



REVIEW ARTICLE

Nutraceutical Values of Few Underutilized Fabaceae Species – A Mini Review

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Abstract

Today's developing world is suffering from under nutrition due to the culture of fast foods, junk foods and adulterated of fruits and vegetables in order to earn more within less time. Proper and timely availability of the unadulterated fresh fruits, vegetables and other nutritious foods are not reaching people. With the increasing population and fast depletion of natural resources, it became necessary to explore the possibilities of using newer indigenous plant resources. There are many plants species still lying unexplored and underexploited. Underutilized plants, in general, constitute those plant species that occur as life support species in extreme environmental conditions and threatened habitats, having genetic tolerance to survive under harsh conditions and possess qualities of nutritional and/or industrial importance for a variety of purposes. The present paper is a review of underutilized Fabaceae species of India. This review may help attend the drawback of mainstream researches which did not provide solutions to agronomic and post-harvest constraints, nor did it develop attractive value added products for a broader market in India.

Keywords: Fabaceae, Nutritional value, Underutilized, unexplored, underexploited.

Introduction

The family Fabaceae is one of the third largest (Legume) families in flowering plants, which includes 751 Genera and 19000 species in world (Christenhusz *et al.* 2016). In India 147 genera 805 species (M Sanajppa *et al.* 1991). Majority of the species are highly economical and are the major crops of India and world. Legumes vary in habit from annual and perennial herbs to shrubs, trees, vines/lianas, and even a few aquatics. Ranging in size from some of the smallest plants of deserts and arctic/alpine regions to the tallest of rain forest trees. Legumes are conspicuous and often dominant component of most of the vegetation types distributed throughout temperate and tropical regions of the world. Legumes are particularly diverse in tropical forests and

temperate scrublands with a seasonally dry or arid climate. This preference for semi-arid to arid habitats is related to a nitrogen demanding metabolism.

Legumes are important sources of nutrients and can serve as high quality dietary protein sources to meet nutrient requirements (Perumal *et al.* 2001). These plants legumes high in protein content, energy values, vitamin and mineral content and have been recognized as “meat of poor people”. Underutilized wild edible Plants (UWEP) are identified as minor, neglected, local, orphan, promising species that have been used for centuries for their food, fiber, fodder, oil or medicinal purposes. Many neglected and underutilized species are nutritionally rich and adapted to low input agriculture. The erosion of these species can have immediate consequences on the nutritional status and food security of the poor (Jyotsna Salvi *et al.* 2016).

According to the World Health Organization (WHO), 462 million adults are underweight, while 1.9 billion adults are overweight and / or obese. In children under 5 years of age, 155 million are stunted, 52 million are wasted, 17 million are severely wasted and 41 million are overweight and / or obese (Natisha Dukhi 2019).

In the South Asian region, India is one of the fastest growing countries economically, educationally, and technologically. Despite economic progress, India has failed to combat malnutrition that adversely affects the country's socio-economic progress. More than one-third of the world's

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Table 1: Comprehensive data of Nutraceutical values

