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A Review of the Anticancer Activity Found in Sea Buckthorn

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ABSTRACT

A traditional Chinese herbal remedy uses sea buckthorn scientifically known as Hippophae rhamnoides L. or Elaeagnus rhamnoides L.. Sea buckthorn is a tropical plant which has been widely used as medicinal plant for centuries. It is used as traditional medicine to treat various diseases, such as cancer, rheumatoid arthritis, and hepatocellular carcinoma. Numerous bioactive components, like polyphenols, fatty acids, vitamins, and phytosterols, are known to be present in this species; these substances may account for some of its therapeutic benefits. Sea buckthorn's health benefits have been known for ages. This plant is rich in bioactive components like vitamins C, K, and E, amino acids, antioxidants, phytosterols, and vital fatty acids. Its distinct scent is additionally enhanced by a low sugar content and a broad range of volatiles. These berries contain a variety of advantageous antioxidant, anti-inflammatory, and anticancer properties, as do the juices, jams, and oils derived from them exhibit antibacterial and antiviral qualities and has a variety of advantageous antioxidant, anti-inflammatory, and anticancer benefits. It may also be used as a nutraceutical or cosmeceutical. In this paper, we will discuss the history, characteristics, and uses of sea buckthorn, shedding light on why it has become such a sought-after plant in different parts of the world, among them, its potential anti-cancer agent has emerged as a significant interest among researchers and scientists. We will also provide insight into the mechanisms behind its effects and prospects for its use in cancer therapy.

KEYWORDS: Elaeagnus rhamnoides (L.) A. Nelson, Sea buckthorns, anticancer, Bioactive compounds.

INTRODUCTION

Seabuckthorn, also known as "nature's treasure", has been studied extensively for its numerous health benefits. sea buckthorn or seaberry, is a group of shrubs and trees that belong to the family Elaeagnaceae. These plants are widespread throughout Europe and Asia and have been gaining popularity in recent years due to their numerous health benefits. They are known for their bright orange berries that are packed with nutrients and have been used in traditional medicine for centuries. In this introduction, we will delve into the history, characteristics, and uses of sea buckthorns, shedding light on why they have become such a sought-after plant in various parts of the world. These plant species have gained popularity in recent years due to their numerous health benefits and wide range of uses. From medicinal purposes to culinary delicacies, sea buckthorns hold great value for both humans and the environment, among them, its potential anti-cancer agent has emerged significant interest among researchers and scientists. Seabuckthorn contains wide range of bioactive constituents which have been shown to possess anti-cancer properties. This powerful plant has been used in traditional medicine for centuries, but recent scientific

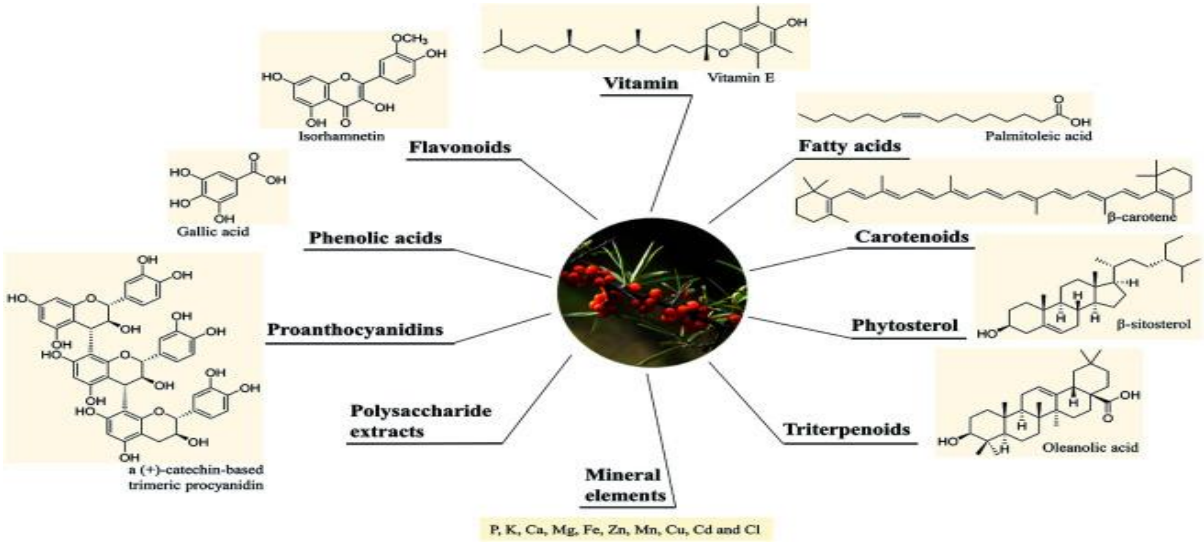
studies have shed light on its effectiveness in preventing and treating cancer. In this essay, we will explore the current research on seabuckthorn and its potential as an anti-cancer activity, providing insight into the mechanisms behind its effects and prospects for its use in cancer therapy. Cancer is an emerging global health concern which is a leading cause of death worldwide. In recent years, extensive research has been done to find the effective treatments and preventions for this disease. One potential solution comes from the unique properties of seabuckthorn, a shrub native to Asia and Europe known for its medicinal uses. Seabuckthorn has gained attention for its anti-cancer activity due to its rich composition of bioactive compounds such as flavonoids, carotenoids, and phenolics.

