



**INTERNATIONAL JOURNAL OF
PHARMACEUTICAL SCIENCES**
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: <https://www.ijpsjournal.com>



Review Paper

The Golden Berry: A Review on the Pharmacological and Therapeutic Potential of Sea Buckthorn

Jaie Zore¹, Shivraj Mane^{*2}, Prashant Pawar³

¹Research Scholar, Progressive Education society Modern College of Pharmacy Nigdi, Pune, Maharashtra India Pin code: -411044

²Department of Pharmaceutics, Progressive Education society Modern College of Pharmacy Nigdi, Pune, Maharashtra India Pin code: - 411044.

³Department of Pharmacology, Progressive Education society Modern College of Pharmacy Nigdi, Pune, Maharashtra India Pin code: - 411044

ARTICLE INFO

Published: 19 May. 2025

Keywords:

Seabuckthorn, Therapeutic potential, Traditional medicine, Bioactive compounds

DOI:

10.5281/zenodo.15462156

ABSTRACT

The plant known as sea buckthorn (*Hippophae rhamnoides* L.) has a number of therapeutic and nutritional uses. The antioxidant, anticancer, antihyperlipidemic, anti-obesity, anti-inflammatory, antibacterial, antiviral, dermatological, neuroprotective, and hepatoprotective properties of the vitamins, carotenoids, polyphenols, fatty acids, and phytosterols it contains are all present. One such dietary supplement is sea buckthorn, which can be taken as a pill, powder, juice, or oil. Sea buckthorn is easy to grow and can be found growing wild in temperate zones on slopes, mountains, riverbanks, and valleys. A research by Stobdan and Phunchok found that the sea buckthorn industry benefited 0.8% of Ladakh's population, which includes farmers, berry collectors, and processors. Its omega fatty acids, notably omega-7 and omega-3, hold promise for cardiovascular health by reducing inflammation and lowering cholesterol levels. A promising plant that merits more study and advancement is sea buckthorn. Many lifestyle ailments, both in the tropics and the temperate, may be cured by the domestication and popularization of the crop. Keywords: antiulcer agent, bioavailability, mucoadhesive, etc.

INTRODUCTION

Hippophae rhamnoides L., or sea buckthorn, is a plant with a number of therapeutic and nutritional uses. Originating in Europe and Asia, it can be

***Corresponding Author:** Shivraj Mane

Address: Department of Pharmaceutics, Progressive Education society Modern College of Pharmacy Nigdi, Pune, Maharashtra India Pin code: - 411044.

Email ✉: shivrajmane5@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



found in temperate parts of Canada, India, China, Mongolia, Russia, and Northern Europe. In India, it is distributed throughout the temperate tracts of Leh-Ladakh, Lahaul-Spiti valleys of Himachal Pradesh, Nathula in Sikkim, Chamoli and Badrinath regions of Uttarakhand and Arunachal Pradesh. The crop is known as the “gold mine of the cold deserts” due to its exceptional winter-hardy nature and multiple uses. Brahmaphal, Chharma, Chuk, Tare, Leh berry, Sea berry, and

Ladakh gold are some of the regional names for the crop. Twelve is the fundamental number of chromosomes. *Hippophae tibetana*, *Hippophae rhamnoides*, *Hippophae gyantsensis*, *Hippophae salicifolia*, *Hippophae neurocarpa*, and *Hippophae litangensis* are the six species that make up the genus *Hippophae*. Shafa, Zafarani, Tozlayan, Oblepikha, Zyryanka, Indian Summer, and Siberian Wonder are significant cultivars.



Fig.1. Sea Buckthorn Fruit

Development, Growth, and Botany of Sea Buckthorn: The sea buckthorn is a small, prickly, deciduous shrub that grows to a height of 2-4 meters. Its brown bark is smooth or frequently cracks. The bushes are prickly. The leaves have a lanceolate or linear shape and are silver-greyish in color. There are four to six apetalous flowers in the male inflorescence, and the crop is dioecious. When the temperature rises to 6–10°C, a lot of

pollen is released. The flowers are small and have a yellowish hue. The fruits are single-seeded, tiny berries with a yellowish-orange hue. The non-climacteric fruits are produced by growth from the previous season. In March, flower buds begin to form, and in April, the flowers begin to bloom. By mid-August, fruit-set has begun, and by September or October, the fruits are ready for harvest.



Fig.2. Sea Buckthorn Male Plant



Fig.3. Sea Buckthorn Female Plant

Principal bioactive components: Phenols, flavonoids (isorhamnetin, quercetin, glycosides, and kaempferol), and carotenoids (lycopene, carotene, lutein, and zeaxanthin) are found in various plant parts. Omega 3, 6, 9, and rare omega 7 fatty acids (4), polyunsaturated fatty acids, minerals, vitamins, tocopherols, sterols, and dietary fibers. The oil extracted from sea buckthorn seeds is the only natural oil that has β -sitosterol as an active ingredient and a 1:1 ratio of omega 3 and omega 6 fatty acids (linolenic and linoleic acids). Principal phytosterol (16). While leaves are a good source of polyphenols, berries are a great source of essential polyunsaturated fatty acids, sugars, and tocopherols. Four distinct subspecies of sea buckthorn—*H. rhamnoides* L. subsp. *turkestanica* (Turkestanica), *H. rhamnoides* L. subsp. *mongolica* (Mongolica), *H. rhamnoides* L. subsp. *yunnanensis* (Yunnanensis), and *H. rhamnoides* L. subsp. *sinensis*—have had their phytochemical compositions investigated. While the *sinensis* subspecies has the highest total phenolic content and associated total antioxidant activity, *H. rhamnoides* L. subsp. *yunnanensis* has

the largest cellular antioxidant and anti-proliferative properties. Six compounds have already been identified from sea buckthorn leaf extract:

1-feruloyl- β -D-glucopyranoside, kaempferol-3-O- β -D-(6''-O-coumaroyl) glycoside, Quercetin-3-O- β -D-glucopyranoside, isorhamnetin-3-O-glucoside, isorhamnetin-3-O-rutinoside, and quercetin-3-O- β -D-glucopyranosyl-7-O- α -L-rhamnopyranoside.

