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A Review Article on Sea Buckthorn Fruits: A Possible Source of Essential Nutrients for Nutraceuticals and Cosmeceuticals

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ABSTRACT

Sea buckthorn (Hippophaë rhamnoides L.) is a plant that now shows many modern benefits. Sea buckthorn has attracted attention mainly because Sea buckthorn berries are rich in nutrients and active substances, including vitamins, fatty acids, free amino acids and essential minerals. This review gives a summary of current research and looks at Sea buckthorn as a possible crop as well as how Sea buckthorn berries are processed after harvest. All of the composition data on Sea buckthorn berries is put into a table so that readers can see a up-to-date list of the chemical and medicinal components that come from different Sea buckthorn varieties. The many good chemicals and nutrients found in Sea buckthorn berries show how useful Sea buckthorn is. From science we know that Sea buckthorn berries hold these parts and they should be used as other food choices in the market. A detailed study that compares how Sea buckthorn processing changes the total nutrients in Sea buckthorn berries from farming areas should also be done.The volatile oil from Hippophaë rhamnoides L. Fruits was studied with GC and GC-MS. Thirty compounds were found, making up 94.6 % of the oil. The main parts of the oil were ethyl dodecenoate (39.4 %) ethyl octanoate (9.9 %) decanol (5.6 %) ethyl decanoate (5.5 %) and ethyl dodecanoate (3.7 %).The fatty acids in the lipids that come from the mesocarps and seeds of Hippophaë rhamnoides L. And Myrtus communis L. Fruits were measured with GC. Fifteen different fatty acids were seen. In the mesocarp of Hippophaë rhamnoides L. Fruit the common fatty acids were palmitoleic acid (47.8 %) and palmitic acid (29.3 %). The main fatty acids were acid (32.8 %) palmitic acid (26.3 %) and linoleic acid (21.7 %). In the mesocarps and seeds of Myrtus communis L., oleic acid was the fatty acid making up 72.1 % and 64.1 % respectively. The free fatty acids of the lipids from Myrtus communis L. Seeds were also checked with GC. The common free fatty acids were oleic (69.5 %) palmitic (17.8 %) and stearic (6.4 %). In every extract the amount of unsaturated fatty acids was higher than the amount of fatty acids.In every extract the levels of unsaturated fatty acids were higher, than the levels of their saturated counterparts.Phytosterols in sea buckthorn (Hippophae rhamnoides L.) seed oil were found using GC–MS and FID. The methods used were pressing, hexane and supercritical carbon dioxide. The compounds found were campesterol, clerosterol, lanosterol, sitosterol, β-amyrin, sitostanol, Δ5-avenasterol, Δ24(28)-stigmasta-en-ol α-amyrin, Δ5,24(25)-stigmastadienol, lupeol, gramisterol, Δ7-sitosterol, cycloartenol, cycloeucalenol, Δ7-avenasterol, 28-methylobtusifoliol 24-methylenecycloartanol, erythrodiol, citrostadienol, uvaol and oleanol aldehyde. Sitosterol and Δ5-avenasterol were the important phytosterols. Total sterols and most individual sterols had differences, across the three methods. Supercritical carbon dioxide gave the amount of sterols. Cold pressed gave the amount of sterols.The berry of sea buckthorn known scientifically as Hippophaë rhamnoides has a history of use as both a food and a medicine in eastern countries. Both the seeds and the tender parts of the berry – the fruit flesh and the skin – contain a lot of lipids. Oils taken from the seeds and from the fruit parts have fatty acid profiles yet both are rich, in fat-soluble vitamins and phytosterols. The composition of these oils changes depending on where the berries come from when they are picked and how the oil is extracted. Clinical studies and animal experiments show many health benefits coming from these oils. This article looks at the composition of sea buckthorn oils, their advantages and their industrial applications.

Keywords: Sea buckthorn fruit; Important nutrients; Bioactive compounds; Antioxidants; Health advantages; Post-harvest handling; Dehydration, Hippophaë rhamnoides; Myrtus communis; Family Eleagnaceae; Family Myrtaceae; Composition of essential oils; Fatty acids. Plant sterols; Sea buckthorn; Isolation.

