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## Challenges & Opportunities Before Indian Business Environment

# Impact of Traditional Himalayan Herbs on Health and Business

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ABSTRACT

The Himalaya has great wealth of traditional medicine. The present study is facilitated to screen Himalayan herb *Rhamnus* which belongs to family *Rhamnaceae*.It is found in Garhwal, Himalayan region. Rhamnaaceae is a family of 59 genera having about 900 species including genus Rhamnus which is commonly known as buckthorn. About 10 species found in Indian Himalayan region. Rhamnus contains various biological active compounds which have been used for the treatment of various diseases. This herb is useful in curing various disease includes lexatives and purgatives strongly hypotensive, in the treatment of stone inhibitor, constipation, inflammation, asthma, tumor, wound healing, burns and odontology without any side effects so large section of the population rely on the herbal medicines for primary health care. In India 70% of the population depend upon it. There are so many reasons to develop the herbal products over synthetic chemical drugs



## 1. Introduction

*Rhamnaceae is a family of 59 genera having about 900 species, including the genus Rhamnus. Approximately 150 species of Rhamnus are found throughout temperate and warmer regions of the world [1],Rhamnus is a genus of small trees and shrubs, commonly known as 'buckthorns', distributed chiefly in the temperate and warmer region of the world. The name 'buckthorns' is due to the woody spine on the end of each twig in many species. About ten species of Rhamnus. occur in India [1]. Rhamnus species are shrubs or small to medium-sized trees, with deciduous or rarely evergreen foliage. Indian species are found in wooded or open forests in Himalaya and Western Ghats, usually at altitudes ranging between 600 to 3000 m*

## 2. Uses of *Rhamnus* species in traditional medicine

The bark and fruit of *Rhamnus* species have been used for centuries in folk and official medicine as purgatives and for blood detoxication [5]. Traditional medicinal uses attributed to *Rhamnus* include laxative,

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urgative, strongly hypotensive, in the treatment of the hepatic complications, dermatological, diuretic, stone inhibitor, constipation, inflammation, tumors, asthma, emetic, tonic, astringent, deobstrument, antiseptic for wound healing, burns and odontology [6,15]. The traditional medicinal uses of *Rhamnus* species are listed in table

The plant *R. alaternus* is known locally as "Oud el-Khir" in Tunisia. The sheet of *R. alaternus* is laxative, purgative and has a strongly hypotensive activity [8]. The decoction of the air parts of this plant seems to be effective in the treatment of the hepatic complications while the bark in a meat bubble is employed in the North Africa countries against certain dermatological and hepatic affections. Other reported indications are the treatment of the burns and odontology and for the ocular care [8] . Fruit of *R. catharticus* L., as well as bark of some species of the related genus *Frangula* Mill. [9] are used as mild laxatives.

The fruit of most species contain a yellow dye and the seeds are rich in protein. Oils from the seeds are used for making lubricating oil, printing ink, and soap. Some species may cause demyelinating polyneuropathies. The purging buckthorn (*R. cathartica*) is a widespread European native species used in the past as a purgative, though its toxicity makes this a very risky herbal medicine and it is no longer in use. Another European species, alder buckthorn (*R. frangula* syn. *Frangula alnus*) was of major military importance in the 15th to 19th centuries, as its wood provided the best quality charcoal for gunpowder manufacture. Many species have been used to make dyes. *R. purshianus* bark and fruit yield a yellow dye and, when mixed with alum, a green dye that has been used in art. *R. utilis* provides china green, a dye used to give a bright green color to silk and wool. Another species, Avignon buckthorn (*R. saxatilis*) provides the yellow dye Persian berry, made from the fruit.

