products, as well as minerals, shells and certain animal parts. In some Asian and African countries, up to 80% of the population relies on traditional medicine for their primary health care needs. When adopted outside of its traditional culture, traditional medicine is often called alternative medicine.[1] Practices known as traditional medicines include Ayurveda, Siddha medicine, Unani, ancient Iranian medicine, Irani, Islamic medicine, traditional Chinese medicine, traditional Korean medicine, acupuncture, Muti, Ifa, and traditional African medicine. Core disciplines which study traditional medicine include herbalism, ethnomedicine, ethnobotany, and medical anthropology. Many of the pharmaceuticals currently available to physicians have a long history of use as herbal remedies, including opium, aspirin, digitalis, and quinine. According to the World Health Organization, approximately 25% of modern drugs used in the United States have been derived from plants. At least 7,000 medical compounds in the modern pharmacopoeia are derived from plants. Among the 120 active compounds currently isolated from the higher plants and widely used in modern medicine today, 80% show a positive correlation between their modern therapeutic use and the traditional use of the plants from which they are derived.

DAUCUS CAROTA

Daucus carota is a scientific name of carrot belongs to family Apiaceae and it contains array of chemical constituent. The **carrot** (Daucus carota subsp. sativus) is a root vegetable, usually orange in colour, though purple, black, red, white, and yellow varieties exist. Carrots are a domesticated form of the wild carrot, Daucus carota, native to Europe and southwestern Asia. The plant probably originated in Persia and originally cultivated for its leaves and seeds. The most commonly eaten part of the plant is the taproot, although the greens are sometimes eaten as well. The domestic carrot has been selectively bred for its greatly enlarged, more palatable, less woody-textured taproot.

The carrot is a biennial plant in the umbellifer family Apiaceae. At first, it grows a rosette of leaves while building up the enlarged taproot. Fast-growing varieties mature within three months (90 days) of sowing the seed, while slower-maturing varieties are harvested four months later (120 days). The roots contain high quantities of alpha- and beta-carotene, and are a good source of vitamin K and vitamin B6, but the belief that eating carrots improves night vision is a myth put forward by the British in

World War II to mislead the enemy about their military capabilities.

The United Nations Food and Agriculture Organization (FAO) reports that world production of carrots and turnips (these plants are combined by the FAO) for the calendar year 2013 was 37.2 million tonnes; almost half (~45%) were grown in China. Carrots are widely used in many cuisines, especially in the preparation of salads, and carrot salads are a tradition in many regional cuisines.

Botanical Classification

Botanical name: *Daucus carrota*
Kingdom : Plantae
Class : Magnoliopsida
Order : Apiales
Family : Apiaceae
Genus : Daucus
Division : Magnoliophyta

Common Names

Fools Parsley, Wild Carrot. Wild flower of Britain, Ireland, Lace Flower, Birds Nest, Bees Nest, Devils Plague, Garden Carrot[1].

DISTRIBUTION

It is generally assumed that the purple carrot originated in Afghanistan in the region where the Himalayan and Hindu Kush mountains are confluent, and that it was domesticated also in Afghanistan and adjacent regions of Russia, Iran, India, Pakistan and Anatolia. Purple carrot, together with a yellow variant, spread to the Mediterranean area and Western Europe in the 11-14th centuries, and to China, India and Japan in the 14-17th centuries. The orange (carotene-containing) carrot probably arose in Europe or in the western Mediterranean region through gradual selection within yellow carrot populations. The Dutch landraces Long Orange and the finer Horn types were the basis for the orange carrot cultivars grown at present all over the world. In Asia they have now largely replaced the purple and yellow types because of superior taste and nutritional value[1].

DESCRIPTION

Daucus carota is a biennial plant that grows a rosett of leaves in the spring and summer, while building up the stout taproot that stores large amounts of sugars for the plant to flower in the second year.