INTRODUCTION

Sea buckthorn, genus Hippophaë is a shrub that makes berries. Grows naturally in Asia and Europe. Sea buckthorn has also been planted in North America and South America. Sea buckthorn species include six species and twelve subspecies. One of the well known is Hippophaë rhamnoides, which people also call sea buckthorn, sandthorn or seaberry. Sea buckthorn is grown in parts of the world (Li, 2003 Li and Schroeder 1996 Rousi, 1971). Sea buckthorn is very hard to drought and to cold. Sea buckthorn helps to restore land and protect farms. Sea buckthorn spreads quickly through its roots and has a complex root system, with nitrogen-fixing nodules (Rongsen, 1992).

Sea buckthorn is a kind of plant that works well as a pioneer in harsh environments. It has been used for a long time in Russia, Europe and Asia to help with health and nutrition. People have relied on sea buckthorn berries for centuries because of the benefits they offer.

This plant is now getting attention as a food source because of its rich nutritional content. Scientists have found than 190 different compounds in the seeds, pulp, fruit and juice of sea buckthorn. These include soluble vitamins like A, K and E. There are also fatty acids lipids organic acids, amino acids, carbohydrates and vitamins such as C, B1, B2 and folic acid. Also present are tocopherols, flavonoids, phenols, terpenes and tannins. Many of these compounds are known to support health (Li & Wang 1998).

Studies show that sea buckthorn berries and seeds are full of antioxidants. These include ascorbic acid, tocopherols, carotenoids and flavonoids. There are also acids that are good for health (Gao et al., 2000; Kallio et al., 2002; Rosch et al. 2003). While the whole sea buckthorn plant has value the berries are the important part. This is because the berries are used to make juice, which's why sea buckthorn berries are becoming more popular around the world (Beveridge, Li, Oomah, & Smith 1999).

All of this points to the potential of sea buckthorn berries as a valuable food source. This paper reviews the literature on the chemical makeup and medicinal effects of sea buckthorn berries and juice. It also looks at ways of processing the berries and how these methods affect their nutritional value. The focus is on berries from regions and varieties to understand their composition better. The goal is to help research in nutrition and food science.

These include improving quality control methods, for sea buckthorn berries and juice. Such improvements could lead to standards and higher quality products in the future.

Sea Buckthorn, known scientifically as Hippophaë rhamnoides L. is a shrub that grows near rivers, torrents and sandy areas in Turkey and Mediterranean regions. Sea Buckthorn is found across eastern Anatolia and is locally called "Yalancı igde" and "Karga dikeni." Sea Buckthorn berries contain carotenoids, lipids, ascorbic acid, tocopherols, sterols, flavonoids and triterpenes. Sea Buckthorn fruits are a source of both water-soluble and fat-soluble antioxidants because they hold vitamins D and E carotenoids and enzymes such as superoxide dismutase isoenzymes. Sea Buckthorn berries are widely eaten as food. Used in traditional Turkish medicine to treat ulcers. The anti-ulcer properties of Sea Buckthorn fruits have been confirmed by research teams. Those scientists found that n-hexane extracts from Sea Buckthorn seed and pulp oils fight ulcers. Sea Buckthorn oils regenerate skin reduce inflammation and protect from sun damage making them useful, for dermatology and cosmetics.

Myrtus communis L., belonging to the Myrtaceae family is a plant that people have used since ancient times for medicine, cooking and seasoning. The leaves contain tannins and flavonoids such as quercetin, catechin and derivatives of myricetin well as volatile oils (Baytop, 1999; Romani et al., 1999). The fruits of Myrtus communis mainly contain oils, tannins, sugars, flavonoids and organic acids such as citric acid and malic acid (Baytop, 1999; Martin et al., 1999). In folk medicine the leaves and fruits of Myrtus communis have been used as antiseptics for wound healing and for treating urinary tract diseases (Baytop, 1999). The essential oil obtained from the leaves by steam distillation is important in perfumery (Baytop, 1999). The leaves of Myrtus communis found in Turkey contain oil whose main components are 1,8-cineole, linalool, myrtenyl acetate and myrtenol (Ozek et al., 2000). Moreover Mansouri et al. (2001) Discovered that a raw methanol extract of Myrtus communis leaves had antibacterial effects, against ten microorganisms, including six gram-positive and four gram-negative bacteria.