Sea buckthorn's physiological and medicinal properties:

1. Anti-inflammatory
2. Antioxidant
3. Antiviral
4. Antibacterial
5. Anticancer

The way of action: Sea buckthorn's mode of action: As previously stated, this is primarily because of its antibacterial, antiviral, anti-inflammatory, antioxidant, and antimicrobial qualities. The anti-inflammatory properties of sea buckthorn may be mediated by activating Nrf2-

dependent pathways. The heme is a powerful anti-inflammatory target. It is known that Nrf2 partially regulates the oxygenase-1 (HO-1) axis. Nrf2 plays a crucial role in controlling the synthesis of antioxidant genes, which have anti-inflammatory properties. The Nrf-2/HO-1-SOD-2 signaling pathway is activated in response to sea buckthorn polysaccharide's protective effects. Recent studies have shown a connection between the NF-kB pathway and the synthesis of other inflammatory mediators and the Nrf2/antioxidant response element system, as well as macrophage

metabolism. For example, taking supplements of sea buckthorn increased the levels of glutathione (GSH) and GSH-Px in the liver, brain, and plasma as well as the production of nitric oxide (NO) and inducible nitric oxide synthase (iNOS), which has been connected to decreased oxidative and nitrosative stress in rats' liver and brain as well as liver damage.

Biological activity of Sea buckthorn: It is utilized in medical therapy due to a variety of biological activities, including.