DESCRIPTION

They frequently grow along the ocean shorelines, which explains the "ocean" part of its name. They're tree- suchlike shrubs with huge, sharp, frustrations and bright orange berries. The berries and the seeds inside of them have great nutrition and are the source of our canvases. Sea buckthorn (Hippophae rhamnoides) is a factory in Europe and Asia. The leaves, flowers, seeds, and fruits are used as drugs. Sea buckthorn contains vitamins A, B1, B2, B6, and C and other active constituents like kaempferol, quercetin, and isorhamnetin. Sea buckthorn widely used for becks, eczema, acne indigestion, high blood pressure, wrinkled skin, and numerous other purposes. carotenoids, polyphenols, adipose acids, and phytosterols. also, ocean buckthorn has numerous health benefits, such as antioxidant, anticancer, anti-hyperlipidemic, anti-obesity, anti-inflammatory, antimicrobial, antiviral, dermatological, neuroprotective, and hepatoprotective conditioning. It's been used traditionally to decelerate the aging process.

Sea buckthorn not only has great medicinal and remedial eventuality, but also is a promising profitable factory since it's a colonist tree species for soil enhancement, wind and beach control, and soil and water conservation. ocean buckthorn is popularly known as "Wonder Factory," Golden Bush," or "Gold Mine" Since the 1940s, Russian scientists have delved into the bioactive substances in the berries, leaves, and dinghy of ocean buckthorn, leading to the development of ocean buckthorn foods and radiation protection creams for Russian cosmonauts. Sea buckthorn contains nearly 200 nutritive and bioactive composites and is known as a "natural vitamin treasure house" and a "source of nutrition and health care". Sea buckthorn is thus extensively used by the food assiduity in the medication of chuck, yogurts, logjams, potables, teas, and other products. Sea buckthorn has colorful pharmacological conditioning similar to anticancer, anti-inflammatory, antimicrobial, and antiviral conditioning, and its capability to act in cardiovascular protection.

Sea Buckthorn plant



Chemical constituents present in sea buckthorns

Bioactive compound	Therapeutic effect
Tocopherol	Antioxidant Analgesic action Protection against degenerative changes, thrombosis, and muscle cramps
Carotenoids	Antioxidant Involved in the synthesis of collagen Protection and restoration of the mucous membranes and epithelia Enhancing the immune system
Phytosterols	Anti-atherosclerotic action, anti-inflammatory and antibacterial properties The prophylaxis and treatment of hypercholesterolemia-induced cardiovascular disorders by lowering serum cholesterol concentrations Reducing the risk of stomach ulcers
Unsaturated fatty acids	Protecting against cerebrovascular and cardiovascular disorders Stimulating the immune system Promoting cognitive function and bone health. A positive effect on such neurological disorders as depression, schizophrenia, and Alzheimer's disease
Organic acids	Acceleration of wound healing Protecting against cerebrovascular and cardiovascular disorders
Vitamin C	Antioxidant Involved in the synthesis of collagen Maintaining correct cell membrane integrity
Vitamin K	Prevention of bleeding Reducing the risk of stomach ulcers Assisting the reconstruction of skin damage
Phenolic compounds	Antioxidant Reducing the risk of cardiovascular disease Involved in regulating heart rhythm Prevention of tumors Alleviating the symptoms of aging

