

Hippophae Rhamnoides: Safety and Nutrition

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INTRODUCTION

Hippophae rhamnoides, known as sea buckthorn, belongs to the Elaeagnaceae family. It explains, as a large shrub in parts of Eurasia.

Hippophae rhamnoides is one of the oldest land plants, dating from the Ice Age. The first references of its therapeutic effects appear in the 4th century BC. According to historical sources, *Hippophae* was part of Alexander's the Great the army diet. It had been observed that both patients and injured horses were treated, by leaves and fruits of this plant. References to its usage are also found in both Tibetan tradition and Chinese medicine. Other sources report that during 13th century, Jenkins Khan had used it in his campaigns. Finally, in 1929 the first biochemical analysis of *Hippophae* fruits took place¹. Since then the knowledge of its health properties increases.

Hippophae rhamnoides includes vitamins A and C, alpha-tocopherol, large amounts of carotenoids and vitamin E, minerals (*K, Na, Mg, Ca, Fe, Zn, Se*), monosaccharides, amino acids, flavonoids, fatty acids, glycerolphospholipids, phytosterols, zeaxanthin esters, polyphenolic compounds (*see Table 1*), etc. Its composition varies according to origin, climate, and the extraction procedure used. Vitamin C is one of the major vitamins contained in *Hippophae rhamnoides*. Its fruit provides about 400-600 mg vitamin C/100 gr¹.

Because of its components *Hippophae rhamnoides* exhibits numerous beneficial actions: antioxidant, anti-inflammatory, antibacterial, antineoplastic, immunomodulatory and hepatoprotective.

Usages-Indications

It possesses strong antioxidant properties so it is used to improve blood pressure and lipids, to prevent and control cardiovascular symptoms (eg angina), to reduce free radicals levels and prevent atheroma.

Both *Hippophae rhamnoides* leaves and flowers are used in arthritis, gastrointestinal ulcers, gout, and rashes. Its fruits are also used to prevent infection and boost immune function.

There are reports of its administration as an expectorant in treating common cold, asthma and pneumonia; as an aid to improve vision and prevent nyctalopia.

It also helps to heal wounds/injuries from burns, acne, skin ulcers; it may help to improve eczema skin lesions and dermatitis symptoms.

Hippophae rhamnoides seems to reduce cancer morbidity and chemotherapy toxicity, alleviate gastrointestinal symptoms (ulcer, reflux) and detain the dementia onset in aged individuals.

Finally, it seems to participate in body's protection against radiance effects (*UV, X-rays, and radioactivity*).

Safety

It is considered to be a safe nutritional supplement, with no evidence of toxicity, when used according to the instructions of a doctor or a clinical dietitian. Clinical research suggests that *Hippophae rhamnoides* can be used safely for up to 90 days [4]. Available reliable information concerning pregnancy and lactation is inadequate.

Effectiveness

Reliable evidence for *Hippophae rhamnoides* efficacy is relatively weak. More extensive clinical research so as to study its effects is required.

Health applications

Cardiovascular disease

Preliminary clinical research in China⁵ suggests that taking 10 mg flavonoids extract from *Hippophae rhamnoides*, 3 times daily for six weeks, reduces blood cholesterol levels, blanks out angina,

and improves cardiovascular function in patients with ischemic heart disease. There are no side effects reported on kidney and liver. It was considered that this extract can reduce myocardial stress by reducing proinflammatory factors.

In a clinical study⁶, dried *Hippophae rhamnoides* emulsion was given to 102 people with hyperlipidemia, for 12 consecutive weeks; they had their blood lipids regularly measured (*4th, 8th and 12th week*). Results showed that in 4 weeks, *Hippophae rhamnoides* lowered total blood cholesterol, atherosclerotic index (TC-HDL/HDL ratio), and increased HDL-C. Triglycerides decreased by 19.2%, mean atherosclerotic index decreased by 28.2%, and mean HDL-C increased by 18.1%, after treatment.

Two hundred twenty nine healthy participants, divided into two groups, were given low-dose *Hippophae rhamnoides* fruit supplement or placebo, for three months. It appeared that it increased fasting plasma flavonols concentrations, but it did not significantly affect blood lipids, in healthy volunteers^{7,8}.