**Table 1 - The uses of Rhamnus Species in traditional medicine.**

| ***Rhamnus species*** | **Traditional uses** | **ref** |
|---|---|---|
| *R. alaternus L.* | Laxative, purgative, strongly hypotensive, in the treatment of the hepatic complications, dermatological, burns and odontology. | |
| *R. frangula* | Laxative, cathartic, depurative and diuretic activity antianalgesic, dyes and gunpowder and charcoal. The bark is used medicinally for stoma. | 3, 12 |
| *R. tinctorum* | Diuretic, stone inhibitor and endowed with genotoxic. | 13 |
| *R. nakaharai* | constipation, inflammation, tumors, and asthma. | 14 |
| *R. cathartica fruits* | Antiseptic for wound healing | 6 |
| *R. fallax bark* | To treat mange and skin diseases | 5 |
| *R. prinoides* | Beverages and for the treatment of fungal and ring warm infections | 7 |
| *R. purshiana Dried bark* | Laxative, tonic, chronic constipation and cathartic activity | 1, |
| *R. pentapomica fruits* | Emetic | 1 |
| *R. triquerta bark* | Tonic, astringent and deobstrument | 1 |
| *R. virgatus fruits* | Emetic and purgative and in affections of spleen | 4 |
| *R. triqueter bark* | Tonic, astringent and deobstrument [58 Kirtikar]. | 4 |

## 3. Biological and Pharmacological Activity of *Rhamnus* Species

Approximately 150 species of *Rhamnus* are found throughout temperate and warmer regions of the world. Some species of *Rhamnus* like *R. alaternus* have shown wide range of pharmacological and biological activities [8,11,16-19.] *Rhamnus* species are rich source of biologically active phtyconstituents. *Rhamnus* species have been reported to possess anti-inflammatory, anti-spamodic, cardio-stimulating, anti-ulcer, antimutageni, anti oxidant, and anti-hypotensive activity [20-38]. The various pharmacological and medicinal properties of *Rhamnus* species that have been reported in the literature are summarized in table 3.1.

Despite the taxonomic and phytochemical diversity of the genus, only a limited number of *Rhamnus* species have been investigated for their medicinal properties. Several *Rhamnus* species and their constituents exhibit a very wide range of biological activities, indicating that some of these plants can be explored for the development of novel phyto-pharmaceuticals.

*R. alaternus* is one of the most studied species for its medicinal properties. The ethyl acetate, methanolic, total oligomers flavonoids enriched extracts, and water extract from aerial parts of *R. alaternus*, showed pronounced cytotoxic effect against the K562 human chronic myelogenous leukaemia cell line and L1210 leukaemia murine cells whereas ethyl acetate and total oligomers flavonoids enriched extracts showed significant antibacterial activity against Gram positive and Gram negative bacterial; *Staphylococcus aureus*, *Enterococcus faecalis*, *Escherichia coli, Salmonella enteritidis and Salmonella typhimurium* [ 18]. The bark extracts of R. alaternus L., *R*. fallax Boiss., *R. intermedia* Steud. and *R. pumila* showed antimicrobial activity against *Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli, Candida albicans, Aspergillus niger* and *Microsporum gypseum wit*h minimal inhibitory concentrations equal to or below 2.500 mg/mL and antioxidant activity .

Total oligomer flavonoids enriched extract and ethyl acetate extracts from *R. alaternus* induce apoptotic death in human chronic myelogenous leukaemia K562 cell line. These extracts were found to be effective to protect against lipid peroxidation and exhibit potential antioxidant and proapoptotic properties [21]. The total oligomers flavonoids enriched extract of *R. alaternus* of leaves exhibited the highest antimutagenic level towards the indirect mutagen AFB1, whereas ethyl acetate extract showed the highest antimutagenic effect towards the direct mutagen, nifuroxazide. The total oligomers flavonoids enriched, ethyl acetate and methanol extracts of *R. alaternus* leaves exhibited xanthine oxidase inhibiting and

superoxide anions scavenging effects. [17] 95. A pronounced antiproliferative effect on human leukemia K562 cells, high DPPH radical-scavenging activity and antioxidative effects using the xanthine oxidase assay was shown by flavonoid-enriched extracts of *R. alaternus* roots and leaves [19]. The aqueous extract of *R. alaternus* leaves and its chloroform fraction significantly decreased the genotoxicity induced by aflatoxin and nifuroxazide and exhibited the highest level of protection towards the direct mutagen, sodium azide-induced response in TA1535 strain. These same active extracts exhibited high xanthine oxidase and superoxide anion-scavenging effects [8].

