MINI-REVIEW

Anticarcinogenic Potential of Lipids from Hippophae - Evidence from the Recent Literature

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Abstract

Hippophae (Sea buckthorn) is a deciduous species, widely distributed throughout the world. Its important products are whole berries, leaves, juice and oil. The last two give this plant a shining name and position in medicinal plants. They contain different kinds of nutrients and bioactive substances such as vitamins, carotenoids, flavonoids, polyunsaturated fatty acids, free amino acids and elemental components. The clinical trials and scientific studies during the 20th century confirm medicinal and nutritional value of sea buckthorn, and the most important of them is its anti-carcinogenic properties. This mini-review is focused on the anti-carcinogenic potential of lipids from this plant, in order to open up a clear understanding for further detailed study in this regard.

Key Words: Hippophae - anticarcinogenic potential - flavonoids - fatty acid - vitamins & antioxidants

Asian Pac J Cancer Prev, **7**, 32-35

Introduction

Hippophae (sea buckthorn) is a deciduous spiny shrub or small tree between two to four meter high, widely distributed throughout the temperate zone of Asia and Europe. The fruit characteristics, Asiatic geographical distribution and cultural practices of sea buckthorn are recently reviewed (Li & Schroeder, 1996). The plant is hard, drought and usually cold tolerant. The leaves are long and narrowed, with shiny attached yellow or orange yellow berries. The oil is obtained from the whole berries, pulp or seeds. Seed or pulp oil is usually yellow in color represented by the occurrence of large amount of carotenoids (Zeb & Mehmood, 2004). Traditional use of sea buckthorn oil to promote the recuperation of skin injuries and support the healing of skin diseases, well agrees with the data of modern clinical studies. Sea buckthorn oil is widely used to promote the recovery of various skin conditions, including eczema, burns, bad healing wounds, skin damaging effects of sun, therapeutic radiation treatment and cosmetic laser surgery. The preparations from the berries are also utilized to prevent gum bleeding, to help recuperate mucous membranes of the stomach and other organs (Yang & Kallio, 2002). Aqueous extract of Hippophae rhamnoides significantly protects against arsenic-induced oxidative stress (Gupta & Flora, 2005). Literature is available regarding other important medicinal properties of lipids and other products from Hippophae (Zeb, 2004a).

The most important and serious of the human diseases is cancer (of different types), which is growing fast in the whole world especially in the developing countries, and their therapy by synthetic medicine is very costly or side affected. In the developing world mostly the cancer patient is treated with traditional, or Chinese medicine. One of these Chinese medicines is sea buckthorn lipid and its products. In order to know the anticarcinogenic activity of Hippophae, this study is aimed to show the correlation of its important chemical constituent and their anticancer properties.

Anticarcinogenic Constituents

The wide chemical and phytochemical composition of sea buckthorn has recently reviewed (Zeb, 2004b; Tiitinen et al, 2005), and was found to vary with the origin, climate and method of extraction. In general H. rhamnoides contains vitamin-C (Yao et al., 1992), large amount of carotenoids and vitamin-E (Jeppsson & Gao, 2000) (Table 1), different flavonoids (Fu et al, 2005), and kaempferol (Zhang & Cui, 2005), fatty acids (Yang & Kallio, 2001), triacylglycerol, glycerophospholipids (Kallio et al., 2002), phytosterols (Yang et al, 2001), zeaxanthin esters (Weller & Breithaupt, 2003), alpha-tocopherol (Luhua et al., 2004) and phenolic compounds (Vaher et al., 2005). Antioxidants prevent free-radical reactions, which normally induce cancer of the respective organ. Hippophae contains different antioxidants, which are helpful in preventing such free radical reactions and oxidative damages of mitochondrial system (Goel et al., 2005). A huge literature is available regarding the activity

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of these constituents as anticancer, however further research is needed to explore other Anticarcinogenic constituents present in Hippophae.

Anticarcinogenic Potential

The literature describing the role of Hippophae in prevention and control of cancer is inadequate, however certain analysis the known experimental research information on anticancer by Hippophae available at present (Zhang et al., 2005; Mingyu, 1994; Zhang, 1989). The inhibition of Hippophae oil on the cancer cells was not as effective as the positive medicine, for example, the cancer inhibition rate of phosphamide was twice as much as Hippophae, The possible mechanisms of antimutagenic action of the sea buckthorn oil, have been discussed (Nersesian et al., 1990).

Most of the work done in this area has been with laboratory animals. Reports on the potential of a hippophae extract, to protect the bone marrow from damage due to radiation; the extract might help faster recovery of bone marrow cells (Agrawala & Goel, 2002). Hippophae juice decreased significantly the genotoxic effect of cisplatin at dose of 1.2 mg/kg on somatic (bone marrow) and germ (sperm) cells of mice. At higher dose of the drug the effects was not statistically significant (Nersesyan & Muradyan, 2004). A faster recovery of the hemopoietic system after high dose chemotherapy in mice fed the sea buckthorn oil was carried out. The seed oil has been found to enhance non-specific immunity and to provide anti-tumor effects in preliminary laboratory studies (Let, 1993).

