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ORIGINAL PAPER



Nutritional potential of seabuckthorn plant for livestock feeding

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INTRODUCTION

Fodder trees and shrubs can play an important role in animal nutrition. Contribution from fodder trees and shrubs is significant in areas where the available grazing is not sufficient for animals. *Hippophae rhamnoides* also known as Seabuckthorn (SBT) is an ancient plant with modern virtues, due to its nutritional and medicinal value.. All parts of Seabuckthorn e.g. berries, leaves and seed or pulp oil contain abundant of nutrients and many bioactive compounds (Nutraceutical value). They are a rich source of natural antioxidants like ascorbic acid, carotenoids, flavonoids, and contain significant amount of protein, vitamins (especially vitamin C), minerals, lipids (mainly unsaturated fatty acids), and phytosterols. Leaves and fruit residue of Seabuckthorn can be used to feed poultry and livestock with a stimulatory effect on growth and performance. Seabuckthorn have various beneficial effects, like antioxidant, hepato-protective, immunomodulatory, anti-stress, cardioprotective, and antidiabetic action. Modern research is needed for better utilization of this species for food/fodder and pharmaceutical potential.

NATURAL DISTRIBUTION

SBT can be cultivated in a wide range of soil and different climatic conditions. There are seven species of SBT out of which three species are found in india. These species are *Hippophae rhamnoides*, *Hippophae salicifolia* and *Hippophae tibetana*. Sea buckthorn grows mostly India's cold, dry regions specially in North-West Himalayas. In India it is found in Ladakh, Kumaon-Garwal in Uttrakhand, Lahual-Spiti and Kinnaur in Himachal Pradesh, and the sacred forests of Sikkim and Arunachal Pradesh.

COMPOSITION

SBT plants parts contain large no. of bioactive compounds which varies with maturity, species, climate and geographical location. SBT leaves and fruit are rich in vitamin C and E. Also contain good amount of Carotenoids which includes Beta-carotene, lycopene, lutein, zeaxanthin and, Flavonoids mainly isorhamnetin, quercetin, kaempferol, etc. SBT fruits, seeds and leaves are rich in fatty acids and contain saturated 13.7% and 86.3% unsaturated fatty acids.

The major fatty acids are Palmitic acid, oleic acid (omega-9), palmitoleic acid (omega-7), linoleic acid (omega-6), and linolenic acid (omega-3). It is rich in essential fatty acids (omega-3 and 6). Pulp oil that contains high levels of omega-7. SBT leaves have significant values of calcium, magnesium and potassium as compare to other commonly used fodder trees and shrubs. SBT leaves contain 15-20 % protein and having 0.73% lysine, 0.13% methionine and cysteine.

Table 1. Chemical composition of Seabuckthorn leave (Sheikh et al., 2011)

Sr. No.	Proximate Principles	Percentage
1.	Dry Matter	93.87
2.	Crude Protein	15.95
3.	Ether Extract	8.50
4.	Crude Fibre	14.67
5.	NFE	52.38
6.	NDF	38.09
7.	ADF	31.00
8.	Total Ash	8.50
9.	Ca	2.36
10.	P	0.12

ANTI-NUTRITIONAL FACTORS

SBT leaves contain mostly hydrolysable tannin which are gallo and Ellagi tannins & tannins are monomeric type .Tannins content of SBT leaves– Total tannins - 9.9%, hydrolysable - 8.8%, Condensed -1.1% & fibre bound condensed tannin - 0.54%.

As a source of feed

For maximizing the animal production, nutritionally balanced and cost effective feeding are the most important objectives for animal nutritionists. Feed cost can be a minimized for livestock and poultry if the cheaper unconventional and potentially useful ingredients are used. Due to lack of feed and fodder resources in India there is need to utilize unconventional feed resources SBT leaves and fruit residues of SBT can be used to feed poultry and livestock . Leaves rich in protein (15-20%), fat (3-9%) and vitamin C. Foliage yield of SBT plant is 16ton/ha which is higher than any shrubs and grasses. The

NDF content is 30-40 % and 30% cell wall nitrogen is available for rumen degradation this makes it an excellent feed resource. Residue left after extraction of oil from cosmetic industries can be used as animal feed because of its nutritious value. Leaf cake is having high nutritional value. Cake is rich in protein (12.3-13.3%) having balanced amino acids. SBT is a very important feeding resource especially in cold arid regions at high altitude where there is lack of fodder during winters.