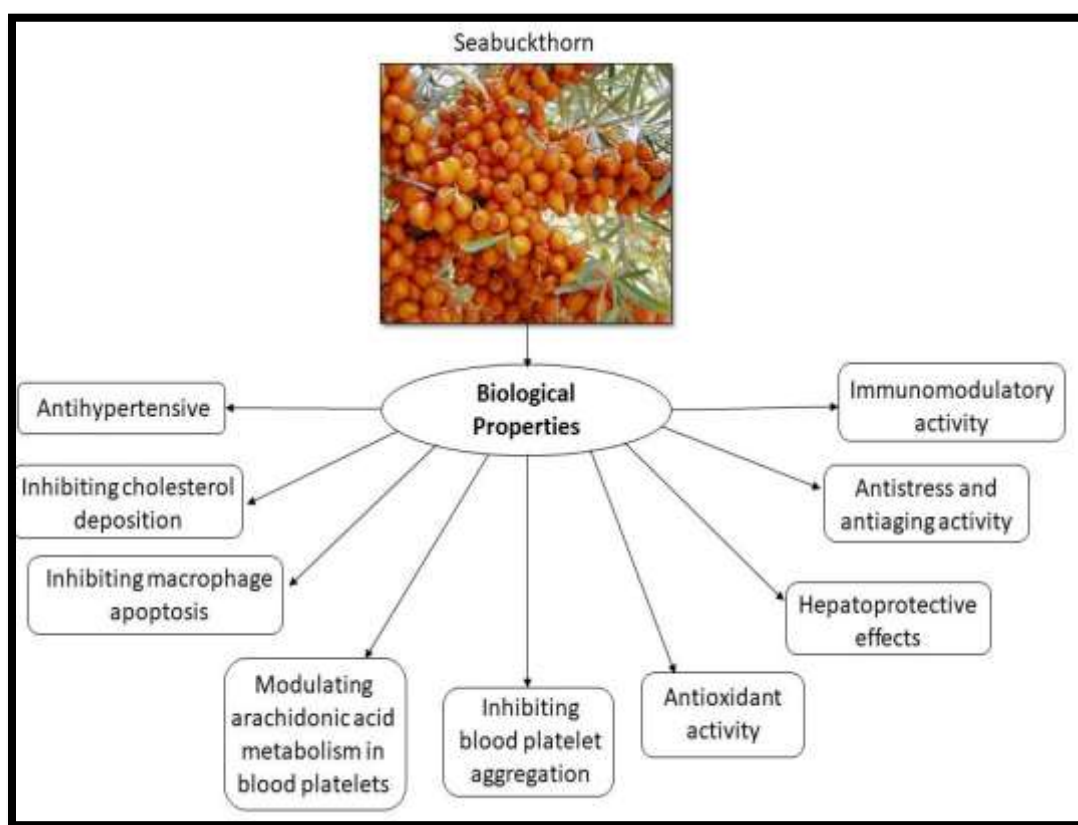


Fig.4. Biological properties of Sea Buckthorn

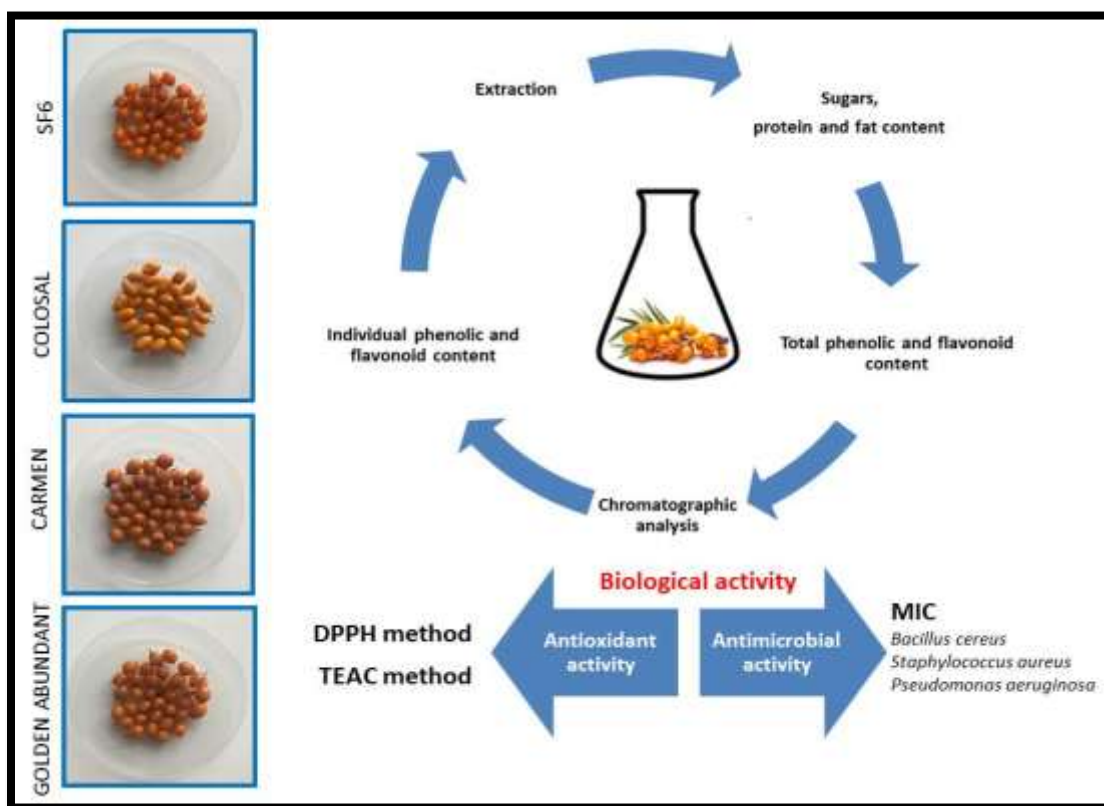


Fig 5. Biological activity

1. **Immunomodulatory, antioxidant, and anti-cancer properties:** In oriental traditional medicine, sea buckthorn has long been used to treat a range of controversial conditions. The ability of malic acid to shield roots from pathogen invasion is well known. Sea buckthorn leaf alcoholic concentrate appears to have controlled macrophage antigen introduction capability in matured mice, exhibiting its resistant boosting and anti-maturing effects, according to a study conducted by Mishra et al. Thus, based on these perceptions, the immunomodulatory and mitigating exercises have been rationally explained.
2. **Hepatoprotective activity:** The liver is in charge of the synthesis, secretion, preservation, and detoxification of both endogenous and exogenous drugs. When xenobiotics (like drugs or poisonous foods)

bioactivate in the liver, reactive metabolic species may react with cellular macromolecules, leading to oxidative stress, lipid peroxidation, protein dysfunction, and DNA damage. The two most prevalent forms of liver injury are intrinsic and idiosyncratic. Cholestasis, necrosis, and numerous lesions with little inflammation are all caused by intrinsic injury, which is predictable and independent of xenobiotic dosage, whereas idiosyncratic reactions are dose-independent and directly associated with extrahepatic lesions.

3. **Anti-aging and anti-stress activities:** Stress varies from person to person and is defined as "a pattern of physiological reactions that prepares an organism for action." The natural sound and function of neurotransmitters that have been harmed by traumatic events may be restored with the aid of adaptogenic herbs.

Adaptogenic herbs are different from other medications in that they balance the immune system and endocrine hormones to help the body maintain appropriate homeostasis. By raising the basal levels of mediators specifically linked to the stress response, plant adaptogens frequently act as smooth pro-stressors, decreasing the reactivity of the host defense mechanism and lessening the negative effects of various stressors. By lowering the water and fluorescein leakage in the lungs as well as the protein and albumin content of the bronchoalveolar lavage fluid, the administration of sea buckthorn leaf extract decreased the hypoxia-induced transvascular permeability in the rats' lungs.

- 4. Anti-atherogenic and cardioprotective effects:** In addition to coronary heart disease, coronary artery disease, atherosclerosis, stroke, myocardial infarction, peripheral arterial disease, and arrhythmia, hyperlipidemia and hypercholesterolemia are the two primary risk factors for cardiovascular disease. For instance, sea buckthorn contains a

lot of flavonoids and other bioactive substances that help treat heart conditions. By preventing ox-LDL-triggered superoxide formation, which inhibits superoxide dismutase activity and regulates eNOS and LOX-1 expression, flavonoids found in sea buckthorn prevented cell death and secretion disorders.