Active constituents present and their role

Sea buckthorn is an evanescent tree or shrub of the Elaeaceae family and Hippophae L. genus. It's generally 1 – 8 m high, with some shops growing up to 18 m altitudinous. The leaves are lanceolate or direct, generally 3 – 8 cm long and lower than 7 mm wide. The upper face of the leaves is dark Argentine, and the lower face is distinct tableware- gray. The fruits are globular or oblate with a periphery of 5 – 8 mm. There are generally several fruits stuck together. The fruit is orange-- unheroic or brownish-red in color and has a ruffled face. The pulp is unctuous and soft in texture. The seeds of ocean buckthorn are about 4 mm long, 2 mm wide, and diagonally ovate. The seeds are brown and candescent, with a longitudinal groove in the middle. The seed fleece is hard, and the seed kernel is delicate white Aceae family and Hippophae L. genus It's generally 1 – 8 m high, with some shops growing up to 18 m altitudinous. The leaves are lanceolate or direct, generally 3 – 8 cm long and lower than 7 mm wide. The upper face of the leaves is dark Argentine, and the lower face is distinct tableware- gray.

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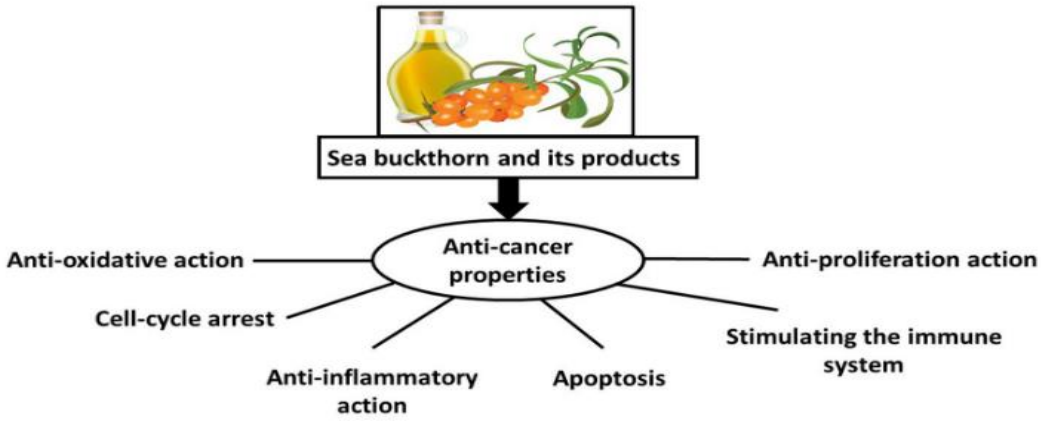
Sea buckthorn contains nearly 200 nutrients and bioactive factors. numerous of the factors are well known for their health benefits. Vitamin C is a veritably important nutrient in ocean buckthorn. Carotenoids and polyphenolic composites, especially phenolic acids, and flavonoids, are the main bioactive and antioxidant factors of ocean buckthorn. The adipose acids, phytosterols, organic acids, amino acids, and minerals contained in ocean buckthorn also play an important part. The vitamin C content of ocean buckthorn fruits ranges from 52.86 to 896 mg/ 100 g. In addition, ocean buckthorn berries contain vitamin A, vitamin E, riboflavin, niacin, pantothenic acid, vitamin B6, and vitamin B12. Mineral rudiments are involved in the conformation of mortal napkins and the conservation of normal physiological functions. Sea buckthorn berries contain numerous minerals., phosphorus, iron, magnesium, boron, calcium, aluminum, potassium, and others.

Sea buckthorn fruits contain 1.34 –2.87 g/ 100 g FW of sugar. likewise, ocean buckthorn is rich in amino acids, which are necessary to the mortal body. Amino acids are the introductory units that make up proteins and are nearly related to life conditioning. Seventeen amino acids, including seven essential amino acids (threonine, valine, methionine, isoleucine, leucine, phenylalanine, and lysine), have been detected in ocean buckthorn fruits, leaves, branches, and seeds. The amino acid content in ocean buckthorn seeds is, in leaves, branches, and fruits. The content of aspartic acid and glutamic acid was loftiest in ocean buckthorn fruits, leaves, and branches, with1.11 and1.24 in fruits,2.42 and1.60 in leaves, and3.71 and0.97 in branches. Sea buckthorn fruits contain high situations of carotenoids, which give ocean buckthorn its characteristic orange-unheroic color. Carotenoids substantially act as antioxidants.