Soon after germination**,** carrot seedlings show a distinct demarcation between the taproot and the stem. The latter is thicker and lacks lateral roots. At the upper end of the stem is the seed leaf. The first true leaf appears about 10–15 days after germination. Subsequent leaves, produced from the stem nodes, are alternating (with a single leaf attached to a node, and the leaves growing in alternate directions) and compounds, and arranged in a spiral. The leaf blades are pinnate. As the plant grows, the bases of the seed leaves are pushed apart. The stem, located just above the ground, is compressed and the internodes are not distinct. When the seed stalk elongates, the tip of the stem narrows and becomes pointed, extends upward, and becomes a highly branched inflorescence. The stems grow to 60–200 cm (20–80 in) tall.

Most of the taproot consists of a pulpy outer cortex and an inner core. High-quality carrots have a large proportion of cortex compared to core. Although a completely xylem-free carrot is not possible, some cultivars have small and deeply pigmented cores; the taproot can appear to lack a core when the colour of the cortex and core are similar in intensity. Taproots typically have a long conical shape, although cylindrical and round cultivars are available. The root diameter can range from 1 cm (0.4 in) to as much as 10 cm (4 in) at the widest part. The root length ranges from 5 to 50 cm (2.0 to 19.7 in), although most are between 10 and 25 cm (4 and 10 in).

ACTIVE CONSTITUENTS

Daucus carrota contains many phytochemical constituent such as Carbohydrates are sugars and dietary fibres. Fats, proteins, vitamins like vitamin A, beta-carotene, lutein zeaxanthin, riboflavin, niacin, pathetic acid, vitamin B6, foliate, vitamin C, vitamin K. Minerals like calcium, iron, magnesium, phosphorous, potassium, sodium and zinc.

PHARMACOLOGICAL SCREENING

ANTIOXIDANT

Like many other colored vegetables carrot is a gold mine of antioxidants. Carotenoids, polyphenols and vitamins present in carrot act as antioxidants. Carotenoids widely distributed in orange carrots are potent antioxidants which can neutralize the effect of free radicals. They have been shown to have inhibition mutagenesis activity contributing to decrease risk of some cancers. [2,3]

ANTICARCINOGEN

The anti-carcinogenic effect of carrot juice extracts on myeloid and lymphoid leukemia cell lines. *In vitro* analysis was done on 72 hours incubation of carrot juice extracts in leukemia cell lines and non-tumor control cells. It was observed that carrot juice extract possessed the ability to induce apoptosis and cause cell cycle arrest in leukemia cell lines. The effect was less prominent in myeloid and hemato-poieticstem cells. Those investigators considered that *β*-carotene and falcarinol present in the carrot juice extract may have been responsible for this beneficial effect of "kill" leukemia cells and inhibit their progression.[4]

IMMUNOENHANCER BENEFITS

The immunomodullatory effect of carrot-extracted carotenoid using 24 albino rats. The percentage variation in lymphocytes, eosinophils, monocytes and platelet count was evaluated. Interestingly, carotenoid administered rats showed a significant increase in lymphocytes, eosinoplils, monocytes and platelet concentration. The beneficial effect was due to carrot's *α*- and *β*-carotenoids.[5]

ANTI-DIABETIC

Recent research demonstrates a significant association between vitamin A-rich carotenoids and diabetes status. According to these investigators higher blood glucose levels, as well as higher fasting levels of insulin, were observed in study participants with lower level of carotenoids. Carotenoid levels also decreased as the severity of glucose intolerance increased. These findings suggest that carrot and vitamin A-rich carotenoids might help diabetics to manage their condition.[6] Comparing the characteristics, properties and *in vitro* hypoglycemic effects of various carrot water insoluble fiber-rich fractions, observed that dietary fiber-rich fractions, which contained not only water insoluble dietary fiber but also alcohol and water insoluble solids, isolated from carrot pomace exhibited glucose-adsorption capacity and amylase inhibition activity. Dietary fiber transports also a significant amount of polyphenols and carotenoids linked to the fibre matrix though the human gut.[7,8,9] And this research is concluded that the enhanced glucose adsorbance capacity and reduction of amylase activity of dietary fiber of carrot might help control post-prandial serum glucose level. This study confirmed the strong relationship between dietary fiber intake and lower risk of type 2 diabetes.[2,3]