- 5. Radioprotective properties and anti-radiation effects:** Agrawala and Goel (2002) found that a whole extract of fresh sea buckthorn berries (*H. rhamnoides*—RH-3; 25–35 mg/kg body weight) shields mouse bone marrow from radiation-induced micronuclei. It was discovered that sea buckthorn pre-irradiation therapy increased radiation-induced apoptosis in vivo. These tests examine the rate of oxidative stress biomarkers like protein oxidation, lipid peroxidation, and superoxide anion.

Sea buckthorn's main phytochemical components:

Table.1. Sea Buckthorn Phytochemical Components

Composition	Concentration in pulp oil (mg/100 g)
Vitamin E	171
Vitamin K	54-59
Carotenoids	300-870
Total acids	38
Total sterols	721
Vitamin C	400

Health Benefits: Through Ca²⁺ mobilization, sea buckthorn pulp, which contains 13.4-51.8% palmitoleic acid, increased glucose-induced insulin secretion (GSIS), which in turn helped lower blood sugar levels. Using sea buckthorn oil to modulate psoriasis and related inflammation in vitro showed that it reduced inflammation by

downregulating NF-κB protein and inhibiting reactive nitrogen species. Sea buckthorn fruit extracts were found to have a protective effect against oxidative damage caused by arsenic, according to Gupta and Flora. Sea buckthorn seed oil's ability to prevent fatalities from breathing in sulfur dioxide.



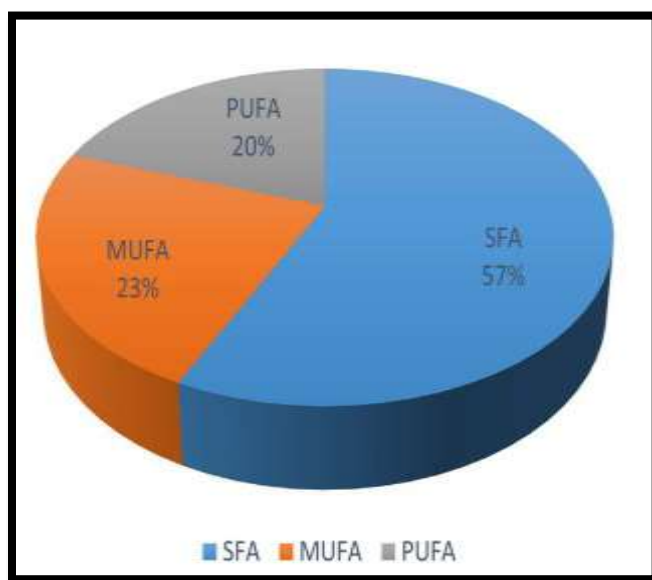


Fig. 6. Chemical profiling of sea buckthorn oil

Sea buckthorn berries and seed: The many fruits are oval-shaped, 6–9 mm long, and dark yellow, orange, or red when ripe. The fruit is composed of a seed encased in pulp, which is a soft, juicy, and meaty substance. The seed is dark brown, ellipso-shaped, 2.8–4.2 mm long, and has a glossy surface. Berry variety, climate, fruit size, ripeness, and processing technique all affect the berries' chemical makeup. The plant is an excellent source of the B group of vitamins, particularly B1 (thiamine) and B2 (riboflavin). β -caroten, lycopene, and lutein are the main carotenoids found in berries. The organic acids found in sea buckthorn are primarily citric, tartaric, oxalic, quinic, and malic acids. In addition, sea buckthorn is a significant source of tocopherols and flavonoids, primarily quercetin, kaempferol, myricetin, and isorhamnetin.

The pulp: The main components of sea buckthorn pulp are zeaxanthin, glycopene, and α -, β -, and γ -carotens. The primary members of the vitamin B group are thiamine (B1), riboflavin (B2), pyridoxine (B6), vitamin PP (nicotinamine, niacin, and vitamin B3), and folic acid, which is essential for the synthesis of nucleic acids. Rarely found in

plants, 5-hydroxytryptamine is present in the peel of the stem and fruits. Post-shock depression is treated with 5-hydroxytryptamine.

The leaves: sea buckthorn plant are a remarkable source of nutrients and bioactive compounds, primarily phenolic. They have an average of 170 mg/100 g of catechin, polyphenols, carotenoid lycopene, bioflavonoids, coumarins, 3.8% of saccharides, 0.2% of protopectin, and 1% of organic acids. Moreover, the leaves have a high concentration of tannins (8%) and vitamin C (up to 370 mg/100 g).

Sea buckthorn oils: Sea buckthorn can yield two different types of oil: pulp and seeds. Between 4 and 13 percent of the pulp is oil. The majority of the fatty acids found in sea buckthorn are unsaturated (Christaki 2012). In 100 g of pulp oil, there are 180–240 mg of carotenoids, 40–100 mg of which are caroten, 110–330 mg of vitamin E, and unsaturated fatty acids, primarily linoleic and linolenic acids. At up to 43%, pulp oil has the highest concentration of palmitoleic acid (16:1, n-7). The primary components of oil extracted from sea buckthorn seeds are essential fatty acids like α -

linolenic acid and linoleic acid (18:2, n-6), which account for up to 42% of the total fatty acid.