Poultry farming is very difficult in the cold arid Himalayan region of India, where the altitude is 3048-3658 m above mean sea level (MSL) and the temperature ranges from +35°C to -35°C. Poultry farming in areas like Leh-Ladakh has generally taken a back seat for a number of reasons. Addition of SBT cake in poultry feed up to 30% replacement of CP showed better growth response and feed conversion ratio. The leaves and fruit residues of sea buckthorn are suitable for use in livestock and poultry fodders. The weight and egg rate of poultry are increased greatly after feeding poultry with the leaves, seeds, and fruit residues of sea buckthorn.

One study observed that supplementation of 0.5% sea buckthorn leaf meal had synergistic effect in improving the FCR of coloured breeder birds. Addition of 2 % SBT as feed additive in poultry feed found to be safe on the basis of growth response biochemical and histopathological basis.

NUTRACEUTICAL POTENTIAL

a) Antioxidant potential

Oxidative damage to cells has been implicated in the pathogenesis of a wide variety of clinical disorders and its broad range of effects in biological systems has drawn attention of many experimental studies. The antioxidant and immunomodulatory properties of SBT were studied in vitro using rat spleenocytes, macrophages and C-6 glioma cell line and in vivo using male albino rats. Bioactive compounds are responsible for the antioxidant activity of SBT. Alcoholic fruit extraction have showed cytoprotective action in lymphocytes against oxidative damage. Phenolic compound in SBT have free radicals scavenging activity especially Isorhamnetin.

b) Immunomodulation

SBT berries shown to have immuno-protective effects against T-2 toxins. This effect is due to activation of Cell mediated immune response. SBT oil promotes tissue regeneration and beneficial effects on mucosa of GIT. Flavones of SBT protect against H₂O₂ induced apoptosis of vascular endothelium by decreasing capase-3 expression. The SBT leaf extract was found to have significant anti-inflammatory activity in adjuvant induced arthritis (AIA) rat model and lipopolysaccharide induced inflammatory response in murine macrophages. A limited number of studies have focused on identification and characterization of the bioactive components, which is an important area for the development of SBT based pharmaceuticals and nutraceuticals.

c) Anti-stress and Meat flavour enhancing properties

Heat stress not only decrease the performance but also affects the meat flavour. SBT increases the IMP (Inosine mono phosphate) content and enhance the flavor. Adaptogenic & antisress activity was studied in rat model in which rat is exposed to hypoxia, cold and restrain. In stress conditions SBT increases blood glucose, free fatty acids to combat stress& reduces oxidative stress of liver and Intestine.

d) Cardioprotective and Anti-atherogenic activity

Flavonoides and unsaturated fatty acids present in SBT improves the function of cardiovascular system. It can prevent coronary heart diseases and diabetes mellitus. These beneficial effects are achieved by Lowering blood glucose by insulin regulation, scavenging free redicals, decreasing susceptibility of LDL to oxidation. Protect endothelial cell form oxidative damage. Some studies on human and animals have been carried out to evaluate the effect of flavonoids of SBT on cardiovascular diseases, as some flavonoid compounds are known to have positive inotropic effects.

Besides these properties it has got other useful properties like Anti-infective and wound healing property (Skin wound & Ulcers), It can modulate hypoxia inducer transvascular leakage and Anti-radiation effects etc.

CONCLUSIONS AND FUTURE PROSPECTS

Sea buckthorn plant contains a large variety of substances which possess a strong biological activity. Use of sea buckthorn berries as a natural food ingredient has been increasing. The fruit and leaves are rich in carbohydrates, protein, amino acids and vitamins, also contain dense contents of carotenoids, vitamin E, dietary minerals and polyphenolic acids. The fruit part can be used as feed additives in livestock. The current research on this crop is very much important which can leads to emergence of new avenues of its utilization including food/feed and pharmaceutical potential. The production potential and sustainable harvest of edible and other useful parts of this plant can also boost the local economy of farmers.

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