CHOLESTEROL

Carrot showed cholesterol absorption mitigating effects in experimental carrot fed rats. Regulation in bile acid secretion and antioxidant status was also reported. A significant decrease in liver cholesterol and triglyceride levels was also observed by these investigators. Moreover, carrot consumption increased the vitamin E level in plasma and increased the ferric reducing ability of plasma.[10] The results suggested that carrot intake may exert a protective effect against cardiovascular disease linked to atherosclerosis. The effect may be due to the synergistic action of dietary fiber and antioxidant polyphenols in carrot.[10] The consumption of carrots has also been associated with lower risk of heart attacks in women.[11]

ANTI-HYPERTENSIVE

The anti-hypertensive effect of two cumarin glycosides (DC-2 and DC-3) from carrots. Dose dependent intravenous administration of these glycoside compounds caused a decrease in arterial blood pressure in normotensive anaesthetized rats. Moreover, *in vitro* studies by the same investigators showed that the glycoside compounds caused inhibitory effects on spontaneously beating guinea pig atria, as well as on the kt-induced contractions of rabbit aorta. The authors concluded that the decreased blood pressure observed *in vitro* studies may be due to the calcium channel blocking action of cumarin glycosides (DC-2 and DC-3) from carrots.[12]

HEPATOPROTECTIVE

Carrot extract help to protect liver from acute injury by the toxic effects of environmental chemicals. In its study the effect of carrot extract on carbon tetrachloride (CC14)-induced acute liver damage in mouse was evaluated. The

increased serum enzyme levels by CC14-induction were significantly lowered due to pre-treatment with the carrot extract. The carrot extract also decreased the elevated serum bilirubin and urea content due to CC14 administration. Increased activities of hepatic 5'-nucleotidase, acid phosphatase, acid ribo-nuclease and decreased levels of succinic dehydrogenase, glucose-6-phosphatase and cytochrome P-450 produced by CCl4 were reversed by the carrot extract in a dose-responsive way. The investigators concluded that results of this study revealed that carrot could afford a significant protective action in the alleviation of CCl4- induced hepatocellular acute injury.[13]

WOUND HEALING

Animals treated with topical cream of ethanolic extract of carrot root, formulated at different concentrations, showed significant decreases in wound area, epithelization period and scar width when compared to control group animals in an excision wound model. Meanwhile, rate of wound contraction significantly increased. Moreover, there were also significant increases in wound tensile strength, hydroxyproline content and protein content in animals treated with the topical cream formulation of ethanolic extract of carrot seeds. The antioxidant and anti-microbial activities of ethanolic extract of carrot root, mainly flavonoids and phenolic derivatives, may be involved in this increased curative property. Wound healing effects may also be due to regulation of collagen expression and inhibition of elevated levels of lipid peroxides.[14]

SEED CARROT EXTRACTS

Seed carrot extracts and its essential oil have been reported in experimental studies to have cardio- and hepatoprotective, cognitive dysfunction, cholesterol lowering, anti-bacterial, anti-fungal, anti-inflammatory, analgesic,and wound healing benefits.

PHARMACOLOGICAL USES

CARDIO- AND HEPATOPROTECTIVE BENEFITS

Carrot seed extract offers cardioprotection and muscle contraction regulation in isoproterenol-induced myocardial infarction in rats by maintaining membrane bound enzymes. From these results investigators concluded that the carrot seed extract might have inotropic effects. Notably, levels of serum aspartame transaminase, alanine transaminase and lactate dehydrogenase were significantly lower in carrot seed extract fed rats.[15]

The *in vitro* antioxidant and hepatoprotective activity of methanolic extracts of carrot seeds. This study concluded that the hepatoprotective activity of the carrot seed extract was due to the antioxidant potential of carrot seed extract.[16]