**Table 2 - Biological and Pharmacological Activity of *Rhamnus* species**

| ***Rhamnus* Species** | **Pharmacological/Biological Activity** | **Plant Extract/Compound isolated from the plant** | **Ref** |
|---|---|---|---|
| *R. alaternus* | Anti-lipid peroxidation and induction of apoptosis | Total oligomer flavonoids enriched extract and ethyl acetate (EA) extracts | 21 |
| | Antimutagenic, and antioxidant | methanol and ethyl acetate extracts (leaves) | 16 , 17 |
| | Antiproliferative, Antioxidant, and Antimutagenic | Flavonoid-Enriched Extracts | 19 |
| | Antioxidant and inhibition of aflatoxin | Aqueous extract of leaves | 8 |
| | Cytotoxic activities | Total Oligomers Flavonoids enriched extracts, ethyl acetate, methanolic and aqueous extracts | 18 |
| | Anti-bacterial | ethyl acetate, TOF extracts | 18 |
| | antioxidant and antimicrobial | Chrysophanol rich extract. | 20 |
| R. frangula | Antifungal | Methanol extracts | 25 |
| | activity | | |
| *R. lycioides* | Antihypertensive action | Aqueous extract | 26 |
| | lowering of systemic arterial blood pressure | A lyophilized hot water extract | 22 |
| | Hypotensive effect | lyophilized hot water extract and various organic solvent extracts. | 23 |
| *R. nepalensis* | Cytotoxic | Aqueous extract | 27 |
| *R. prinoides* | Antiplasmodial activity | Aqueous extracts | 28 |
| | Antimalarial activity | Methanol extract | 29 |
| | antimutagenic effects | Dichloromethane extracts | 30 |
| | Antimalarial | Hot water extracts (leaves and root bark) | 31 |
| *R. nakaharai* | Antiinflammatory | Quercetin 3-*O*-methyl ether and quercetin | 33 |
| R. fallax, | antioxidant and antimicrobial | Physcion rich extract | 20 |
| *R. intermedia* | antioxidant and antimicrobial | Physcion rich extract | 20 |
| *R. catharticus* | Antioxidant and antimicrobial | methanol extracts of barks | 24 |
| *R. orbiculatus* | Antioxidant and antimicrobial | methanol extracts of barks | 24 |

### 3.1. Biological activity of flavonoids

In 1936 St. Rusznyák and A. Szent-Györgyi described, in a paper in Nature [69], the aid of certain pathological conditions, characterized by an increased permeability or fragility of the capillary wall, by extracts of Hungarian red pepper containing flavonols, a type of flavonoids, which were then named "vitamin P".

The first report on biological activity of the flavonoids was published in 1938 [70], since than flavonoids have been reported to possesses variety of biological activities viz., anti-inflammatory, anti-fertility, anti-neoplastic, hepatoprotective, anti-ulcer, anti-oxidant, cardiotonic, anti-microbial, anti-viral and gained much interest as bioactive constituents [71-72]. Kaempferol, meciadanol, catechins, sofalcone, quercetin have been reported as anti-ulcer agents [73, 74], apigenin and rutin asanti-arthritis [75, 76], Quercetin, apigenin, catechin, hesperidin, rutin, luteolin, kaempferol, myricetin and fisetin anti-inflammatory [7173,76,77], quercetin, kaempferol, galangin, apigenin, naringin, genistein, luteolin, catechins anti-cancer [1, 77,78], naringenin, 2S-hesperidin, linarin as anti-depressant [ 79,80], fisetin, quercetin anti-diabetic [74], quercetin, rutin, citrin as anti-allergic [81,82], and quercetin, avicularin, hirustrin, onitin, luteolin as hepato-protective [83,].

Number of flavones, flavanones and flavans has been tested against selective anti-HIV activity.