Uses of food: Sea buckthorn has high economic value and is used extensively in food in addition to its biological and medical uses. Sea buckthorn has many biologically active compounds and is high in nutrients. Nowadays, sea buckthorn is used in many food products as a natural additive, antioxidant, and antimicrobial. Sea buckthorn oil, freeze-dried powder, fruit juice, fruit wine, milk tablets, fruit vinegar drinks, tea (94), preserved fruit, yogurt, and jam are just a few of the increasingly varied uses of sea buckthorn in the food industry. Manufacturers and researchers in the food industry are currently working to maximize the use of sea buckthorn to enhance the nutritional value and sensory qualities of sea buckthorn products.

Sea Buckthorn Yoghurt: Additives in foods Adding sea buckthorn to yogurt increases its nutritional value because it contains a lot of beneficial active ingredients. Made from sea buckthorn berries, sea buckthorn yogurt satisfies people's nutritional needs by being high in fat, protein, carbs, and antioxidants (such as vitamin C, vitamin E, carotenoids, phenols, etc.). The yogurt's microbiological quality is unaffected by storage at 4°C for 12 days or at 15°C for 3 days (9). To create new healthy yogurt, sea buckthorn has been combined with carrot (101), tomato (102), water chestnut (103), yellow peach, and passion fruit.

Sea Buckthorn Jam & Jellies: Berries from sea buckthorn have a short shelf life and a sour flavor. Thus, making jam from berries is a good way to enhance their sensory qualities and boost their use. High amounts of total carotenoids and polyphenols are present in the jam, which is made with sea buckthorn fruit at 102°C with stevia and has antioxidant properties. Sea buckthorn was used as an acidulant in place of citric acid and as a raw

material in the *Elaeagnus angustifolia* and sea buckthorn compound jam. If no preservatives are added, the jam will keep for 177 days at 20°C. A tasty and nourishing jelly can be made by combining sea buckthorn juice with other fruit juices, such as papaya, watermelon, or grape juice. Sea buckthorn grape jelly has a six-month shelf life at room temperature.

Sea Buckthorn Beverages: Under ideal fermentation conditions, a 3% ethanolic sea buckthorn beverage was produced. This beverage has low amounts of ethanol and carbon dioxide, but it has high levels of phenolic compounds (such as gallic acid, protocatechuic acid, vanillic acid, chlorogenic acid, etc.) and strong antioxidant activity. Thus, it's a functional drink that's both healthy and refreshing. The micro-wet milling (MWM) method can be used to create a waste-free whole fruit pulp juice of sea buckthorn in addition to fermentation. When compared to commercial and mixed milled sea buckthorn juice, MWM sea buckthorn juice is brighter yellow, has a higher total carotenoid content (145 ± 0.10 mg/mL), smaller particles, a higher ascorbic acid value (67.67 ± 1.15 mg/mL), a higher total phenolic content, and more antioxidant activity.

The role of sea buckthorn in cardiovascular diseases: Cardioprotective action is one of the many health advantages of sea buckthorn. A body of evidence indicates that patients with CVD. It can reduce blood triglyceride and cholesterol levels, which are risk factors for heart attacks and atherosclerosis. It can prevent platelets, which are blood cells that can clump together and obstruct blood flow to the heart or brain, from aggregating. It has the ability to scavenge free radicals and stop oxidative stress, two dangerous processes that can harm heart and blood vessel cells and tissues.

Pharmacology of CVD:



Anti-inflammation: The pattern and ultimate result of inflammation are determined by the interaction of inflammatory cytokines in the inflammatory response (59). Flavonoid components in sea buckthorn prevented LPS-induced production of NO/PGE₂ and expression of iNOS/COX-2 mRNA. It lowers the mRNA and protein levels of TNF- α , IL-6, and IL-1 β (35). The anti-inflammatory effects of 1,5-dimethyl citrate derived from sea buckthorn on LPS-induced RAW264.7 mouse macrophages were demonstrated in a different study (28). In a rat

model of exercise-induced myocardial damage, sea buckthorn flavonoid treatment markedly raised the levels of SOD and GSH-Px while significantly lowering the levels of MDA, IL-1 β , IL-6, and TNF- α in rat cardiac tissues. Furthermore, the NF- κ B and MAPK (SAPK/JNK and p38) signaling pathways were inhibited by sea buckthorn flavonoids. Adhesion molecules are frequently employed as pro-inflammatory markers that are crucial to the treatment of CVD and that are involved in the migration and adhesion of inflammatory cells to injured tissues.

