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Review Article

Nutritional and Medicinal Value of Underutilized Fruits

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Abstract

India is origin of many fruit crops and the most of crops is limited to its growing region only. Inspite of their high nutritional and medicinal properties their commercial cultivation is lacking. Most of underutilized fruits are in the core recipes of many ayurvedic formulations. The most common underutilized fruits which are gaining its popularity are Aonla (*Emblica officinalis*), Bael (*Aegle marmelos*), Wood Apple (*Feronia limonia*), Jamun (*Syzygium cumini*), Ber (*Ziziphus mauritiana*), Karonda (*Carissa carandas*), Chironji (*Buchanania lanzan*), Tamarind (*Tamarindus indica*) etc. These fruits are also riche source of food, nutritional and medicinal values. The value added products of these fruits have expected to catch the national and international markets if it is properly focused. The review paper is mainly emphasizing on nutritional, food and medicinal value of these underutilized fruits and its impact on betterment of health.

Keywords: Underutilized Fruits; Nutrition; Food Value and Medicinal Values

Introduction

Fruits are undoubtedly known as protective as they are rich in vitamins, phytochemicals and minerals. Fruits are excellent source of soluble dietary fiber, which helps in lowering the cholesterol level and fats from the body and also helps in smooth bowel movements. Generally, when fruits are compared with vegetables, pulses and cereals, possess very high anti-oxidant values. Antioxidant properties helps in removal of free radicals from the body, and thus provide protection against many chronicle and infectious disease. Underutilized fruits are equally important to commercially grown fruit crops in these regards.

The term 'underutilized' crop has been defined in various ways in world literature, most of these have been given importance to features, among others, like linkages with the cultural heritage of the locality, multiple uses, traditional crops in localized areas, and neglected by agricultural research and development agencies [1]. Since time immemorial, edible wild fruits have played a very vital role in supplementing the diet of the people of Indian Subcontinent. Apart from customary use as food, wild edible fruits have various health advantages as it potentially give immunity to many diseases. Accordingly, Ayurveda, the Indian Folk medicine was developed from wild fruits and plants. Major fruit crops like Mango, Banana, Papaya Litchi, Guava etc. are commercially cultivated while the wild edible fruits refer to species that are neither cultivated nor domesticated, but it come from their wild natural habitat and used as one of the sources of food [2,3]. Most of the underutilized indigenous fruit crops used as medicinal plants throughout India and popular in various indigenous system of medicine like Unani, Ayurveda and Homoeopathy. It was recognized that a high consumption of fruits and vegetables can help to prevent several non-communicable diseases such as cardiovascular diseases, the diabetes type 2 and some cancer [4].

Most of the important underutilized fruits are indigenous and it is easily available. In India most common underutilized fruits are Aonla (*Emblica officinalis*), Bael (*Aegle marmelos*), Wood Apple (*Feronia limonia*), Jamun (*Syzygium cumini*), Ber (*Ziziphus mauritiana*), Karonda (*Carissa carandas*), Chironji (Buchanania lanzan), Tamarind (*Tamarindus indica*) etc. So, the review paper is mainly

emphasizing on nutritional, medicinal and other values of these crops.

Aonla

Aonla or Indian gooseberry (*Emblica officinalis* Gaertn.) belongs to family Euphorbiaceae and is known for its medicinal and therapeutic properties from the ancient time in India. It is one of the important indigenous fruits of Indian subcontinent and widely used in Indian System of Medicine.

The aonla fruits are round, ribbed and pale green. The fruit is divided into six segments through pale liner grooves. The surface of the fruit is shiny and the size varies from small marble to a large plum. It is quite hard with a thin and translucent skin. The raw fruit, due to its high acidic nature and astringent taste, is unacceptable to consumers. The average fruit weight and seed weight varies from 22.29 to 25.20 and 1.54 to 1.82 g, respectively, among Krishna, NA7 and Chakaiya cultivars [5]. The seed pulp ratio is reported to vary from 1:15 to 1:22 [6].

Various workers reported the chemical composition of fresh fruit (Table 1) in respect to moisture, protein, fat, crude fibre, starch, sugars, minerals and vitamins. The fruits are rich in ascorbic acid and tannins. The chemical composition of aonla fruits is influenced by environmental factors. The total sugars content in aonla fruit varies from 7 to 9.6%, reducing sugars from 1.04 to 4.09 per cent and non-reducing sugars from 3.05 to 7.23 per cent, among the various varieties. Aonla is particularly rich in vitamin C. The pulp of fresh fruit contains 200 to 900 mg of vitamin C, as reported by [6-9].