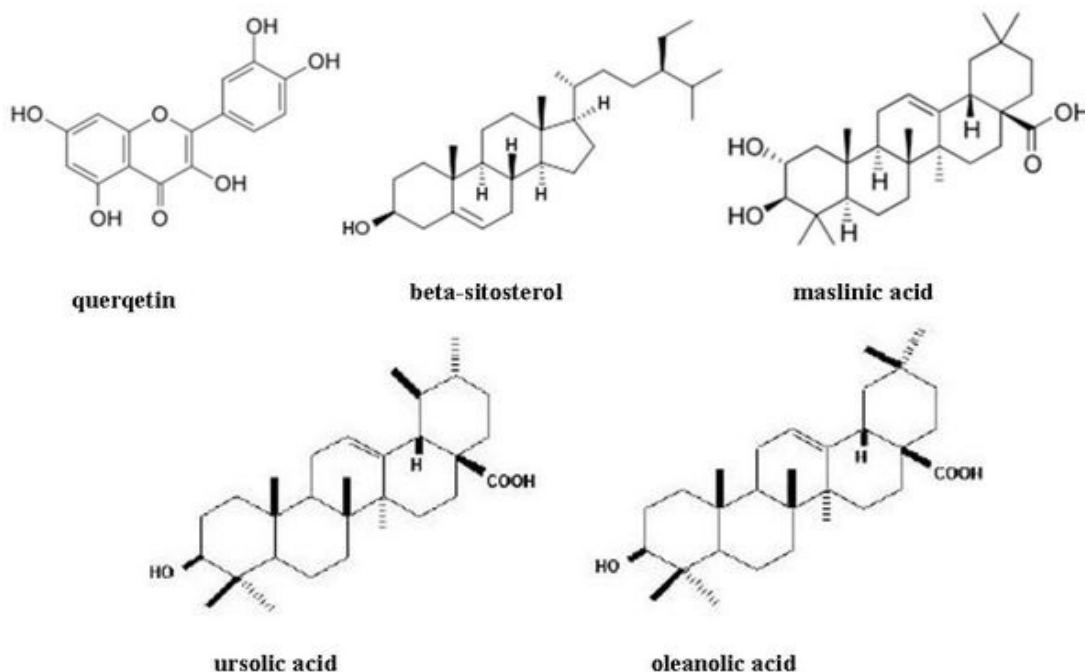


Fig. 1: *Hippophae rhamnoides* L. active constituents

Common cold

Preliminary clinical research shows that consumption of 28 gr *Hippophae rhamnoides* mashed fruits per day for 90 days does not significantly reduce either the risk of common cold or symptoms duration [4]. Oral administration of 500 mg alcohol extract to sensitive to cold people, every day for three months, reduced cardiovascular effects of stress, from cold⁹.

Digestive infection

Clinical research supports that eating 28 gr *Hippophae rhamnoides* mashed fruits per day, for 90 days, significantly reduces the risk of infection of the digestive tract⁴.

Liver Cirrhosis

Clinical research suggests that taking *Hippophae rhamnoides* extract may reduce liver inflammation¹⁰.

In this study, 50 cirrhotic patients were divided into 2 groups. Group A was given 15 g *Hippophae rhamnoides* extract, 3 times a day for

six months. Group B was given a vitamin B complex supplement, three times a day for six months. After treatment, values of laminin, hyaluronic acid, collagen III and IV and total bile acids were decreased significantly vs. control group (see Figure 2).

Dermatological issues

Palmitoleic acid, contained in *Hippophae rhamnoides* oil, is a component of our skin, and is thought to help healing wounds and burns – when topically applied. Oral administration of palmitoleic acid may nourish the skin and help in various dermatological issues such as atopic dermatitis.

