

SEABUCKTHORN- A PANACEA FOR ANIMAL HEALTH AND PRODUCTION

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Introduction

Herbs, in fact, represent one of the first pharmacological inventions attempted by the healer and it also forms the basis of the modern system besides being sheet anchor of ancient Indian system of medicine. Indian geography is rich for its biodiversity of medicinal herbs particularly the Indian Himalayas. But these medicinal plants species decline very rapidly in last few decades. The World Health Organization has also recommended to actively promote the use of natural medicines based on their beneficial effect and also to initiate steps to cultivate and conserve the medicinal plants. Indian subcontinent, especially the northwestern Himalayan region, is endowed with the richest expertise in traditional medicine. "Seabuckthorn" is one of the prime medicinal plants inhabiting dry temperate region of Himachal Pradesh and adjoining areas of Ladakh. Seabuckthorn is widely prevalent in dry temperate Himalayan region. Indian Himalayas have been the second or third richest resource of seabuckthorn (30,000-40,000 hectare) of the world. It is primarily found in Lahaul-Spiti in Himachal Pradesh and Nubra valley in Ladakh (Singh, 2001). In Himachal Pradesh, seabuckthorn grows on riversides of marshy lands and sun facing slopes in Lahaul-Spiti, some parts of Chamba, Kinnaur, Kullu and Shimla districts.

Historical background

The first investigation on the therapeutic use of seabuckthorn was made by Chinese people as long back in eighth century. Seabuckthorn (*Hippophae rhamnoides*) has had been used by Chinese and Tibetan people as a traditional medicine more than thousands of years ago. The medicinal plant has also been mentioned in the writings of ancient Greek as proven remedy for horses. They used leaves and young branches in the fodder to achieve rapid weight gain and a shiny coat. The name of the plant has been derived from Latin words-'*Hippo*' which means "horse" and '*phaos*' which means "to shine". Many of its pharmacological effects on the lungs, stomach, spleen and blood circulation have been recorded in classics, such as *Sibu Yidian* from the Tang Dynasty and *Jing Zhu Ben Cao* from the Qing Dynasty. Different parts of seabuckthorn were used in treatment of skin wounds and various cardiopulmonary and gastrointestinal disorders according to classical Tibetan medicinal book "*Sibu Yidian*" (Xiaoping *et al.*, 1995). 1903 *Sibu Yidian* was published in Russia in Peterburg. The preliminary research on the fruit juice of seabuckthorn was published in 1956. Seabuckthorn was for the first time officially listed in Chinese Pharmacopoea by the ministry of Public health in 1977. Seabuckthorn has been mentioned in the writings of ancient Greek scholars such as Dioscorides and Theophrastus. The medicinal and nutritional values of seabuckthorn for humans were recorded in Tibetan classic "*rGyud Bzi*". The berries were used as a source of herbal medicines, health food and natural skin care in Europe and Asia since long back.

Nutraceutical composition of seabuckthorn

Seabuckthorn has got tremendous potential for therapeutic utilization in human and veterinary medicine. It is reported to possess many bioactive substances notably lipids, fatty acids, vitamins (both fat soluble and water soluble), flavonoids, tannins, phenols, progestin, amino acids, minerals, coumarin, triterpine (ursolic acids), steroids (ergosterol, stigmasterol, lanosterols), amyryns, organic acids (approximately 2-4 % in ripen berries, mainly the malic acid, oxalic acid and other unidentified acids) and 5-hydroxytryptamine etc. Fruit juice contributes to its 80 % of the total volume of fruit and is a source of nearly 190 bioactive substances whereas its oil has nearly 106 such components. Oil is store of 6 kinds of fat soluble vitamins, 22 kinds of fatty acids, 42 kinds of lipids and 36 kinds of flavonoids and phenols. Seabuckthorn is a source of many vitamins, mainly, vitamin C (2-6 mg/g), carotenoids (249mg/100g), vitamin E (203 mg/100g) and vitamin K (150 mg/100g). It also contains unsaturated fatty acids (mainly linoleic and linolenic acids), flavonoids, oils and oil soluble bioactive compounds as well as minerals mainly Ca (0.80-1.4 g/kg), Mg (0.47-0.73 g/kg), K (6.44-12.20 g/kg), Cu (3.8-12 mg/kg), Fe (64—282 g/kg), Mn (8.7-15 mg/kg), Zn (8.8-27 mg/kg), Cd (16-55 µg/kg) and Pb (0.34-1.1 µg/kg). It is rich in total sugar (25-10 mg/g) out of which glucose is highest followed by sucrose, amino acids (37-75 mg/g) in which essential amino acids (13-28 mg/g) such as lysine, threonine, methionine, valine and isoleucine are prominent. Seabuckthorn seed oil contains a high amount of two essential fatty acids, linoleic and α -linolenic acid, while pulp oil of seabuckthorn berries is rich in palmitic acid and palmitoleic acid (Chen *et al.*, 1990).