Characters	Composition
Moisture (%)	80.22 to 89.36
TSS (°B)	10.32 to 16.00
Acidity (% citric acid)	1.25 to 3.24
Ascorbic acid (mg/100g)	200 to 1500
Reducing sugar (%)	1.04 to 4.09
Non-reducing sugar (%)	3.05 to 7.23
Total sugar (%)	2.11 to 8.68
pH	2.20 to 3.21
Tannin (% gallotannic acid)	0.35 to 0.64
Protein (%)	0.65 to 0.98
Pectin (% Ca pactate)	0.44 to 0.78

Table 1: Chemical composition of fresh aonla fruit [7-10].

Aonla fruit is highly nutritive with a great medicinal use and the richest source of vitamin C. It contains 500-1500 mg of ascorbic acid per 100 g of pulp [10], which is much more than the vitamin C content of guava, citrus and tomato fruits. The fruit juice contains nearly 20 times as much vitamin C as in orange juice. Its other constituents are phenols and tannins containing gallic acid, elegiac acid and glucose which prevent oxidation of vitamin C. A tablespoonful each of fresh aonla juice and honey mixed together forms a very valuable medicine for the treatment of several ailments like tuberculosis of lungs, asthma, bronchitis, scurvy, diabetes, anemia, weakness of memory, cancer, tension, influenza, cold, loss and grayness of hair etc. Because of its highly acidic and astringent nature, the consumers do not relish this fruit in fresh form and consequently it is used in the preparation of various ayurvedic tonics like Chayvanprash, Triphala, etc.

Fruit	Characteristics	References
Aonla	Neutraceutical and pharmacological properties	11,12
	Antioxidant	13
	Anti-fungal, anti-bacterial	14
	Anti-viral	15
	Anti-mutagenic	13
	Anti-hepatoxic	11
	Anti-inflammatory	16
	Anti-histaminic, immuno-modulatory	17
	hypolipidemic	18
	Useful in	
	Cure bronchitis, liver ailment, diarrhoea	19
	Refrigerant, diuretic, laxative, useful in anemia, atherosclerosis, hemorrhages, leucorrhea	20
	Diabetes	21, 22
	Jaundice, dyspepsia, cough	23
	Chronic Dysentery	24

Table 2: Characteristics and uses of aonla fruit.

It has also been reported that pellets of dried aonla powder was served to soldier during world war for the treatment of scurvy [6]. Medicinal products chyavaprash, Triphla, Amrit Kalash, Amol Ki Rasayan etc.) and cosmetics (Chair oil, shampoo, hair dyes etc) are prepared from it [25-27]. The fresh aonla fruits are not popular as a table fruit due to their high astringency and its storability after harvesting is also limited due to its high perishable nature. It has

got great potential in processed forms, which can have great demand in national as well as international market. The processes for preparation of various value added products like appetite, murabba, chawanparash and trifala. However, now several new products have been developed by value addition namely aonla candy, jam, herbal jam, chutney, pickle, squash, juice, sharbat, vinegar etc. Fruit powder is also used in preparation of toiletries and cosmetics. Several other processing methods are being developed and research is continuing at various institutes in India to popularize and increase the consumption of aonla [28]. The nutritional values of aonla are nu¬merous and is recommended to be included as part of the daily diet.

It is also useful for haemorrhage, leucorrhoea and discharge of blood from uterus [29]. However, the fruit contains high density of ellagitannins such as emblicanin A (37%), emblicanin B (33%), punigluconin (12%) and pedunculagin (14%). It also contains punicafolin and phyllanemblinin A, phyllanemblin other polyphenols: flavonoids, kaempferol, ellagic acid and gallic acid [30].

Bael

Bael (*Aegle marmelos*) is an important member of Rutaceae family and native to India. Moreover, it is found throughout South-east Asia. Bael fruits contains vitamin and mineral contents include calcium, phosphorus, iron, carotene, thiamine, riboflavin, niacin and vitamin C [29]. All the parts of plant are economical and possess different medicinal values viz. leaves, roots, seed, bark and fruit etc contain a large number of coumarins, alkaloids, sterols and essential oils hence, possess analgesic, anti-inflammatory, antipyretic, anti-microfilaria, antifungal, hypoglycemic, antidyslipidemic, immunomodulatory, antiproliferative, wound healing, anti-fertility, and insecticidal abilities [31]. The fruit is considered one of the richest source of riboflavin. Marmelosin in fruit has therapeutically active factor of Bael fruit which is remedy of the stomach ailments. The fruit is converted into different products viz. the green Bael fruit slices are sundried for further use, pulp is converted to prepare sherbet and syrup, marmalade prepared from its fruits is used to treat diarrhea and dysentery, fruits are also used for the preparation of powder, preserve, nectar and toffee [32].