After a 4-month administration of *Hippophae rhamnoides* oil in patients with atopic dermatitis, remission of symptoms was observed¹¹. 49 patients received 5g per day seed oil, pulp oil or paraffin, for four months. Researchers found that *Hippophae rhamnoides* seed oil increased significantly the proportion of alpha-linolenic in plasma neutral lipids, alpha-linolenic, and eicosapentaenoic acids in plasma phospholipids. After one month of

Table 1: *Hippophae rhamnoides* L. constituents [1-3]

Category	Constituent examples
Triterpenoids	Oleanolic acid, 3-o-trans-p-coumaroyl-oleanolic acid, 3-o-cafeenoyl-oleanolic acid, 2-o-trans-p-coumaroyl-maslinic acid, 2-o-caffenoyl-maslinic acid, ursolic acid, 19-hydroxy-methyl-ursolic acid
Vitamins	C, A, E, zeaxanthin esters, b-carotene, a-tocopherol, folate
Minerals	Ca, Mg, K, Se, Na, Fe, Zn, P, Co, Cr, Cu, Mn, Ni, Sr, Va, Mb, Al, Li, Cd, As
Heavy metals	Cd, Pb, Hg
EFA	Palmitoleic acid, oleic acid, palmitic acid, linoleic acid, a-linolenic acid
Flavonoids	Quercetin, kaempferol, isorhamnetin, catechin, rutin, myricetin
Tannins	Hippophaenin A, hippophaenin B
Lipopolysaccharide	Octacosanoic acid
Phenols	Ellagic acid, ferulic acid
Monosaccharides	Xylose
Volatile esters	Ethyl-dodecanoate, ethyl-octanoate, ethyldecanoate
Glucosides	1-O-hexadecanolenic acid
Sterols	b-sitosterol, stigmastanol, campesterol, stigmastadiol
Aldehydes	1-decanol, circiumaldehyde, 5-hydroxy-methyl-2-furancarboxaldehyde
Polyalcohols	Mannitol, sorbitol, xylitol
Glycosphingolipids	<i>Hippophae</i> cerebroside
Free aminoacids	Aspartic acid, praline, threonine, serine, lysine, valine, alanine, phenylalanine, glutamine, isoleucine, glycine, histidine, tyrosine, arginine, cysteine, methionine

supplementation with seed oil, there were positive correlations between symptom improvement and the increase in proportions of alpha-linolenic acid in plasma phospholipids and neutral lipids. In plasma phospholipids and neutral lipids, the pulp oil increased the proportion of palmitoleic acid ($p < 0.05$) and lowered the percentage of pentadecanoic acid. In addition, seed oil increased docosapentanoic acid concentration and reduced that of palmitate in skin glycerolphospholipids. That implies greater efficiency in integrating and metabolising *Hippophae rhamnoides* alpha-linolenic acid (vs. linoleic acid), and providing a more stable fatty acids composition of skin glycerolphospholipids.

Burns

Wang *et al* in a controlled study in 151 patients with burns used *Hippophae rhamnoides* oil or petroleum jelly (*control*), on their wounds. They reported that the oil reduced wound swelling and relieved pain. Compared to control group, patients in the intervention group reported statistically significant decreased exudation, greater pain relief and faster wound healing.

Sea buckthorn oil is widely used alone or in various preparations topically applied for burns,

scalds, ulcerations, and infections. Hippophae oil has UV-blocking activity as well as emollient properties and promotes regeneration of tissues¹². The fruit may also be used for benefiting the hair: the name hippophae, means shiny horse, and refers to the good coat developed by horses feeding off the plant.

Mechanism of action

Cardiovascular effects

Flavonoids from *Hippophae rhamnoides* fruits are thought to reduce incidence of cardiovascular diseases by reducing cholesterol, inflammation and platelet aggregation⁶.

In healthy volunteers, consumption of 28 gr *Hippophae rhamnoides* mashed fruits per day for 90 days, significantly reduced inflammation rate, and C-reactive protein (CRP) compared to placebo⁴. However, the addition of these flavonols in oatmeal does not appear to significantly reduce CRP, homocysteine or levels of oxidized low density lipoprotein (LDL), in humans. Preliminary clinical research in humans indicates *Hippophae rhamnoides* oil may prevent platelet aggregation¹³.