Polyphenols are the main composites with antioxidant exertion in ocean buckthorn, the polyphenol content in the fruit ranges from12.36 to34.6 mg GAE/ g(GAE, gallic acid coequals). Flavonoids may have implicit places in the forestallment of habitual conditions, similar to diabetes, cardiovascular complaints, and cancer. the total phenols and flavonoid aglycones in the ocean buckthorn excerpt had antioxidant and anti-proliferative conditioning. 95 flavonoids have been linked to ocean buckthorn which has potent remedial exertion. Sea buckthorn is rich in a variety of adipose acids that play an important part in mortal health, similar to treating skin and mucous membrane diseases and dry eye patterns and reducing the threat of

cardiovascular complaints. Phytosterols, as a bioactive element present in ocean buckthorns can help cardiovascular conditions.



Sea buckthorn and it's products

ANTICANCER ACTIVITY IN SEABUCKTHORN

Currently, a large body of research indicates that the bioactive elements of sea buckthorn possess anticancer properties. The active constituent of sea buckthorn polyphenols, has demonstrated strong anti-colon cancer efficacy both in vitro and in vivo. To decrease cyclin expression and stop the cell cycle in the G1 phase, sea buckthorn polyphenols upregulate the expression of microRNA (mir)-195-5p and miR-497-5p and down-regulate the expression of miR-1247-3p. This effectively stops the progression of colon cancer. Furthermore, in xeno-grafted BALB nude mice, sea buckthorn polyphenols (50 mg/kg) markedly decreased tumor volume and regulated tumor growth in vivo. An aqueous extract from sea buckthorn leaves efficiently targeted the androgen receptor (AR) and markedly downregulated prostate-specific antigen (PSA), eleven-nineteen lysine-rich leukemia 2 (ELL2), and ELL-associated factor 2 (EAF2), in vitro calreticulin (CALR). Prostate cancer cell migration and proliferation can be successfully inhibited by an aqueous extract from sea buckthorn leaves. Consequently, sea buckthorn leaves have potential as a functional diet that could be important in preventing prostate cancer in high-risk individuals. The possible bioactive substances found in sea buckthorn leaves, however, have not yet been studied in the hopes of creating novel prostate cancer treatments.

Sea buckthorn leaf extract at concentrations of 6.2 and 62 µg/mL significantly inhibited the rapid proliferation of C6 glioma cells (11 and 49.5%), up-regulated expression of the pro-apoptotic protein B-cell lymphoma-2 (BCL2)-associated X (Bax), and reduced the production of intracellular ROS by 16.3 and 42.3%, respectively, according to Kim et al. Consequently,d sea the application of buckthorn leaf extract at different concentrations has shown significant effects on various cellular processes. At concentrations of 6.2 and 62 µg/mL, the extract was found to reduce the production of intracellular reactive oxygen species (ROS) by 16.3% and 42.3% respectively. Additionally, it up-regulated the expression of the pro-apoptotic protein B-cell lymphoma-2 (BCL2)-associated X (Bax), leading to the inhibition of rapid proliferation in C6 glioma cells by 11% and 49.5% respectively.

These findings suggests sea buckthorn could have potentially serve as a valuable source for pharmacological interventions in glioma treatment. Furthermore, the active component of sea buckthorn, isorhamnetin, was found to increase the expression of the mitochondrial pathway pro-apoptotic protein (cytochrome c-caspase 9-caspase 3) in gastric cancer cells under hypoxic conditions. It also exhibited

significant inhibition of autophagy in MKN-45 gastric cancer cells and promoted apoptosis by activating the Phosphoinositide 3-kinase (PI3K)-protein kinase B (AKT)-mammalian target of rapamycin (mTOR) signaling pathway. In summary, these studies provide evidence supporting the anticancer properties of sea buckthorn, with polyphenolic compounds potentially playing a crucial role in its effectiveness. The mechanisms underlying its anticancer effects involve the regulation of cyclin expression, pro-apoptotic proteins, autophagy in cancer cells, and related signaling pathways. However, due to deficiency of in vivo experiments and clinical trials investigating the anticancer effects of sea buckthorn. Therefore, further research is necessary to fully understand and validate its potential as an anticancer agent in humans.