The fresh leaf juice in doses of 8 to 16 gm is given with honey as a mild laxative in fever, catarrh and asthama. Fresh leaves and fruits are used as a remedy for beriberi [34]. Half ripe fruits are mostly used in medicine and the fruit has characteristic aromatic, cooling and laxative properties. Fruit is also useful in preventing scurvy and strengthens the stomach and promotes its actions [35]. Bael is also used in the treatment of chronic diarrhea, dysentery, and peptic ulcers, as a laxative and to recuperate from respiratory affections [36].

Characters	Composition
Water (g)	57.46 ± 3.54
Protein (g)	2.13 ± 0.38
Fat (g)	0.3 ± 0.09
Carbohydrates (g)	29.07 ± 1.04
Ash (g)	1.3 ± 0.76
Carotene (mg)	54.5 ± 1.74
Thiamine (mg)	0.10 ± 0.04
Riboflavin (mg)	1.03 ± 0.14
Niacin (mg)	0.9 ± 0.02
Ascorbic Acid (mg)	75 ± 5.28
Tartaric Acid (mg)	1.98 ± 0.33

Table 3: Chemical composition of bael fruit [9,16,33].

Fibers	Pulp	Seed
Acid detergent fiber	12.0 ± 0.28	4.0 ± 0.14
Hemicellulose	0.00	8.0 ± 0.07
Cellulose	2.0 ± 0.03	6.0 ± 0.09
Lignin	8.0 ± 0.12	6.0 ± 0.12
Pectin	8.8 ± 0.26	5.8 ± 0.27

Table 4: Dietary fiber constituents (g/ 100g) of bael (*Aegle marmelos* L.) pulp and seed [33].

Wood Apple

Wood Apple (Feronia limonia) also known as monkey fruit, curd fruit and kathbel belongs to the family Rutaceae. The ripe fruits contain sweet aromatic pulp, which has 74% moisture, 7.3 g protein, 15.5 g carbohydrates, 170 mg riboflavin, 2 mg vitamin C per 100 g of pulp and minerals, especially 0.17% calcium 0.08% phosphorus and 0.07% Iron [37]. The fruits contain phytochemicals (polyphenols, phytosterols, saponins, tannins, coumarins, triterpenoids), vitamins, amino acids etc. [38]. It has curative value for various diseases of bones and joints, bilious diseases, prevention of capillary bleeding, cold, influenza, piles, dysentery, habitual constipation and scurvy. The fruit used as a liver and cardiac tonic, diarrhoea and dysentery [39]. The fruit pulp can be used for the preparation of different value added products like preserve, candy, sherbet, juice, chutneys, jam, jelly and squash.

Characters	Composition
Moisture (%)	72.00 ± 2.04
Protein (%)	7.14 ± 0.24
Fat (%)	1.45 ± 0.09
Carbohydrates (%)	7.24 ± 0.12
Ash (%)	4.98 ± 0.02
Calcium (%)	0.12 ± 0.07
Phosphorus (%)	0.07 ± 0.002
Iron (%)	1.0 ± 0.03

Table 5: Chemical composition of wood apple [37-39].

Jamun

Jamun (Syzygium cumini skeels) is important well known underutilized fruit crop and belongs to family Myrtaceae. The fruit found in most of the states in neglected areas, forest marshy lands, and roadside plantations. The fruit has very high nutritive value [37]. The fruits can be used for making several products like beverages, squash, jam, jelly and wine. All parts of the tree and basically the seeds are used to treat a range of ailments, the most important being diabetes mellitus [40]. The gallic acid and ellagic acid content present in seed plays an important in role in conversion of starch into sugar that's why minimize blood glucose level [41]. It is also effective in the treatment of inflammation, ulcers and diarrhea. Fruit pulp contains a very high anthocyanin content and can be a good source of natural food colourants for the food processing industries [42]. The pigment is known for their strong antioxidant capacity and health-protecting effects and reduces the risk of various diseases [43].

Characters	Fruit	Seed
Moisture (%)	82.19 ± 2.46	16.34 ± 0.49
Crude protein (%)	2.15 ± 0.06	1.97 ± 0.59
Crude fat (%)	0.83 ± 0.02	0.65 ± 0.01
Crude fiber (%)	1.76 ± 0.05	4.19 ± 0.12
Ash (%)	2.04 ± 0.06	2.18 ± 0.06

Table 6: Chemical composition of Jamun [21,44].