Leaves of seabuckthorn have also been reported by many workers for its nutritious and fodder value. The feeding of supplementary seabuckthorn leaves and fruit residues increases body weight by 9-13 % in weak pigs; increases milk production by 6-7% in goats; enhances growth rate by 9-13% in chicken, and laying capacity increases by 25-29% in laying hen. Long term feeding with supplementary additives (leaves, fruit residues and bark) promoted growth and improve immunity of animals. It also helps in recovering and regaining the body and their shine in case of horses. In northern Ganelue Province, a large area is covered by natural seabuckthorn forest where the herdsmen always graze their sheep on Seabuckthorn foliage which resulted into fatten their sheep livestock (Rongson, 1994).

Therapeutics uses of seabuckthorn

Anti-inflammatory effect

Fayman (1991) and Sabynich *et al.* (1994) studied the effect of application of seabuckthorn oil on postoperative tonsillitis, chronic cervicitis, carrageenin-induced oedema, UV-induced erythema and exudative peritonitis. It was found that the oil effectively arrests the inflammatory reaction and help in progression of recovery. Application of seabuckthorn oil induces an increase in plasma linoleic, α -linolenic acid, neutral lipids, eicosapentaenoic acids, palmitoleic acid and a little extent pentadecanoic acid in both plasma phospholipids and neutral lipids that contribute to healing process in atopic dermatitis. Further, Kallio *et al.* (2001) reported that topical application of seabuckthorn pulp oil and seed oil alleviated dimethylbenzene-induced ear inflammation whereas oral administration significantly reduced the acetic acid-induced body writhing in mice.

Many health claims had been studied associated with reparative effect of seabuckthorn oil application on mucosal injuries, skin diseases, abdominal disorder and acidic acid induced gastric ulcers. These effects are reported to be due to the presence of different kinds of flavonoids, terpenoids and stress reducing compounds. Similarly, reparative effect of hyperplastic reunion of tympanic membrane by use of seabuckthorn oil for treatment of traumatic perforation reported by Fan (1991). Seabuckthorn also helpful in the enhancing the healing process of excised skin and chemical and physical burn wounds and operative wounds in different species of animals. Buhatel *et al.* (1991) revealed that combination of seabuckthorn oil with a large spectrum of antibiotic and some other ingredients had synergistic effect on the process of cicatrization of wounds in animals. Gao *et al.* (2003) reported a significant decrease in serum levels of collagen types III and IV, total bile acid following feeding of seabuckthorn extract (15 g three times a day) for six month. The feeding of extract also prevented liver fibrosis.

Anti-oxidant and anti-radiation effect

Use of seabuckthorn increases the free radical, scavenging activity; accelerate the haemopoetic stem cells proliferation. This contributes towards the protective action against radiation induced mortality. Seabuckthorn is rich in carotenoids (including β -carotene, β -4-4-biketone- β -carotene, γ -carotene, zeaxanthin, lycopene and polyring-lycopene), progesterin, flavoxanthin, cryptoxanthin, violaxanthin, neoxanthin, vitamin C, vitamin K and vitamin E, these bioactive ingredient responsible for its antioxidant activity.