The biological and phytochemical characteristics of H. Rhamnoides and Myrtus communis fruits have been studied extensively. In this study we examined the oil composition of H. Rhamnoides fruits and the fatty-acid composition of H. Rhamnoides and Myrtus communis fruits.

Sea Buckthorn is a shrub that produces yellow or orange berries and has been eaten in Europe and Asia for many centuries. Recently modern analytical methods have shown that the fruit has a composition that makes it useful as both a food and a medicine (Beveridge, Li, Oomah, & Smith 1999). Sea Buckthorn is now known for its high levels of nutrients and therapeutic ingredients.

Phytosterols are components found in vegetable oils and have attracted much interest because they can lower serum cholesterol in people (Hicks and Moreau 2001; Jones et al., 1997). This helps reduce the risk of heart disease. Their inclusion in products such as the margarine Benecol® (Mellentin, 2005) shows how important they are. Phytosterols also have anti-inflammatory, anti-bacterial, anti-ulcerative and anti-tumor properties (Beveridge, Li, & Drover 2002). These benefits add value to Sea Buckthorn products when they are used as nutraceuticals. Unfortunately data on the amounts of phytosterols in Sea Buckthorn are scarce. The seed oil extracted with a solvent from the sinensis cultivar contained a total of 1441 ± 52 mg kg^{-1} of phytosterols (Yang, Karlsson, Oksman, & Kallio 2001). The oil content of the seed was not reported. If we assume an average of 14.2 % oil (Beveridge et al., 1999) this translates to 1015 mg of phytosterols per 100 g of oil. In the sinensis seed oil sitosterol is the phytosterol while a mixture of Δ5-avenasterol and obtusifoliol makes up a smaller second fraction.

Historically oils were obtained from seed material by pressing (CPE). Recently organic solvents such as hexane (HE) have been used because they give higher yields. Carbon dioxide (SCE) extraction has become popular for nutraceutical oils because it leaves no solvent residue; any remaining CO_2 evaporates when exposed to air. This study looks at how these three main extraction techniques affect the amounts and types of phytosterols, in Sea Buckthorn seed oil using GC–MS analysis (Beveridge et al., 2002).

MATERIALS AND TECHNIQUES

The voucher specimens were kept in the herbarium at Ataturk University.

To extract the components, dried fruits of H. Rhamnoides were subjected to steam distillation for four hours. After that the volatiles were extracted using CHCl3. Then dried with anhydrous sodium sulfate.

The fatty acids present, in the seeds and mesocarps of H. Rhamnoides.

All solvents were grade and used without further purification. Solvents were handled directly in the laboratory. Hexane was an available blend of glass-distilled hexanes from Caledon Laboratories, Georgetown, Ont., Canada. Solvents containing hexane were used in all chromatography steps. Silica gel 60F thin-layer chromatography (TLC) plates, each with an aluminum backing and a 0.25 mm layer thickness were supplied by Whatman Ltd. (Maidstone, Kent, United Kingdom). Silica gel plates were stored in an environment. Potassium hydroxide pellets, with 85% purity were purchased from BDH Chemicals Inc. (Poole, UK). Potassium hydroxide was used to adjust pH in the reactions. The phytosterols cited in this study were α-amyrin and 5α-cholestane.

OIL CONTENT

A unique feature of the sea buckthorn berry is the amount of oil in the soft parts of the fruit as well as the oil found in the seeds. The oil in the seeds is usually 10 percent but some types of plants and wild berries from Altai, Czech Republic and Tajikistan have been found to have higher amounts (up to 15–16 percent) (Franke & Muller 1983; Kallio et al., 2002; Kallio et al., 2000; Yang, 2001; Yang & Kallio 2001; Yang & Kallio 2002). Unlike the seeds the oil levels, in the fruits flesh and skin.