Additionally, while carotenoids, particularly lycopene, have been found to reduce the risk of cancers such as prostate, lung,cervical and breast cancer, there is limited research on the anticancer activity of sea buckthorn carotenoids. Exploring the anticancer properties of sea buckthorn carotenoid extracts could be a promising avenue for future research.

Cancer cell

With radio-protective effect, **Sea Buckthorn** helps prevent cancers caused by UV exposure. A study published by Indian Institute of Nuclear Medicine and Allied Sciences, reported anti cancer and radio protective properties of hippophae extract. **Sea Buckthorn** seed oil is found to have shown anti tumor effects in lab. Bioactive chemicals in **Sea Buckthorn** have anti-oxidant and anti cancer properties and help in prevention of cancer of gastro intestinal tract.

Sea buckthorn	Effective concentration/time	Study type	Experimental model	Main results	Bioactive compounds

Anticancer					
Polyphenols extraction	80 and 120 µg/mL	*In vitro*	Human colon cancer cell	↓ Expression of cyclins and cell proliferation	Kaempferol and its derivatives
	50 mg/kg	*In vivo*	Xenograft BALB/c nude mice model	↓ Tumor volume and kinetic tumor growth	
Leaf aqueous extract	3.12, 6.25, 12.5, 25, 50 µg/mL	*In vitro*	LNCaP and C4-2 cell	↓ Proliferation and migration of prostate cancer cells	–
Leaf extract	6.2, 62 µg/mL	*In vitro*	Rat C6 glioma cells	↓ Intracellular ROS ↑ Pre-apoptosis in rat C6 glioma cells	Phenolics
Isorhamnetin	12.5, 15 µmoL/L	*In vitro*	Hypoxia model of $CoCl_2$ (100 µmol/L) promoting maximal proliferation of MKN-45 cells	↓PI3K AKT mTOR-mediated adaptive autophagy ↑ MKN-45 gastric cancer cell apoptosis in a hypoxic environment	Isorhamnetin