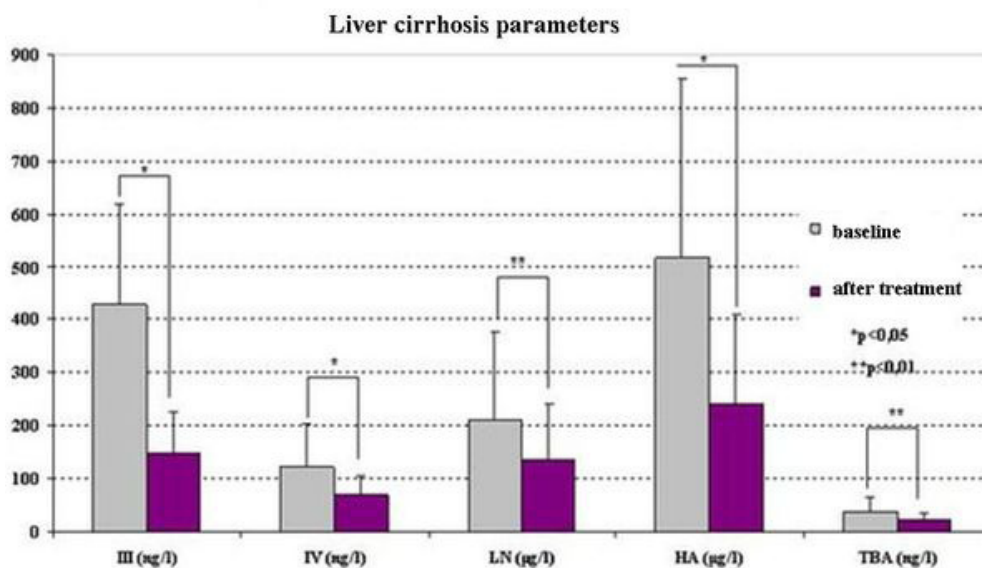


Fig. 2: *Hippophae rhamnoides* extract effects on liver cirrhosis parameters. Treatment decreased significantly collagen types III and IV, laminin (LN), hyaluronic acid (HA), and total bile acids (TBA). * $p < 0,05$, ** $p < 0,001$. From Gao ZL *et al*, *World J Gastroenterol* 2003; 9(7): 1615-7

Supplementation of *Hippophae rhamnoides* juice with vitamin C, alpha tocopherol, beta-carotene and flavonoids increased plasma HDL-C levels by 20% in healthy male volunteers¹⁴. Furthermore, reduced susceptibility of LDL-C to oxidation was observed in these subjects.

Antidiabetic effects

Thirty children with insulin dependent diabetes, were given a concentrated supplement, of *Hippophae rhamnoides* and blueberry for 60 days (see Figure 3). After two months of treatment both erythrocytes' superoxide dismutase and C-peptide were significantly increased, whereas glycated hemoglobin was significantly decreased¹⁵.

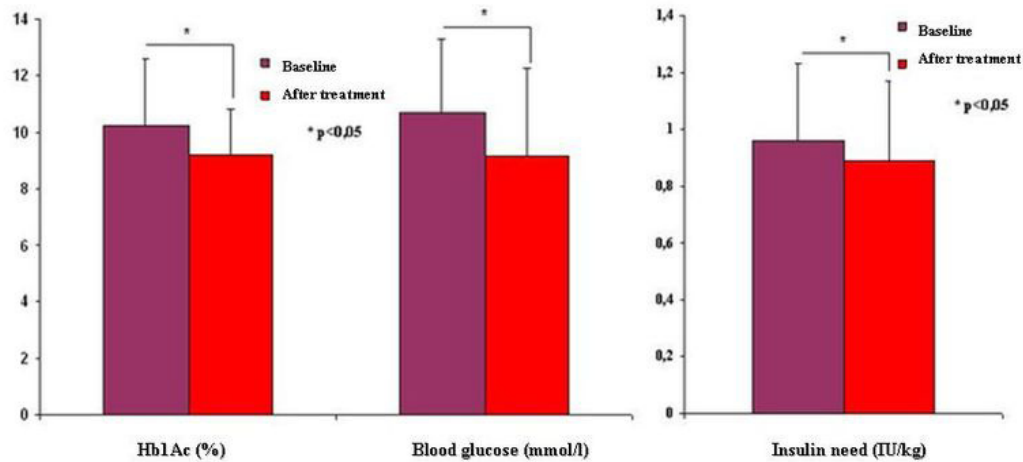


Fig. 3: Supplement administration effect on diabetes type I parameters. Glycated hemoglobin, fasting blood glucose and need for insulin significantly decreased ($p < 0.05$) in kids with insulin dependent diabetes, after 2 months of treatment with *H. rhamnoides* and blueberry. From Nemes-Nagy Å, *et al. Acta Physiol Hung* 2008; 95(4): 383-93.