Ber

Ber or Indian Jujube (Zyziphus mauritiana) belongs to the family Rhamnaceae, which is a native of India. It is also called poor man's fruit, and one of the richest source of nutrition. The fruit contains good amount of vitamin C, A, and B complex, and also of Ca, K, Br, Rb, and La [45]. Fresh fruit of ber contains 81.6-83.0 g moisture, 0.8 g protein, 0.07 g fat, 0.60 g fibre, 5.4-10.5 g carbohydrates, 25.6 mg calcium, 26.8 mg phosphorus, 0.76-1.8 mg iron, 0.021 mg carotene, 0.02-0.024 mg thiamine, 0.02-0.038 mg riboflavin, 0.7-0.873 mg niacin and 65.8-76.0 mg ascorbic acid per 100 g of edible pulp [37]. The fruits can also be used for preparation of various products like chutney, dried ber, murabba, jelly, wine etc. The decoction from root and bark is good for dysentery and diarrhea and leaf decoction is useful as gargle in sore throat and in bleeding gums. The powder of ber roots has medicinal properties for curing ulcer, fever and wounds [39]. It is also rich in carotenes and phenolics [46]. The secondary metabolites were present in ber fruits like flavonoids, glycosides, saponins, lignins, sterols and phenols are very effective function against pathogens. The different parts of plant like root, bark, leaves, flowers, seeds are used for treatment and also used as blood purifier and appetizer [47,48].

Karonda

Karonda (*Carissa carandas* L.) belongs to the family Apocynaceae and another native fruit of India. Fruits taste is sour and astringent, are a very rich in iron contains a good amount of vitamin C, protein, carbohydrates, fat, fibre and calcium. The fruits are used to prepare jelly, sauce, carissa cream or jellied salad, pickles, sauces and chutney. The dried fruits may act as a substitute for raisins [49,50]. The fruits are traditionally used for medicinal treatments of malaria, epilepsy, nerve disorder, relieve of pain and headache, fever, blood purifier, itches and leprosy [51]. The major bioactive constituents, which impart medicinal value to the herb, are alkaloids, flavonoids, saponins and large amounts of cardiac glycosides, triterpenoids, phenolic compounds and tannins. Fruits have been reported to contain carisol, β-caryophyllene, carissone, carissic acid, carindone, carinol, ascorbic acid, lupeol, and β-sitosterol. These chemicals are very effective in the treatment of scabies, intestinal worms, pruritus, biliousness and also used as antiscorbutic, anthelmintic [52].

Chironji

Chironji (*Buchanania lanzan*) belong to family of Anacardiaceae and another native frutit to Indian subcontinent. Nutritional composition of the seeds shows that it as a potential source of protein, fat, dietary fiber, and energy. It is very good source of Phosphorus, Calcium, Magnesium and Iron. It contains 3.0 g moisture, 19.0 g protein, 59.1 g fat, 3.8 g fibre, 12.1 g carbohydrates, 279 mg calcium, 528.0 mg phosphorus, 8.5 mg iron, 0.69 mg thiamine, 0.53 mg riboflavin, 1.5 mg niacin and 5.0 mg vitamin C per 100 g of kernel and provides 656 calories [53]. The fruit has high socioeconomic

value providing livelihood to tribal population of the region and has high potential as commercial fruit species. The fruit is juicy and sweet in taste and used for preparation of various value added products like squash, ready to serve (R.T.S.) drinks and nectar after juice extraction. Chironji kernel contains about 52% oil [54]. Kernel oil is used mostly in cosmetic manufacturing and substitute for olive and almond oils [55]. The polyphenols have been proven for its disease fighting power and possess good antioxidant activities. The fatty acids, polyphenols, phytosterols and stigmasterol in seed extract has both medicinal and nutritional value [56].

Tamarind

Tamarind (*Tamarindus indica* Linn) also known as 'Indian date' and one of the most important fruits of family Fabaceae. It has various pharmacological activities like hypolipidemic, weight reducing, antimicrobial, hepatoprotective, anthelmintic, antioxidant, analgesic and anti-inflammatory etc [57]. Tamarind fruit pulp contain proteins, carbohydrates and minerals especially sodium, zinc and iron and can be eaten as fresh or processed into different food products and also the principal souring agent for squashes, chutney, beverages, etc. A refreshing acid drink and syrup are prepared from pulp [58]. The fruit is rich source of medicinal value and treated as a number of diseases. Antioxidant activity present in tamarind indicate that fruits contain biologically important mineral elements and have high antioxidant capacity associated with high phenolic content that can be considered beneficial to human health [59, 60].

Conclusion

The fruit crops mentioned under the review possess various medicinal values beside the nutritional one. These crops are present around us in unsystematic manner. So, cultivation of these crops in systematic manner and efficient utilization of marketing systems and channels for fresh fruits and processed products can motivate the growers towards growing these crops and can uplift the economy of country. There is tremendous scope of utilizing these crops in different promising value added products to the food and nutraceutical industry. The value added product can meet the dearth of new product in the market and serve the purpose of nutritional security along with healthy and safe life. By this we can prove what Hippocrates said, "Let food be thy medicine and medicine be thy food".

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