PHYSIOLOGICAL EFFECTS OF SEA BUCKTHORN OILS

Sea buckthorn berries have a history of use in Tibetan medicine and Mongolian medicine. These berries were used to deal with cough and extra mucus in the body. They were also used to improve blood circulation and help with digestion. A study from 1985 by Ge, Shi, Zhang and Wang talked about this. The berry became known as a medicine in the Pharmacopeia starting in 1977. During the half of the 1900s many experiments on animals and tests, with people were done. These studies looked at how sea buckthorn affects the bodys functions.

OUTCOMES AND ANALYSIS

Steam distillation of H. Rhamnoides fruits produced an oil with a yield of 0.1% (w/w). The yield was calculated based on the weight of the fruits. The oil components and their percentages are listed according to their elution order on the SE-52 column, in Table 1. A total of 30 components were identified in the oil making up 94.6% of the oil. The oil is unstable. Mainly consists of aliphatic alcohols, hydrocarbons and esters. Among these eight aliphatic esters account for 63.3% of the oil primarily.

Chromatographic evaluation of the component of sea buckthorn seed oil revealed seventeen distinct phytosterol peaks labeled A to Q. Chromatographic evaluation confirmed the identities of campesterol, lanosterol, sitosterol, β-amyrin sitostanol, α-amyrin lupeol, cycloartenol, erythrodiol and uvaol by comparing their RRt values and MS fragments with those of TMS ether derivatives made from samples. The TMS ether derivatives of sterols, from olive (Filippo Berio).

NUTRITIONAL VALUE OF SEA BUCKTHORN BERRIES

I think Schroeder and Yao (1995) say that sea buckthorn berries are among the nutrient-dense and vitamin-packed fruits in the plant kingdom.

Sea buckthorn berries contain amounts of carbohydrates, protein, fat-soluble vitamins, antioxidants (for example vitamins C and E β-carotene and lycopene) essential fatty acids, amino acids, phytosterols and flavonoids and they also contain chemical elements such as iron, calcium and others.

(Beveridge et al., 1999; Mironov, 1989; Zhang et al., 1989). In addition, to being nutritious the sea buckthorn berries.

POSSIBLE HEALTH ADVANTAGES OF SEA BUCKTHORN FRUITS.

Sea buckthorn berries have long been known for their healing qualities and excellent nutritional content. Sea buckthorn berries were used for centuries in their regions of Europe and Asia. Recently sea buckthorn berries have attracted interest mainly because of their nutritional and medicinal benefits. Sea buckthorn berries are found in two hundred industrial products, such as lifesaving medicines and herbal remedies, for cancer, heart conditions, ulcers, liver problems, burns and neurological disorders.

PROCESSING OF SEA BUCKTHORN BERRIES AFTER HARVEST

The process begins by gathering berries in autumn. The berries remain on the branches through winter if they are not disturbed (Li & Schroeder 1996).

Berries are gathered by hand although research on harvesters is underway and hormonal treatments that could lessen the effort to separate berries look promising (Li & Schroeder 1996). The effect of hormones such as ethylene, on the processing qualities of the berries is still unclear yet berry ripening.

PRODUCTION AND APPLICATION OF SEA BUCKTHORN OILS: THE PRESENT AND THE FUTURE

I have seen that sea buckthorn oils have been used for decades in China and Russia as ingredients in health products such as nutraceuticals and natural medicines and also in cosmetics. Recently I have noticed that sea buckthorn oils are gaining popularity as unique dietary supplements and ingredients in Japan, Europe and North America because people, in western nations are becoming more aware of the nutritional benefits of sea buckthorn oils. I find that pressing is not a way to extract oil from the seeds because the yield is low.

CONCLUSIONS AND UPCOMING POSSIBILITIES

Sea buckthorn berries have different compounds that do a lot of good things in the body. As people start to prefer things that help them feel better using sea buckthorn berries as a natural food ingredient has become more common in recent years. The fruits have lots of carbohydrates, proteins organic acids, amino acids and vitamins. They also have amounts of carotenoids, vitamin E, dietary minerals, β-sitosterol and polyphenolic acids.

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