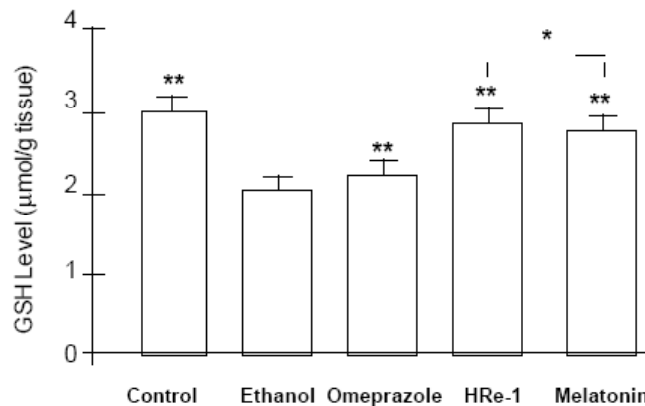


Fig. 4: The effects of *Hippophae rhamnoides* L. extract, (500mg/kg), omeprazole (20 mg/kg), melatonin (10 mg/kg) and ethanol (1 mL of 50%) on gastric tissue GSH (glutathione) levels in rats. * $p < 0.01$ (comparison between HRe-1 and melatonin), ** $p < 0.001$ when compared to the ethanol groups (group 4).

Antioxidant effects

Hippophae rhamnoides leaf extract protected albino male mice from chromium induced oxidative damage¹⁶. It may also inhibit the effects of oxidative stress on erythrocytes of nicotine exposed mice [17].

Anticancer activity

Animal models show that *Hippophae rhamnoides* juice reduces the incidence and growth of experimentally induced tumours. Preliminary investigations show that *Hippophae rhamnoides* oil may reduce chemotherapy toxicity. Extracts, which mainly contain flavonoids, may protect bone marrow by radiation, and can possibly help its faster recovery¹⁸. Hematopoietic system of mice fed with *Hippophae rhamnoides* oil, rebounded quickly after a large dose of chemotherapy¹⁹.

Gastroprotective activity

Hippophae rhamnoides likely normalizes gastric acid secretion and reduces inflammation, as well as proinflammatory factors. Preliminary research on animal models showed that *Hippophae rhamnoides* extract and two components of this oil (*beta-sitosterol-beta-D-glucoside* and *aglycone*) may exert protective properties against gastric ulcers²⁰. In addition, seed oil seems likely to improve the symptoms of reflux²¹.

In Wistar albino rats with ethanol-induced gastric ulcer, the effects of *Hippophae rhamnoides* extract (HRe-1), melatonin or omeprazole on glutathione levels (GSH) of gastric tissue were examined²². It seemed that HRe-1 induced close to normal glutathione levels (see Figure 4), more than the melatonin, and helped effectively in preventing gastric ulcer formation.

Hepatoprotective activity

In animal models, it was showed that *Hippophae rhamnoides* seed oil can protect liver from damage induced by carbon tetrachloride, ethyl alcohol or acetaminophen²³.

Protection against radiation

In mice fed with *Hippophae rhamnoides* fruit, protection from deadly radiation has been reported. Goel *et al*²⁴ demonstrated that *Hippophae rhamnoides* alcoholic extract contributed to survival

of 82% of mice compared with no survival of the control group. As shown, this extract caused a strong suppression of chromatin, which could make cells resistant even to a radiation dose of 1000 Gy. Also, it suspended radiation and TBHP induced damage on DNA chains, in a dose dependent manner. This ability to protect DNA could be mainly attributed to direct modulation of chromatin.

Antimicrobial effects

Some studies suggest that *H. rhamnoides* L. exerts antimicrobial effects. Phenolic compounds of its fruit seem to inhibit Gram-negative bacteria growth²⁵.

Immunomodulatory effects

Hippophae rhamnoides leaves extract appears to possess significant immunomodulatory effect. In chromium-induced immunosuppression in animals, leaves extract (100 mg / ml) inhibited production of free radicals [26]. Moreover, it stimulated production of both IL-2 and c-IFN, and inhibited chromium-induced reduction of their secretion; however, it did not alter the IL-4 production.