Anti-

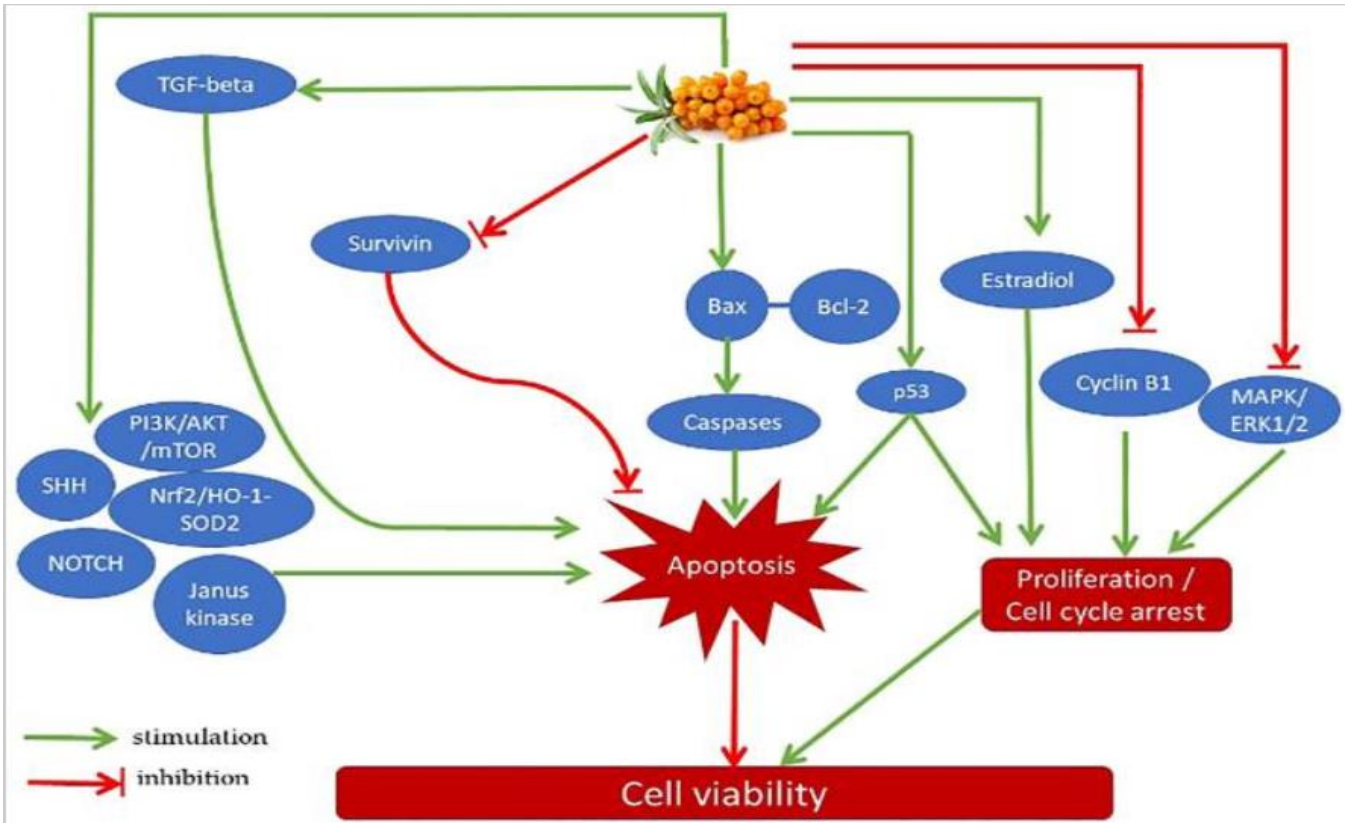
Anticancer activity in sea buckthorn

Mechanism of sea buckthorn

It has been hypothesized that both extracellular and intracellular modes are involved in the action of sea buckthorn and its constituents on cells; however, the evidence for each of these processes is scant, and the interactions between these mechanisms are poorly understood. However, it is thought that sea buckthorn's antioxidant, anti-inflammatory, antiviral, antimicrobial, and antibacterial properties are to blame for the herb's ability to prevent and treat infections as well as cancer. Allergies and cancer are two examples of clinical conditions in which inflammation plays a significant role. Ocean buckthorn's calming impacts might be intervened by invigorating Nrf2-subordinate pathways. Nrf2 controls a portion of the heme oxygenase-1 (HO-1) axis, an effective anti-inflammatory target. The Nrf-2/HO-1-SOD-2 signaling pathway is activated by sea buckthorn polysaccharide, which contributes to its protective effect. The Nrf2/antioxidant response element system has also been linked to the production of inflammatory mediators, such as macrophage metabolism and the NF-B pathway. Also, ocean buckthorn polysaccharide has shown hepatoprotective impacts by decreasing catalysts like alanine aminotransferase (ALT) and aspartate aminotransferase (AST) in instances of acetaminophen-prompted liver harm in rodents. Increased levels of glutathione (GSH) and GSH-Px, as well as the production of nitric oxide (NO) and inducible nitric oxide synthase (iNOS), have been linked to various therapeutic benefits resulting from the antioxidant properties of sea buckthorn's components. In rodents, ocean buckthorn has been found to have antitumor properties because of its cancer prevention agent synthetic substances, especially phenolic parts like flavonoids kaempferol, isorhamnetin, and quercetin. These flavonoids guard against oxidative stress, which can cause cell mutations and cancer. Treatment with ocean buckthorn separate diminished the development of receptive oxygen species (ROS) and the feasibility of glioma cells. Sea buckthorn has also been shown to limit the proliferation of rat glioma