Sl. No.	Name of the Plant	Part used	Description	Nutrients	References
1.	<i>Vigna umbellata</i> (Thunb.) Ohwi & H. Ohashi	Seeds	<i>Vigna umbellata</i> is an annual legume. It is a semi-erect or twining herb with extensive root system taproot. The stems are branched and with fine hair. The leaves are trifoliate with entire, oblong leaflets. The flowers are bright yellow, axillary racemes, are papilionaceous. The fruits are cylindrical, long pods, contain 6-10 oblong seeds.	Moisture (%) Total Carbohydrates (%) Crude Protein (%) Fat (%) Crude Fibre (%) Ash (%) Ca (mg/ 100 g) P / 100 g) Fe (mg/100 g) Free reducing sugars (%) Vitamin A	J.C Rana <i>et al.</i> , 2017; Baruah <i>et al.</i> , 2018; Manpreet Kaur, 2015; Chavan <i>et al.</i> , 2009; Molhotra <i>et al.</i> , 1988; Lepcha <i>et al.</i> , 2019. 11.0 – 13.8, 3.58 ± 0.21, 6.20, 10.1 ± 0.2 60.7 – 65, 77.54 ± 0.37, 68.7, 59.28 – 76.89, 17.8 -25.1, 29.09 ± 0.13, 23.75, 17.50 - 23.10, 16.1–19.12, 0.6 – 1.2, 1.72 ± 0.31 4.0-5.8, 1.16, 1.70 -4.25 3.81 -4.06, 4.85, 0.21 ± 0.01, 3.06 - 4.48, 315.0 – 450.0 301.0 – 480.0 7.2 – 10.9 3.71 – 5.37 30 IU
2.	<i>Vigna aconitifolia</i> (Jacq.) Marechal	Seeds	<i>Vigna aconitifolia</i> is a prostrate creeping habit. The main stem is slender, erect. Leaves are alternate, petiolated, trifoliate, deeply lobed. The inflorescence, axillary. Flowers are bright yellow. bisexual, papilionaceous, and The fruit is a hairy, brown or pale grey cylindrical pod,	Moisture (%) Total carbohydrate (%) Crude protein (%) Crude Fat (%) Crude fibre (%) Ash (%) Iron (mg/100 g) Phosphorus (mg/100 g) Potassium K Manganeseium Mg Calcium Ca Manganese	Opara <i>et al.</i> , 2017; Sharma <i>et al.</i> , 2013; Singh <i>et al.</i> , 2015; Badami <i>et al.</i> , 2019; Soris <i>et al.</i> , 2011; Haytowitz <i>et al.</i> , 2005. 12.87 ± 0.03, 10.30, 12.9, 7.89 ± 0.216 66.41 ± 0.00, 37.1, 57.65 ± 0.517, 61.5 14.06 ± 0.01, 22.94, 20 – 23, 23.78, 24.96 ± 0.690, 22.9 3.52 ± 0.00, 1.61, 2.8, 1.07 ± 0.122, 1.6 0.33 ± 0.01, 4.34, 4.80 ± 0.273, 2.81 ± 0.00, 4.26, 3.0, 3.60 ± 0.095. 1.49 ± 0.00, 10.85, 8.9, 7.46, 10.9 31.13 ± 0.03, 489, 174.26, 489, 1191 381, 214.04, 1.61, 381 150, 244.10, 150 1.82
3.	<i>Vigna angularis</i> (Willd.) Ohwi & H. Ohashi	Seeds	It is an annual vine, with an erect to twining growth habit and is usually bushy. Stem is erect. The leaves are trifoliate, ovate to rhomboid leaflets, alternate. The flowers are axillary racemes, bright yellow, papilionaceous. The fruit is pod, small constrictions between the seeds.	Moisture (%) Total carbohydrate (%) - Protein (%) Fat (%) Crude fibre (%) Ash Iron (mg / 100g) Calcium (mg/ 100g)	Adamu <i>et al.</i> , 2016; Yadav <i>et al.</i> , 2018. 78.4, 8.52 ± 0.03. 54.65, 17.5 ± 1.15 28.32, 20.82 ± 0.02 3.94. 1.17 4.08, 2.63 ± 0.70 0.022 0.256