Neurological effects

After two weeks of *Hippophae rhamnoides* fruit extract (4.0 mg / kg body weight) administration, Wistar albino male rats showed significant increase in mobility. Repeated treatment with haloperidol (2 times/day, 3 mg/kg weight for 2 weeks) – a powerful tranquilizer/antipsychotic drug – reduced significantly ($p < 0.01$) brain tryptophan (TRP) and 5-hydroxytryptamine (5-HT), both involved in the metabolism of the hormone serotonin [27]. This reduction was prevented by *Hippophae rhamnoides* extract.

Side effects

It should be avoided by people with known allergy or hypersensitivity to *Hippophae rhamnoides* and its components. Incidentally, there are no side effects reported. *Hippophae rhamnoides* could cause excessive bleeding if used postoperatively. Patients should stop consuming it at least two weeks before surgery.

Contraindications

It is not recommended while taking antihypertensive medication²⁸ (ACE inhibitors or A2R blockers),

anticoagulation or antiplatelet agents^{12, 13}, and anticancer agents (*especially cyclophosphamide*)²⁹⁻³¹. In patients with diabetes mellitus or on hypoglycemic agents, *Hippophae rhamnoides*' flavonoids may reduce blood glucose, as demonstrated in animal models³². In patients with autoimmune diseases or on immunosuppressants, it can increase immune system activity^{33, 34}.

Interaction with drugs

Hippophae rhamnoides may interact with antibiotics³⁵ or medicines for blood pressure, such as angiotensin converting enzyme inhibitors or competitors receptor II antagonists²⁸.

It may increase the risk of bleeding when taken along with drugs that reduce blood coagulation^{13, 14, 36}, such as aspirin, anticoagulants (*eg warfarin, heparin*), antiplatelet drugs (*eg clopidogrel*), and nonsteroidal anti-inflammatory drugs (*NSAIDs, ibuprofen or naproxen*).

It can also reduce blood glucose levels^{11, 32}. Caution is advised when using medications that may also help reduce blood glucose. Patients taking oral agents for diabetes or insulin should be monitored closely by their doctor or clinical dietitian. Medication adjustments may be necessary.

Use with caution if you receive hypocholesterolemic therapy^{5, 6} due to risk of cumulative effects.

The antioxidant activity of *Hippophae rhamnoides* is unclear. Use with caution with antioxidant supplements because of possible additive effects.

Hippophae rhamnoides can reduce the formation of ulcers^{22, 37}. Use with caution if you take antiulcer treatment because of possible additive effects.

It may significantly affect the action of certain immunosuppressive drugs²⁶ and chemotherapy formulations¹⁸. Use with caution if you are taking immunosuppressive drugs because of possible additive effects.

Interactions with Herbs & Supplements

Simultaneous use of *Hippophae rhamnoides* with herbs that prevent platelet aggregation¹³ can theoretically increase the risk of bleeding. Some of these herbs and supplements include: *ginkgo biloba, cloves, garlic, oil, vitamin E, the Panax ginseng, the ginger, red clover (red clover), turmeric, the chrysanthemum, the horse chestnut, Angela* etc.

Caution is recommended in case of concurrent *Hippophae rhamnoides* use with herbs or supplements that lower blood pressure^{28, 38} (*fish oil, coenzyme Q10, garlic, ginseng, andrographis, peptides of casein, cat's claw, L-arginine, lycium, stinging nettle, theanine* etc.) and / or blood glucose (*beta-glucan, bitter melon, ginseng, gymnema, chromium*).

Interactions with food

There is no interaction known.

Interactions with laboratory tests

No interaction is known.

Manufacture of sea buckthorn products

Separation of useful components of the berries with the use of a press/decanter yields the key products of juice, dried fruit nutrients, and oil from the seeds and pulp. The juice containing oil and water passes through a disk stack centrifuge (cream separator) and yields juice and sediment. The sediment passes then through a spray drier to yield the nutrient supplement in powdered form. Through the cream separator we also get the cream which yields the sea buckthorn pulp oil through extraction.

Seed oil can be obtained from the press/decanter through the press cake, the finisher, the drier and the oil extractor.

Residues can be utilized as valuable animal feed

New technologies, involving supercritical carbon dioxide extraction, are now being used in China to efficiently produce the oil products³⁹.

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