### 3.2 Biological activity of Quinones

Quinones are the natural color pigments ranges from pale yellow to almost black. They are widely distributed and exhibit great structural variations. They make relatively little contribution to color in plants. Quinones are frequently present in the bark, heartwood, roots, seeds, leaves and other natural resources. The naturally occurring anthraquinones can be divided into two groups on the basis of their biosynthetic pathways. Quinones can conveniently be divided into four groups as benzoquinones, nathaquinones, anthraquinones and isoprenoid quinones. The first three groups are frequently hydroxylated with phenolic group and may occur either in combined form with sugars as glycosides or in free state, some times dimeric and quinol form. The isoprenoid quinones are involved in cellular respiration (ubiquinone) and photosynthesis (plastoquinones) and are thus universally distributed in plants (84-, 85).

The plants belonging to the families *Rhamnaceae,* are rich in anthraquinones which have been widely used as laxative and other traditional medicines . The anthraquinone rich roots extract of Rubia tinctorum has been used for the treatment of kidney stones [86,87], and have antimicrobial [88-89], hypotensive [90 and anti-leukemic [91-92] properties. Emodin and rhein showed antitumor activity while the emodin is chief constituent of cathartic drugs [100]. Chrysophenol, physcion, emodin, fragulin B and physcion β -D-rhamnosyl (1→2)-glucoside isolated from R. formosana exhibited cytotoxic effects [99]. The chemical constituents isolated and characterized from various *Rhamnus* species so far and their biological activity are listed in table-3.

**Table 3 - Chemical Constituents/Biological Activity of *Rhamnus* Species found in India**

| *S.no* | ***Plants' Name (Part)*** | **Isolated Compounds/biological Activity** | **Ref** |
|---|---|---|---|
| 1. | *R. alaternus* berries | Delphinidin 3-*O*-rutinoside, 3-*O*-rutinoside derivatives of cyaniding, petunidin, pelargonidin, peonidin and malvidin. | 47 |
| 2. | *R. cathartica* (fruits) | Oxyprenylated anthraquinones , 3-isopentenyloxy emodin. | 48 |
| | *R. catharticus* | quercetine (3,5,7,3′,4′-pentahydroxy-flavone) | 49 |
| *3.* | *R. formosana* | Emodin 8-*O*-rhamnosyl-(1→2)-glucoside. | 51 |
| | *R. formosana* | Anthraquinone; frangulin B | 33 |
| 5. | *R. leptophylla (fruit)* | Three flavonol glycosides identified as multiflorin A, Kaempferol-3-O-β-rhamnoside and alaternin | 56 |
| 6. . | *R. nakaharai (stem bark)* | *Isotorachrysone, 6-methoxysorifenin, quercetin-3-O-methylether* | 34 |
| | *R. nakaharai* | Isotorachrysone isolated from *R. nakaharai* is potentially an effective and versatile antioxidant, and can help protecting LDL against oxidation. | 35 |
| | *R. nakaharai* | 3-*O*-Methylquercetin, a main constituent of the plant, has been reported to have potential for use in the treatment of asthma. | 10 |
| | R. nakaharai | 5,7-dihydroxyphthalide 5-*O*-β-[6-*O*-{3″-methoxy-4″-*O*-β-[6‴-*O*-(4⁗-*O*-carboxy-3⁗,5⁗-dimethoxy)phenyl] gluco pyranosyl}phenyl]glucopyranoside and 6-*O*-{3′-methoxy-4′-*O*-β-[6″-*O*-(3‴-mercapto-5‴-methoxy-4‴-*O*-methylcarboxy)phenyl] glucopyranosyl} phenyl β-glucopyranose | 58 |