4.	<i>Macrotyloma uniflorum</i> (Lam.) Verdc.	Seeds	This is annual climbing herb, stem pubescent, hairs spreading. Leaf trifoliolate, broad, ovate rhomboid, obovate or elliptic, obtuse, pubescent. Inflorescence axillary. Fruit: Pod	Moisture (%) Carbohydrate (g) - Protein (g) Fat (%) Fibre (g) Ash (%) Calcium mg/kg Iron (mg/100 g)	9.72, 11.39, 6.72 ± 0.03 68.70, 57.02, 58.32 ± 0.01 23.00, 22.0, 22.12 ± 0.11 2.30, 0.50, 11.39, 1.25 ± 0.10 16.07, 12.14 ± 0.12 3.0 – 3.8, 2.24 ± 0.20 120.00. 11.00	Kanmani et al., 2018; Gopalan et al., 1999; Marimuthu et al., 2013.
5.	<i>Sesbania grandiflora</i> (L.) Pers.	Seeds	<i>Sesbania grandiflora</i> is a fast-growing perennial, deciduous or evergreen legume tree. Roots are nodulated. The leaves, pinnately compound. Inflorescence axillary racemes. The flowers are white, yellowish, pink or red. Fruit: pod.	Moisture Content (%) Crude Protein (%) Crude Fat (%) Crude Fibre (%) Ash (%) Carbohydrate(%CHO)	6.92 ± 0.01, 5.2 . 32.50 ± 0.00, 23.65, 9.60 ± 0.01, 7.4 20.44 ± 0.0, 33.01 4.10 ± 0.00, 8.51, 4.5 26.40 ± 0.02, 51.6	David et al., 2018; Kumar et al., 2017; Duke 1983.
6.	<i>Vicia faba</i> L.	Seeds	<i>It is annual plant, stems are, hollow, and unbranched. Faba bean has tillers that grow from the basal nodes. The leaves are alternate, pinnately compound, The leaflets are round or oval. The inflorescence axillary racemes. Flowers papilionaceous. Flowers are large white or white with black/dark purple spots. The fruit is pod,</i>	Moisture (%) Protein (%) Carbohydrates (%) Fibre (%) Oil (%) Ash (%) Ca (mg/100g) - K (mg/100g) - Mg (mg/100g) Na (mg/100g) P (mg/100g) Fe (mg/100g)	18.13 (± 0.11), 26–33. 31.13 (± 0.06) 47.25 (± 0.29) 8.06 (± 0.22), 0.55–1.06. 1.76 (± 0.25) 3.67 (± 0.13), 3.41 392.03 (± 2.91 975.4 (± 1.76) 222.90 (± 1.74) 30.49 (± 1.59) 178.23 (± 1.99) 5.25 (± 0.29), 1.8 – 21.3	Ali et al., 2014; Alba et al., 2021.

7.	<i>Mucuna pruriens</i> (L.) DC	Seeds	<i>Mucuna pruriens</i> (L.) DC. is a vine. It is annual plant. trailing or climbing. The stems are slender and slightly pubescent. The leaves are trifoliate, alternate, romboid ovate. The inflorescence is axillary raceme that bears many white to dark purple flowers. seeds are glossy black to white or brownish in colour.	Moisture content (%) Carbohydrate (%) Crude fibre (%) Crude protein (%) Ash content (%) Crude fat (%) K Ca Mg Fe Zn	13.01 ± 0.14 53.47 ± 1.48, 525.6, 49.9-61. 3.92 ± 0.27, 51.6, 8.7-10.5. 29.19 ± 0.14, 314.4, 20.2-29.3 6.47 ± 0.24., 41.1., 3.3-5.5 3.12 ± 0.39, 67.3, 6.3-7.4 778.1-1846.0, 778.1-1846.0, 174.9-387.6, 10.8-15.0, 5.0 – 10.9	Alaye et al., 2020; Siddharaju et al., 1996; Vadivel et al., 2022.
8.	<i>Canavalia ensiformis</i> (L.) DC	Seeds	It is annual shrubby twinner. Stem-glabrous, Leaves trifoliate, ovate. Inflorescence axillary raceme, Flowers are deep pink. Papilionaceous. Fruit- a pod. Seeds white in colour.	Moisture (%) Total fat (%) Fibre (%) Ash (%) Total protein (%) Carbohydrate (%) Phospholipids (%)	12.5, 7.24, 83.3, 2.4, 5.5, 1.59, 1.2, 7.14, 3.98 2.8, 3.88 34.6, 25.31, 10.85 12.15 0.1	Arya et al., 2015; Solomon et al, 2018; Patel et al., 2016.
9.	<i>Rhynchosia minima</i> (Willd.) DC.	Seeds	This plant is subshrubs; branchlets glandular, pubescent. Leaves, trifoliate, ovate, acute, pubescent; Inflorescence: raceme. Flowers yellow; Stigmacapitate. Pod oblong, puberulus to glabrous; seeds 1 or 2.	Moisture (%) Crude protein (N * 6.25) (%) Carbohydrate (%) Crude Lipid (%) Dietary fibre (%) Ash (%) Calcium (mg 100g-1) Magnesium (mg 100g-1) Phosphorus (mg 100g-1) Zinc (mg 100g-1) Manganese (mg 100g-1) Iron	10.5 ± 0.52 12.8 ± 0.36, 14.28 – 19.40 60.29 – 72.51%. 3.3 ± 0.12, 3.28 – 4.41. 9.8 ± 0.38, 6.39 – 8.44. 2.4 ± 0.07, 2.80 – 3.50. 160.3 ± 0.78 160.5 ± 0.75 174.1 ± 0.32 4.1 ± 0.11 8.4 ± 0.13 6.2 ± 0.14	Arinathan et al., 2009; Kalidas et al., 2012.