The direct effects of sea buckthorn on the tumorigenesis, in addition to its indirect ones caused by general immunity or other mechanisms, include inhibiting action on the cancer cells and blocking the carcinogenic factors. Experiment on mice transplanted tumors, including sarcoma (S180), lymphatic leukemia (P388) and B16 was carried out. It was found that both intra-peritoneal injection of sea buckthorn oil and oral administration, inhibited the tumor from developing. Sea buckthorn juice can both kill the cancer cells of S180 and P388 and inhibit growth of the cell strains of the human gastric carcinoma (SGC7901) and lymphatic leukemia (L1200) (Mingyu et al, 1994). Another study (Yang, 1989) on mice with inhibiting the Ellis-ascites carcinoma in vitro with sea buckthorn oil and fruit residue was completed. The results showed that it could prolong the life of the mice with Ellis-ascites carcinoma. It was further found that bioactive substances extracted from seed oil and bagasse had cellulotoxic effects on extrinsic cell strains of human leukemia (K562).

Table 1. Main Constituents of Sea Buckthorn Oils from Seeds, Fruit Pulp (Juice), and Fruit Residue (Zeb, 2004b)

Ingredient	Oil Concentration (mg/100g)		
	Seed	Pulp	Residue
Vitamin E	207	171	300-600
Vitamin K	110-230	54-59	-
Carotenoids	30-250	300-870	1280-1860
Total acids	11	38	-
Total flavonoids	-	-	550
Total sterols	1094	721	-
Unsaturated fatty acids	87%	67%	70%
Saturated fatty acids	13%	33%	30%

Table 3. Some Important Medicinal Properties of Hippophae (after Zeb, 2004a)

Medicinal property	Subject	SBT Product
Anticancer	Rat	Oil
Antimutagenic	Mouse	Oil
Immunological antitumor	Rat	Oil
Non-specific immunity	Rat	Oil
Protection against radiation	Rat	Oil
- cardiovascular diseases	Rat, Human	Oil
- coronary disease	Human	Juice
- arterial thrombosis	Mouse	Oil
- atherosclerosis	Human	Oil
- gastric ulceration	Rat	Oil
- liver injury	Human	Oil
Treatment of liver fibrosis	Human	Oil
- chronic hepatitis	Human	Oil
- skin burns	Human	Oil
- atopic dermatitis	Human	Oil
- other skin diseases	Rat, Human	Oil

The effect of sea buckthorn juice on aflatoxin B1 (AFB1), the carcinogenic factor of liver cancer was also studied. It was found that the number and area of the GCT focus, which is the hepatocyte proliferation (i.e. precancerous lesions), were reduced (Tang, 1989). In human liver cirrhosis is a common chronic hepatic injury caused by chronic hepatitis B, ethanol consumption and metabolic disorders, etc, which induce liver cancer. Clinical study has shown that sea buckthorn may be a hopeful drug for prevention and treatment of liver fibrosis (Gao et al., 2003).

Inhibitory effects in carcinogenesis are important in respect of control and spread of disease. It has been shown that Hippophae inhibits benzo (a) pyrene-induced fore-stomach and DMBA-induced skin papillomagenesis in mouse. This decrease in carcinogenesis may be attributed to the concomitant induction of phase II enzymes such as glutathione S-transferase and DT-diaphorase and antioxidant enzymes such as superoxide dismutase, catalase, glutathione peroxidase, and glutathione reductase in the mouse liver. This was accompanied by a remarkable induction of the transcription factor interferon regulatory factor-1 in the Hippophae-treated liver. Results strongly suggest that Hippophae fruit is able to decrease carcinogen-induced fore-stomach and skin tumorigenesis, which might involve up-regulation of phase II and antioxidant enzymes as well as DNA-binding activity of IRF-1, a known antioncogenic transcription factor causing growth suppression and apoptosis induction for its anticancer effect (Padmavathi et al., 2005).

Discussion

The literature above describes the anti carcinogenic properties of Hippophae are now noticeable. This is merely due to the fact that Hippophae lipids contain various types of natural antioxidants; which prevent body from the oxidative damage and consequent genetic mutation, and ultimate cancer.

The anticarcinogenic properties of vitamin-C, carotenoids, vitamin-E, different flavonoids, kaempferol, fatty acids, triacylglycerol, phytosterols, and phenolic compounds are well known and present in literature, the discussion of which is beyond the scope of this article. However it is suggested that the presence of these bioactive substances would exert a net anticarcinogenic effect on the cancer cells and consequently the growth rate of cancer cells would be inhibited, and this should be confirmed by further detailed laboratory investigations.

Conclusion & Future Studies

Most of the work done in this regard is limited to experimental animals, and now it should be extended to human. If a co-operative anti-carcinogen is developed from the lipids, the immunity of cancer patients can probably be strengthened and the side effects caused by chemotherapeutic agents might be decreased. It is necessary to extract pure effective substances from sea buckthorn & its products and to determine effective and proper application in human cancer. The abundant mass of experimental data evidencing important ingredients and bioactive substances is vast and continues to increase rapidly. It is possible to conclude that hippophae is a promising plant containing many anticarcinogenic compounds with a potential beneficial role in experimental animals and possibly in human health. Thus, with the aim to establish whether these compounds from lipids of hippophae are really capable to influence positively the incidence and progression of oncogenic reactions in molecular and cellular level, a great deal of work in these areas is still necessary. This includes: (I) further studies on bioactive compounds from sea buckthorn and its metabolism in human beings; (II) analysis of factors affecting bioavailability, including interaction with other therapeutic drugs; (III) dietary variations within and between populations; (IV) anticarcinogenic potential of individual component from hippophae; and (V) molecular or cellular mechanism involve during therapy.

Acknowledgments

The laboratory staff of the department of biotechnology is hereby acknowledged for their help in typing this manuscript, Prof. Aman ullah & Prof. Imdad ullah University of Malakand for critical evaluation.

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