cells and stop the growth of prostate cancer cells. It advances apoptosis through the expanded articulation of the supportive of apoptotic Bax quality and the restraint of c-Jun N-terminal kinase phosphorylation. Quercetin-actuated apoptosis has been seen in human retinoblastoma cells, alongside the enactment of caspase-3 and caspase-9. Moreover, buckthorn procyanidins have been found to prompt cell demise in a portion subordinate way and possibly block intracellular unsaturated fat synthase (FAS) movement, prompting apoptosis in human bosom disease cells. These discoveries recommend that ocean buckthorn and its parts altogether affect malignant growth cells. These procyanidins may be able to cause apoptosis and inhibit intracellular fatty acid synthase (FAS) activity in human breast cancer cells. Prominently, ocean buckthorn procyanidins have been found to obstruct the development of disease cells, and FAS is a urgent chemical for the creation of long-chain unsaturated fats without any preparation, which is plentiful in malignant growth cells. Different flavonoids, especially isorhamnetin, can impact a few compounds engaged with fat combination and digestion, possibly adding to their hypolipidemic, cholesterol-bringing down, and hostile to stoutness impacts. Besides, ocean buckthorn polysaccharides might apply against corpulence impacts by animating brown fat tissue and advancing thermogenesis, in this manner working with fat consuming. Moreover, ocean buckthorn's enemy of diabetic and hostile to stoutness properties might be credited to its dietary filaments, which can decrease glucose creation and digestion by stifling glucose retention, repressing glucose dispersion, obstructing starch processing and sticking, and hindering α-amylase movement. Androgen receptors might act as the following expected go between of ocean buckthorn's consequences for chemical ward tissues. These receptors control the statement of qualities receptive to androgens through ligand-subordinate record factors. Assuming that the androgen receptor is sequestered in the cytoplasm and kept from entering the core, the objective qualities receptive to androgens can't be enacted, and the development of prostate malignant growth cells can't be stopped. Ocean buckthorn leaf separates have been displayed to affect the androgen receptors in prostate disease cells, prompting the concealment of qualities receptive to androgens and restraining cell development and endurance. Ocean buckthorn's constructive outcomes on spermatogenesis might be credited to its effect on androgen receptors. Sea buckthorn therapy can improve spermatogenesis by enhancing stem cell survival, reducing sperm abnormalities, and promoting the proliferation of spermatogonia. Additionally, the available literature indicates that sea buckthorn has a protective effect against the negative effects of gamma radiation. Sea buckthorn's actions on various organismal targets and their associated cellular pathologies have been linked to a number of signaling molecules and mechanisms. A portion of these go betweens might display explicitness towards specific objective cells or organs, like steroid chemicals for steroid-subordinate cycles. Then again, a few middle people have a more broad impact, influencing cell multiplication, apoptosis, and oxidative cycles. In addition, it is plausible that there is a functional hierarchy among the mediators of sea buckthorn effects, even though the connections between them have not been fully investigated. It is essential to take note of that most examinations exploring the impacts of ocean buckthorn and its middle people have fundamentally used cell societies. Accordingly, it is basic to direct fitting in vivo examination to approve

the discoveries got from such models.



SUMMARY

A traditional Chinese herbal remedy uses sea buckthorn scientifically known as Hippophae rhamnoides L.Numerous bioactive components, like polyphenols, fatty acids, vitamins, and phytosterols, are known to be present in this species; these substances may account for some of its therapeutic benefits. In this paper, we have discussed the history, characteristics, and uses of sea buckthorn, shedding light on why it has become such a sought-after plant in different parts of the world, among them, its potential anti-cancer agent has emerged as a significant interest among researchers and scientists.These plants are widespread throughout Europe and Asia and have been gaining popularity in recent years due to their numerous health benefits.

In this introduction, we will delve into the history, characteristics, and uses of sea buckthorns, shedding light on why they have become such a sought-after plant in various parts of the world.These plant species have gained popularity in recent years due to their numerous health benefits and wide range of uses.From medicinal purposes to culinary delicacies, sea buckthorns hold great value for both humans and the environment, among them, its potential anti-cancer agent has emerged significant interest among researchers and scientists.Seabuckthorn contains wide range of bioactive constituents which have been shown to possess anti-cancer properties.This powerful plant has been used in traditional medicine for centuries, but recent scientific studies have shed light on its effectiveness in preventing and treating cancer.Sea buckthorn contains nearly 200 nutritive and bioactive composites and is known as a “natural vitamin treasure house” and a “source of nutrition and health care”.Despite numerous studies confirming the anti-cancer properties of sea buckthorn, the appropriate medicinal and preventive dosages are still uncertain. Furthermore, no clinical trials have been conducted thus far, with only in vitro and in vivo studies involving experimental animals. However, it is established that sea buckthorn has the potential to

contribute to the prevention and treatment of cancer. Additionally, it aids in the recovery of patients undergoing chemotherapy by enhancing the immune system's functionality and alleviating hematological damage.

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