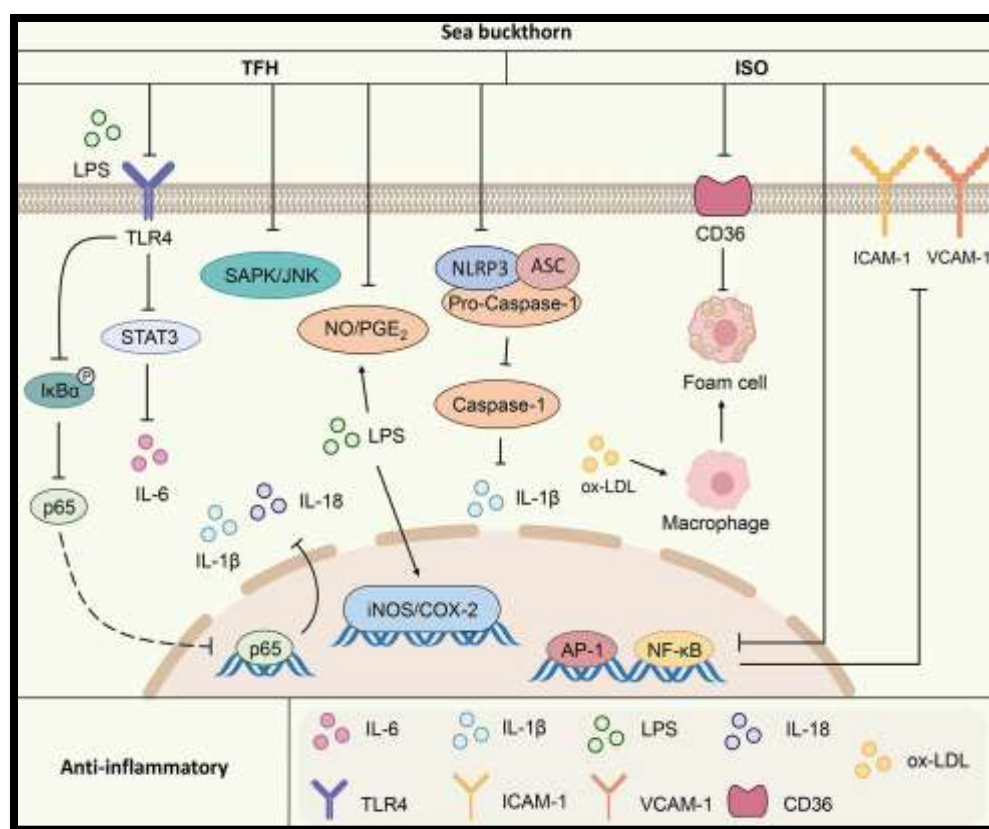


Fig 7. Pharmacology of CVD:

Sea buckthorn's active ingredients have an anti-inflammatory mode of action. Sea buckthorn flavonoids, ISO, isorhamnetin, LPS, lipopolysaccharides, TLR4, toll-like receptor 4, STAT3, signal transducers and activators of transcription 3, I κ B α , inhibitor kappa B alpha, IL-1 β , interleukin-1 beta, IL-18, interleukin-18, IL-6,

CD36, cluster of differentiation 36, ox-LDL, oxidized low-density lipoprotein, and SAPK/NF- κ B, nuclear factor kappa B; iNOS/COX-2, inducible nitric oxide synthase/cyclooxygenase-2; NLRP3, NOD-like receptor thermal protein domain associated protein 3; ASC, apoptosis-associated speck-like protein containing a CARD; JNK, stress-activated protein kinase/c-Jun N-

terminal kinase; NO/PGE₂, nitric oxide/Prostaglandin E₂; AP-1, activating protein-1; Intercellular cell adhesion molecule-1 (ICAM-1), vascular cell adhesion molecule-1 (VCAM-1),

and pro-caspase-1 (pro-cysteinyl aspartate specific proteinase-1)

Impact on CVD of sea buckthorn extract and its active components:

Sample	Active ingredient	Molecular formula	Biological activity in CVD
Aqueous extract powder of <i>H. rhamnoides</i> fruits	1,5-Dimethyl Citrate	C ₈ H ₁₂ O ₇	IKK α / β ↓, I κ B α ↓, NF- κ Bp65↓, iNOS↓, COX-2↓, IL-6↓, TNF- α ↓
Sea buckthorn fruit oil	-	-	Free fatty acids↑, SREBP-1↓, FAS↓, ACC synthesis↓
Sea buckthorn polyphenol extract	Gallic acid Proto catechuic acid Chlorogenic acid Quercetin	C ₇ H ₆ O ₅ C ₇ H ₆ O ₄ C ₁₆ H ₁₈ O ₉ C ₁₅ H ₁₀ O ₇	LDH↓, CK-MB↓, Inhibits beclin-1 and LC3 proteins

Influence of Sea buckthorn on Coronary heart disease:

Among the risk factors for cardiovascular diseases are blood platelet function (i.e., platelet aggregation), lipid metabolism, and hypertension. As a result, scientists made lowering the risk of heart disease their top priority. The sea buckthorn berry, leaves, and oils' total phenolics chemical concentration has been linked to several of its medicinal benefits against a variety of illnesses, particularly heart conditions. The results showed that the experimental group's blood contained significantly higher amounts of flavonols, quercetin, and isorhamnetin. However, consumption of sea buckthorn berries did not affect the levels of triglycerides, high density lipoproteins, low density lipoproteins, or total cholesterol in the blood (Larmo et al., 2009). Through the regulation of vascular endothelium's unregulated production of nitric oxide and low-density lipoprotein receptor-1, Bao and Lou (2006) discovered that sea buckthorn (9.38; 18.75; and 37.5 g/ml) protected vascular endothelium

from oxidized low-density lipoprotein-induced endothelial cell damage. In another experiment, wistar rats were fed sea buckthorn fruits once daily for 28 days at a weight of 50 g/60 kg body mass. Triglycerides, low density lipoprotein concentrations, and the lipid profile were measured at the beginning and conclusion of the experiment. Consuming sea buckthorn berries decreased serum cholesterol levels, according to the analysis. In rats with hyperlipidemia, phenols from sea buckthorn berries (given orally at a frequency of 7–28 mg/kg) significantly reduced the lipid profile and increased oxidative enzyme activity. They also decreased the production of proteins and endothelium nitric oxide (eNOS) mRNA in the ascending aorta. The polyphenol component of sea buckthorn berries inhibited the carbonylation of proteins and the increased degradation of human plasma caused by hydroxyl radicals or H₂O₂/Fe (a source of hydroxyl radicals). Compared to an extract from aronia berries, the phenolic component of sea buckthorn fruits exhibited noticeably greater antioxidant and antihypertensive properties.