10.	<i>Rhynchosia suaveolens</i> (L.f.) DC	Seeds (g/100g)	Annual undershrub. Stem apubescent, herbaceous. Leaves alternate, trifoliolate; Flower-cluster stalks arise in leaf-axils, 2-flowered. Flowers yellow; papilionaceous. Stamens are diadelphous; anthers uniform. Stigmaphyllon. Fruit is pod.	Moisture Crude protein (N * 6.25) Carbohydrate (%) Crude lipid Dietary fibre Ash Calcium (mg/100g) Magnesium (mg/100g) Phosphorus (mg/100g) Zinc (mg/100g) Manganese (mg/100g) Iron (mg/100g)	5.1 ± 0.11 14.8 ± 0.07, 14.28 – 19.40 60.29 – 72.51% 3.2 ± 0.13, 3.28 – 4.41 8.4 ± 0.17, 6.39 – 8.44. 4.1 ± 0.14, 2.80 – 3.50. 210.2 ± 0.30 94.3 ± 0.66 278.2 ± 0.21 3.5 ± 0.01 7.4 ± 0.11 5.3 ± 0.16	Arinathan et al., 2009; Kalidas et al., 2012.
11.	<i>Rhynchosia rufescens</i> (Willd.) DC.	Seed	It is shrub with trailing branches, glandular-hairy. Leaves are trifoliolate; ovate, pointed, rounded at base; leaf-stalk long; Flowers are in racemes; Fruit: pod	Moisture (%) Crude Protein (%) Crude lipid (%) Total dietary fibre (%) Ash (%) Na (mg/ 100 g) K (mg 100 g) Ca (mg 100 g) Mg (mg 100 g) Fe (mg 100 g)	5.10 ± 0.01 19.40 ± 0.01 4.41 ± 0.01 8.44 ± 0.03 64.25 34.14 ± 0.03 1849.30 ± 0.13 194.10 ± 0.98 178.36 ± 0.01 9.08 ± 0.01	Kalidas et al., 2012.
12.	<i>Canavalia rosea</i> (Sw.) DC.	Seeds	Herbaceous Vine plant along the beaches. Stem is Woody and branched. Leaves compound, semi succulent, rounded. Flowers purplish to pink in colour. Fruit is pod.	Seeds Moisture (%) Crude Carbohydrate (NFE) (%) Ash content (%) Crude fiber (%) Crude fat (Ether extract) (%) Crude protein (%) K (mg/100g) Ca (mg/100g) Mg (mg/100g) Fe (mg/100g) Zn (mg/100g)	13.94 ± 0.90, 12.24 34.07, 26.98 3.51 ± 0.01, 2.53 9.81 ± 1, 3.84 3.90 ± 0.8, 3.57 48.71 ± 1.02, 50.84 981 301 123 54 15 Leaf 11.06 40.60 8.45 3.99 5.31 30.59 789 468 98 43 13	Aswanthi et al., 2020; Tijani et al., 2019.