Li (1989) reported anti-radiation effect of seabuckthorn oil and juice. Seabuckthorn juice restored the 11-oxycorticosteroid level in blood, helped in maintaining their normal basal activity and increased their average life span in mice. Further, Suleyman *et al.* (2002) revealed that seabuckthorn extract prevented nicotine-induced increase in erythrocyte malondialdehyde level and decrease in erythrocyte superoxide dismutase activity in rat. Kumar *et al.* (2002) revealed that direct and indirect antioxidant action of alcoholic extract of whole berries of seabuckthorn. The extract was found to inhibit 2-deoxy ribose degradation (IC_{50} approximately 500 μ g/ml) and also inhibited radiation and tertiary butyl hydroperoxide induced DNA strand breaks in a dose-dependent manner. The extract of seabuckthorn, thus, acted as free radical scavenger and contributed to DNA protection. Further, Goel *et al.* (2002) reported that, alcoholic extract of whole berries of seabuckthorn inhibited the Fenton reaction and also radiation-induced hydroxyl and nitroblue tetrazolium reduction generated superoxide radicals mediated peroxidation of liver. The alcoholic extract of seabuckthorn provided 82 % of protection in dose-dependant manner. The seabuckthorn juice is rich in ascorbic acid and is responsible for 75 % of its total antioxidant activity. In many studies it had been proved that leaf extract have comparable antioxidant activity. Geetha *et al.* (2002) reported that alcoholic fruit and leaf extracts of seabuckthorn had cytoprotective action against sodium nitroprusside induced oxidative stress. The alcoholic leave extract also have better anti-oxidative and immunomodulatory activity than that of fruit extract

Immunomodulatory effect

Zhong *et al.* (1989) reported that compound extracts of seabuckthorn had a prophylactic effect through stimulation of macrophage function and enhancement of serum lysosome activity in mice and complement activation in guinea pigs. It also increased the serolysin and serum accelerator levels and thus counterchecked the immune suppression caused by cyclophosphamide. Ren (1992) described that seabuckthorn seed oil helps in restoring the natural killer cells activity which is responsible for the nonspecific immune defense mechanism. Further, Li (1993) reported that multiplicative index of splenic lymphocytes was higher in aged mice fed with seabuckthorn juice. Spanu *et al.* (1994) studied the various types of extracts of seabuckthorn and he found that extracts effectively enhance cellular and humoral immunity in rabbits. Immunostimulant activity of seabuckthorn seed oil was superior over seabuckthorn fruit oil. Further, Geetha *et al.* (2002) observed that the alcoholic extract of seabuckthorn fruits (500 mg /ml) was capable of arresting the chromium-induced inhibition of lymphocyte proliferation.

Effect on cardiovascular system

The total flavonoids of seabuckthorn extracted from the leaves and fruits is a group of compounds containing seven kinds of flavonoids: leucocyanidin, catechin, flavonol and tress flavone. These could recruit angina and improve the mechanical cardiography and the echocardiogram which might be due to the increased volume of coronary blood flow. It is also due to myocardial nutritional blood flow and the decrease of myocardial oxygen consumption and inhibition of platelet aggregation. Flavonoids from the seed and fruit residue significantly reduced the levels of serum glucose, serum cholesterol and serum triglyceride and contribute toward the prevention of cardiac problems. Wu *et al.* (1994) reported that application of seabuckthorn flavonoids (100-200 mg/L) in cultured myocardial cells strengthened the contractile force of myocardial cells through inhibition of Ca^{2+} influx in rat. Wang *et al.* (2000) described that flavonoids help in improving myocardial contractile function by strengthening the contractile mechanisms through calcium transmission and prevented congestive heart failure. Dietary supplementation of seabuckthorn juice in humans reduced the susceptibility of low-density lipoprotein oxidation, thereby reducing the risk of heart disease. Dubey *et al.* (2003) reported that oral administration of alcoholic extract of seabuckthorn fruits at 500 mg for three months exhibited beneficial effect on cold stress induced cardiovascular reactivity and enhanced the stress tolerance capacity.