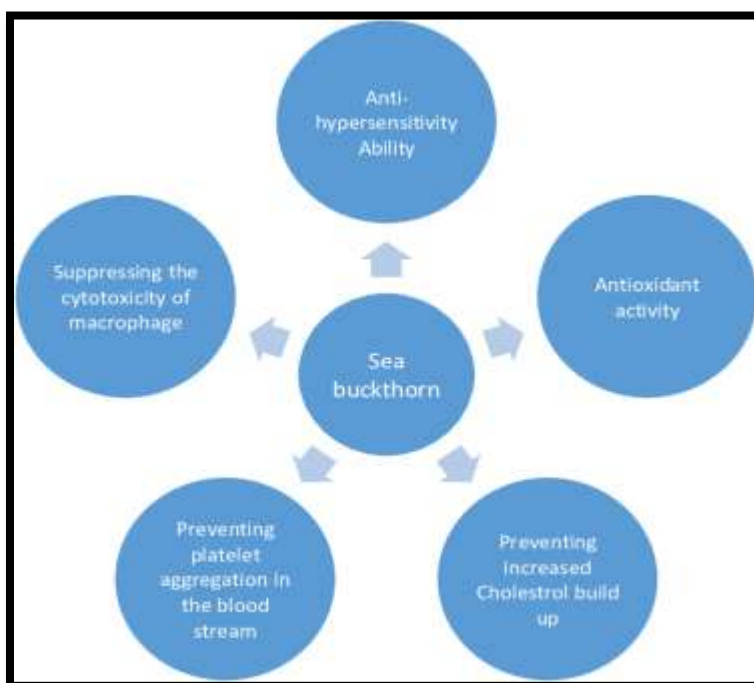


Fig 8. Cardio-protective mechanism of Sea buckthorn (*Hippophae rhamnoides*)

Indian Scenario: According to a study by Stobdan and Phunchok [7], the sea buckthorn industry benefited 0.8% of Ladakh's population, which includes farmers, berry gatherers, and processors. Between 2004 and 2015, their net income grew from 0.2 crores to 2.4 crores. They calculated that 20 crores would be the anticipated income in 2030. The Department of

Biotechnology (DBT), the Indian Council of Agricultural Research (ICAR), the Indian Council of Medical Research (ICMR), and non-governmental organizations (NGOs) are the main organizations in India addressing sea buckthorn. 187 genotypes with a yield greater than 5 kg were chosen by the Defence Institute of High-Altitude Research (DIHAR).

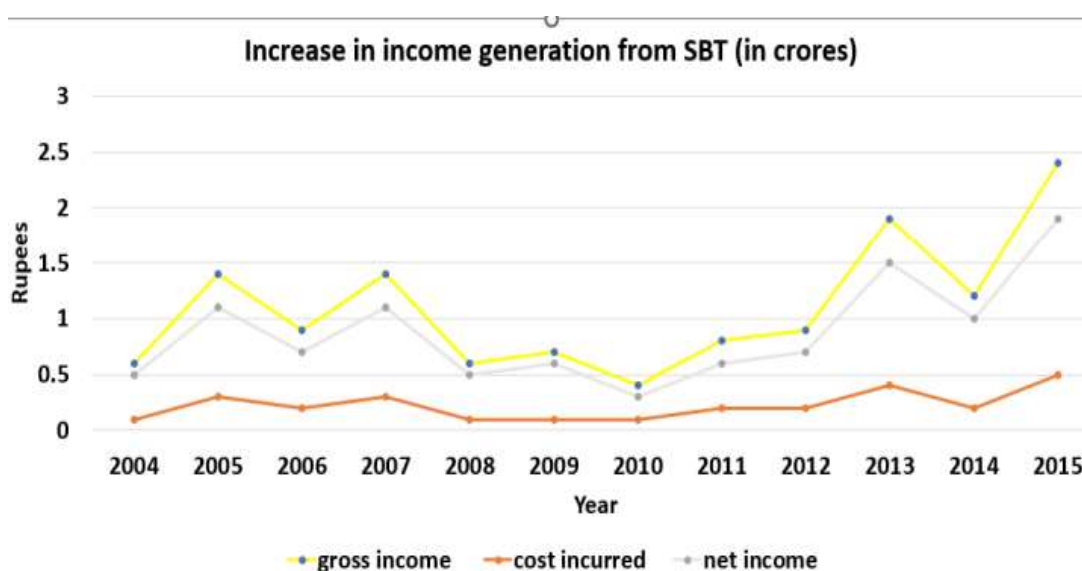


Fig. 9. Increase in income generation from sea buckthorn (in crores)

CONCLUSION:

Numerous in vitro and in vivo investigations have shown the potential for cardioprotection as well as the critical role that sea buckthorn's numerous bioactive compounds—found in its leaves, berries, and oils—play in the heart and lungs. Numerous mechanisms, such as lowering blood pressure, reducing oxidative stress and blood platelet activation, and altering lipogenesis—specifically, the physiology of blood platelets' arachidonic acid—are how sea buckthorn achieves its anti-cardiovascular effects. Additional information about sea buckthorn's numerous applications in the treatment of cardiac disorders is provided. Furthermore, more investigation is needed to elucidate the medicinal benefits and other features of the bioactive metabolites that are isolated from sea buckthorn. Consequently, it could lead to the plant's increased use as a supplement and as a therapeutic ingredient in the treatment of heart conditions. The production of high-quality planting material from promising cultivars, standardization of production technology, appropriate government interventions and policies, etc., are some strategies for making the crop more widely known. Sea buckthorn is a nutrient-dense, potentially useful functional food.