COGNITIVE DYSFUNCTION AND CHOLESTEROL LOWERING

Cognition includes all aspects of perceiving, learning, thinking and remembering. The cognitive dysfunctions include delirium, behavioral disorders and dementia. Cognitive impairment is the leading cause of neurodegenerative diseases such as Alzheimer's disease and dementia in elderly individuals. It is characterized by progressive memory loss and personality defects accompanied by structural abnormalities in the brain like speech disorder and loss of space orientation. Carrot seed extract reversed the memory deficits in scopolamine (or diazepam)-induced amnesia in young mice. These investigators concluded that administration of carrot seed extract reduced brain acetylcholinesterase activity and cholesterol levels in mice (acetylcholine synthesis is mediated by choline and acetyl coenzyme A in the presence of the enzyme choline acetyltransferase). Furthermore they observed that the ethanolic extract of carrot seeds improved the retention capacity of aged mice, when administrated orally for 7 days.[17] And it resulted that enhanced cholinergic transmission resulted from increased acetylcholine synthesis in the brain due to abundant availability of choline and reduction of brain cholinesterase activity.

ANTI-BACTERIAL AND ANTI-FUNGAL BENEFITS

Carrot seed oil extracts exhibited moderate inhibitory effects on mycelia growth of *Alternaria alternate* (one of the most popular phytotoxic fungi infesting the carrot plant), isolated from the surface of carrot seeds cultivar Perfekcja. Experiments, namely with the chemical compounds, carotol, *β*-caryophyllene, and daucol were carried out to find out whether the observed activity was derived from the action of carotol alone or from a synergistic action. Carotol significantly inhibited the growth of the fungi and reduced the colony radial size. Meanwhile, the inhibitory effect produced by daucol was comparatively less than carotol. No

effect was exerted by *β*-caryophyllene. The results suggested that carotol is the main agent responsible for the anti-fungal activity of carrot seed oil extracts.[18]

ANTI-INFLAMMATORY AND ANALGESIC BENEFITS

The anti-inflammatory and analgesic effects of carrot seed extract have been reported experimentally. The carrot seeds possess anti-inflammatory effect. In their research paw edema was induced in rats using carrageenan histamine, and serotonin; and arthritis was induced using formaldehyde. Surprisingly, the disease condition decreased in rats fed with a high dose of carrot seed extract. Furthermore, in order to assess the carrot's analgesic activity, writing effect was induced by intra-peritoneal injection. There was a significant reduction in writhing effect after the administration of carrot seed extract. [19]

FERTILITY BENEFITS

The fertily effect of carrot seed extract is gender dependent. Pharmacological studies showed that carrot seeds exhibit anti-fertility properties in females.[20,21] The carrot seed extract induces spermatogenesis in male rats. They observed that rats fed with carrot seed extract recovered from gentamicin- induced reproductive toxicity and displayed enhanced spermatogenesis. Thus, carrot seed extract was able to induce spermatogenesis and cauda epididymal sperm reserves. The probable biochemical mechanism behind the effect is through the elevation of testosterone levels in male rats. Besides carrot seed extracts are rich in antioxidants and therefore the elevation in cauda epididymal sperm reserves may be also attributed to its antioxidant effect.[22]

CONCLUSION

Carrot has remarkable nutritional and health benefits. There are good reasons to include carrots in human diet, since they are enriched with carotenoids, phenolic compounds, polyacetylenes, and vitamins and by this reason they may help reduce the risk of some diseases. Experimental evidence has reported that these carrot compounds exert antioxidative, anticarcinogenic, and immune enhancer effects. Anti-diabetic, cholesterol and cardiovascular disease lowering, anti-hypertensive, hepato-protective, reno-protective, and wound healing benefits of carrot have also been reported. The mechanism by which these carrot compounds decrease the risk of some diseases is complex and sometimes largely unknown.

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