| | | | |
|---|---|---|---|
| | *R. nakaharai* root bark | Chrysophanol 8-*O*-xylosyl-(1 → 6)-glucoside and 2-acetyl-3-methyl-6-methoxynaphthalene-1,8-diol 8-*O*-xylosyl-(1 → 6)-glucoside. | 59 |
| | *R. nakaharai* | Quercetin 3-*O*-methyl ether, kaempferol, and quercetin. | 33 |
| | *R. nakaharai* (fruits) | A new flavonol triglycoside, trioside, and kaempferol | 79 |
| | *R. nakaharai (root bark)* | *nakahalene, chrysophanol, physcion, emodin, rhamnocitrin and kaempferol* | 67 |
| | R. nakaharai stem bark | Isotorachrysone, isotorachrysone peracetate, 6-methoxysorigenin, quercetin 3-O-methyl ether, and quercetin 3-O-methyl ether peracetate. | 34 |
| *7.* | *R. petiolaris* fruits | Rhamnazin-3-*O*-[α-L-rhamnopyranosyl (1 → 4)-α-L-rhamnopyranosyl (1 → 6)]-β-D-galactopyranoside and rhamnetin-3-*O*-α-L-rhamnopyranosyl (1 → 2)-α-L-rhamnopyranosyl (1 → 6)]-β-D-galactopyranoside. | 61 |
| | *R. petiolaris* berries | Flavonol glycoside; Rhamnetin 3-*p*-coumaroylrhamninoside | 62 |
| *8.* | *R. procumbens (whole plant)* | Musizin, physcion, emodin, chrysophanol, frangulin, kaempferol and 7-hydroxy-5-methoxyphthalide | 65 |
| | *R. procumbens (whole plant)* | kaempferol-7-O-methylether and kaempferol-4'-O-methylether | 66 |
| *9* | *R. pubescens* (leaves and stems) | Emodin and syringaldehyde | 67 |
| | *R. purshiana* cultures ( Bark )wwway urveda .com | 1,8-dihydroxyanthraquinones, anthrones, dianthrones emodin, chrysophanol and physcion | 68 |
| *10.* | *R. triqueria (leaves)* | Kaempferol-7-methyl ether | 73 |
| *11.* | *R. virgata* | A new anthraquinone diglucoside ; physcion-8-*O*-β-gentiobioside . | 74 |
| *12.* | *R. virgatus (aerial parts)* | A-type proanthocyanidin, epiafzelechi-(4∝→8; 2∝→O→7')-kaempferol together with physcion, chrysophanol, kaempferol-7-O-methylether, 7-O-methyl kaempferol-3-O-β-rhamninoside and kaempferol-3-O-β-rhamninoside. | 75 |
| *13.* | *R. wighti (stem bark)* | Cynodontin, chrysophanol, physcion, musizin, lupeol, sitosterol, 7-hydroxy-5-methoxyphthalide, emodin, sitosterol glycoside, β-sorigenin, 7-hydroxy-5-methoxyphthalide and naphthalide glucoside. | 76 Pepalla 1991 |
| *14.* | *R. nepalensis* | 3'-O-acetylfrangulin A (8), several new rhamnosylanthrones, the prinoidin-emodin bianthrones, the prinoidin bianthrones, and rhamnepalins. | 27 |
| *15.* | *R. nipalensis* | A new chalcone glycoside, chalcone-2',4-dihydroxy-4'-O-β-D-glucoside together with sitosterol, lupeol, di-O-methyldaidzein, kaempferol-4'-methylether, quercetin, physcion, sitosterol glucoside and emodin. | 80 |

## 4.Conclusion

The Uttarakhand Himalayan people have a close relationship with nature because they are entirely reliant upon forest for food, fruits, and medicinal plants for their healthcare. Local people in this region, especially older age people, tribal people and women heavily use these traditionally available medicinal plants for health and believe that these are easily accessible, less costly and have no special effects as compare to synthetic chemical medicine the present condition of traditional knowledge about medicinal plants everywhere is an issue of deep anxiety as the traditional knowledge is gradually declining and disappearing from the countryside. Due to the unavailability of modern health facilities, poverty, connectivity

with urban centre, awareness, etc. people in rural areas are still relying on traditional medicines for their health care govenrment has to frame proper policies and focus on execution at commercial level to preserve the forests and medicinal plants . Farmers and local people should be occupied and encouraged in the cultivation of medicinal plants at least on their barren land.

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