REFERENCES

1. Journal of Agriculture and Ecology Research International Volume 25, Issue 4, Page 98-106, 2024; Article no. JAERI.121004 ISSN: 2394-1073
2. Dubey, R. K., Shukla, S., Shukla, V., & Singh, S. (2024). Sea buckthorn: A potential dietary supplement with multifaceted therapeutic activities. *Intelligent Pharmacy*, 2(5), 681–687.
<https://doi.org/10.1016/j.ipha.2023.12.003>
3. Chen, Y., He, W., Cao, H., Wang, Z., Liu, J., Wang, B., & Wang, C. (2024). Research progress of sea buckthorn (*Hippophae rhamnoides* L.) in prevention and treatment of cardiovascular disease. *Frontiers in Cardiovascular Medicine*, 11, 1477636.
<https://doi.org/10.3389/fcvm.2024.1477636>
4. Kumari, S., & Sharma, S. P. (2021). Effect of Sea buckthorn in preventing cardiovascular diseases in human beings. *Journal of Cardiovascular Disease Research*, 12(6), 215–224.
5. Fatima, T., Snyder, C. L., Schroeder, W. R., Cram, D., Datla, R., Wishart, D., Weselake, R. J., & Krishna, P. (2012). Fatty acid composition of developing sea buckthorn (*Hippophae rhamnoides* L.) berry and the transcriptome of the mature seed. *PLOS ONE*, 7(4), e34099.
<https://doi.org/10.1371/journal.pone.0034099>
6. Upadhyay, N. K., Kumar, M. S., & Gupta, A. (2010). Antioxidant, cytoprotective and antibacterial effects of Sea buckthorn (*Hippophae rhamnoides* L.) leaves. *Food and Chemical Toxicology*, 48(12), 3443-3448.
<https://doi.org/10.1016/j.fct.2010.09.019>
7. Fatima, Tahira, et al. "Fatty Acid Composition of Developing Sea Buckthorn (*Hippophae rhamnoides* L.) Berry and the Transcriptome of the Mature Seed." *PLOS ONE*, vol. 7, no. 4, 2012, e34099.
<https://doi.org/10.1371/journal.pone.0034099>
8. Zhao, Y., Zhang, M., & Li, X. (2020). Phytochemistry, health benefits, and food applications of sea buckthorn (*Hippophae rhamnoides* L.). *Frontiers in Nutrition*, 7, 103.
<https://doi.org/10.3389/fnut.2020.00103>
9. Shah, R. K., Idate, A., Ugale, V., & Poorva. (2021). Comprehensive review on sea buckthorn: Biological activity and its potential uses. *The Pharma Innovation Journal*, 10(5), 942–953.
<https://doi.org/10.22271/tpi.2021.v10.i5l.6325>



10. Kallio, H., & Yang, B. (2021). Bioactive compounds in sea buckthorn and their efficacy in human health. *Nutrients*, 13(6), 1944. <https://doi.org/10.3390/nu13061944>
11. Krejcarová, J., Straková, E., Suchý, P., Herzig, I., & Karásková, K. (2015). Sea buckthorn (*Hippophae rhamnoides* L.) as a potential source of nutraceuticals and its therapeutic possibilities—a review. *Acta Veterinaria Brno*, 84(3), 257–268. <https://doi.org/10.2754/avb201584030257>
12. Stobdan, T., Korekar, G., & Srivastava, R. B. (2013). Nutritional attributes and health applications of sea buckthorn (*Hippophae rhamnoides* L.): A review. *Current Nutrition & Food Science*, 9(3), 195–202. <https://doi.org/10.2174/1573401311309030004>
13. Kanayama, Y., Kato, K., Stobdan, T., & Kanahama, K. (2012). Research progress on the medicinal and nutritional properties of sea buckthorn (*Hippophae rhamnoides* L.). *Journal of Ethnobiology and Ethnomedicine*, 8(1), 1–8. <https://doi.org/10.1186/1746-4269-8-1>
14. Royster, R. L., Butterworth IV, J. F., Groban, L., Slaughter, T. F., & Zvara, D. A. (2019). Cardiovascular anatomy and pharmacology. *PubMed Central*. <https://pmc.ncbi.nlm.nih.gov/articles/PMC7121118/>
15. Amin, G., Booz, G. W., & Zouein, F. A. (2023). New pharmacological agents and novel cardiovascular therapies. *PubMed Central*. <https://pmc.ncbi.nlm.nih.gov/articles/PMC10236523/>
16. Singh, R., & Sharma, S. (2011). Important therapeutic uses of sea buckthorn (*Hippophae*): A review. *Pharmacognosy Reviews*, 5(9), 130–134. <https://doi.org/10.4103/0973-7847.79085>

HOW TO CITE Jaie Zore, Shivraj Mane*, Prashant Pawar, The Golden Berry: A Review on the Pharmacological and Therapeutic Potential of Sea Buckthorn, *Int. J. of Pharm. Sci.*, 2025, Vol 3, Issue 5, 3155-3167. <https://doi.org/10.5281/zenodo.15462156>