Anti-tumour and anti-carcinogenic effect

The direct effects of seabuckthorn on tumorigenesis, in addition to its indirect effects caused by humoral immunity including inhibiting action on the cancer cell and blocking the carcinogenic factors. Seabuckthorn juice can both kill the cancer cells of S180 and P388 and inhibit growth of the cell strains of human and gastric carcinoma (SGC7901) and lymphatic leukaemia (L1200). Zhang *et al.* (1989) reported that the aqueous and alcoholic extracts of seabuckthorn were effectively inhibitory activity against fibrosarcoma in mice and sarcoma in Wistar rats. Seabuckthorn oil has also been shown to inhibit the sarcoma and lymphatic leukemia in rats and Elli's ascites carcinoma in mice. Further, Nersesyan *et al.* (1990) described that seabuckthorn oil had antimutagenic activity against

cyclophosphamide and farmorubicin. Flavonoids present in oil are responsible for anticarcinogenic action and have potent inhibitory action on liver cancer cell line.

Anti-senilism effect

It is believed that senility is closely related to production of peroxide. Blocking of peroxidation and elimination of free radicals has, therefore, become important in antisenilism. High content of fat-soluble vitamins and essential fatty acids and phytosterols in seabuckthorn play an important role in anti-aging and revitalizing skin. Seabuckthorn oil effectively helps in combating symptoms of malnourishment and premature aging of skin. So, seabuckthorn can be used as dietary supplement to improve the conditions of mucous membranes and is regarded as a natural source of carotene, phytosterols and essential fatty acids. Superoxide dismutase in seabuckthorn fruit juice and leaves have antioxidative effect and it has scavenging action on cellular membrane. Ju *et al.* (1989) observed that total flavonoids of seabuckthorn significantly inhibited chemi-luminescence of human polymorphonuclear leucocytes and cleared away the superoxide free radical produced by purine oxidase system and had delaying effect on aging process. Agarwal (2001) studied the age related memory disorder in human beings and he found that regular use of seabuckthorn juice in diet helps in improving age-related memory disorders in humans.

Anti-bacterial and anti-viral effect

The seabuckthorn promote the immune function and regulate the activity of the immune cells in-vivo and promoting the animal resistance against disease and postponing senescence. Shipulina (2001) reported that purified tannin fraction from seabuckthorn had a wide spectrum of antimicrobial activity against gram positive and gram negative bacteria. It also had antiviral activity against the influenza viruse A & B, herpes simplex type I, adeno viruses type 2, HIP-I. Seabuckthorn extract also had activity against flu. Preparation from seabuckthorn Hiporamin was also exhibit interferon induction activity.

Toxicity

In various toxicological reports on seabuckthorn, it has been cleared the seabuckthorn is quite harmless, if they use even higher doses than that of normal dose. Rachimov *et al.* (1989) did not observe any untoward effect of seabuckthorn when it was fed at a dose 20-30 times higher than the therapeutic dose to mice, rat, dog and cat. Further, Gupta *et al.* (2001) reported a decrease in total leukocyte count, increase in bilirubin and alteration of blood contents in albino mice when it was fed at 40% of dietary levels and has no effect on the body. It did not produce any clinical sickness except that of mice fed on 100 % seabuckthorn.

Conclusion:

The utilization and exploitation of seabuckthorn in improving the productivity of livestock and poultry can also be useful means of increasing the income of the farmers and overall economy of the rural areas, particularly in dry region of Himalayas. Seabuckthorn and its various products ensure the

human and animal bodies inner equilibrium through the action of its various effective components. Through its dual physiological and medicinal action, it not only supports normal metabolism, but also get rid of toxic substances and many of the diseases. It is no exaggeration to say that seabuckthorn acts as "housecleaner" and "panacea" for the animal health and production.

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