15.	<i>Acacia nilotica</i> (L.) Delile	Seeds	A medium-sized almost evergreen tree; Stem- erect, branched, solid, woody/gummy; Leaves- alternate, stipulate, thorns white, petiolate, compound, bipinnate and oblong, entire, uncostate reticulate., Inflorescence; cymose head; Flowers tiny, clustered together in bright-yellow, hypogynous; Corolla 4 or 5 petals; Fruit- a lomentum.	Moisture (%) Carbohydrate (%) Crude fat (%) Crude fibre (%) Crude protein (%) Ash (%) Na (mg / 100 g) K (mg / 100 g) Ca (mg / 100 g) Mg (mg / 100 g) Fe (mg / 100 g) Cu (mg / 100 g) Mn (mg / 100 g) Zn (mg / 100 g)	6.67 ± 0.12, 29.72 ± 0.10 23.33 ± 0.58, 13.6 ± 0.3, 24.77 6.53 ± 0.15, 30.5 30.95 ± 0.85, 21.4 2.80 ± 0.10, 11.67 958.00 ± 8.60, 25.0 ± 0.3 1168.00 ± 62.36, 110.0 ± 1.1 809.00 ± 49.27, 198.0 ± 1.8, 0.96 305.80 ± 81.16, 2.5 ± 0.1, 0.15 213.00 ± 9.50, 18.0 ± 0.3 30.33 ± 1.53, 0.3 ± 0.0 50.00 ± 1.00, 3.0 ± 0.2 148.00 ± 10.00, 2.4 ± 0.0	Mustaphal et al., 2017. Wati et al., 2017. Abbdalla et al., 2014.
16.	<i>Cyamopsis tetragonoloba</i> (L.) Taub.	Seeds	An annual herb, root system – tap root, Stem- erect, branched, hairy, Leaves- Compound, trifoliate, leaflets elliptic, acute. Flowers- purple, Small, papilionaceous. Fruit – pod, compressed.	Moisture (%) Protein (%) Carbohydrate (%) Ash (%) Fat (%) Fibre (%) Fe (ppm) Zn (ppm) Cu (ppm)	10.00, 4.8 - 8.7 33.25, 24.55 ± 0.94, 3.5-5.5 54.72 ± 1.32, 83.3-87.5 4.53, 3.59 ± 0.43., 0.5- 1.3 3.32., 3.06 ± 0.21. 0.5-0.9. 11.06, 9.78 ± 0.44, 1.4- 2.0 465.90 73.31 11.17	Badret al., 2014. Sharma et al., 2017. Murwan et al., 2012.
17.	<i>Bauhinia variegata</i> L.	Seeds	It is an tree, Stem- woody, erected, branched, cylindrical; Leaves- simple, alternate, rounded lobes, cordate base; Inflorescence- raceme, axillary. Flowers- least purple marked.; Fruit- pod.	Moisture (%) Protein (%) Carbohydrates (%) Fiber (%) Ash (%)	6.7 ± 0.46 41.9 ± 1.6 28.4 ± 1.6 6.9 ± 0.8 4.8 ± 0.1	Araïn et al., 2012.

18.	<i>Trigonella foenum-graceum</i> L.	Seed	An annual herb, stem- erect, herbaceous, aromatic, glabrous.; Leaves- compound, trifoliate, obovate-oblong, stipuled and lanceolated.; Flowers- white or purplish.; Fruit- pod.	Moisture (%) Protein (%) Fat (%) Carbohydrate (%) Ash (%) Fibre (%) Humidity (%)	10.91 ± 0.85, 25.4 2.74 ± 0.35, 27.50 6.33 ± 0.52, 4.50, 7.9 77.04 ± 0.63., 42.26 2.99 ± 0.48, 3.35, 3.38 6.55 4.90	Buba et al.,2015., Sara et al., 2018. Nasri et al., 2007.
19.	<i>Milletia pinnata</i> (L.) Pierre	Cake	It is an tree.; Stem- erect, branched, cylindrical, woody, glabrous.; Leaves – compound, imparipinnate, opposite, ovate – oblong, acute, entire.; Inflorescence- raceme, axillary.; Flowers- purplish. Fruit-pod, compressed.	Crude protein (%) Crude fibre (%) Lignin (%) Ash (%) Ca (mg/kg) P (mg/kg) Mn (mg/kg) K (mg/kg) Mg (mg/kg) Zn (mg/kg) Cu (mg/kg) Fe (mg/kg)	26.3 5.6 2.9 4.9 7 6.2 76 2.3 76 199 12 23	Kumar et al., 2007., Chandrasekaran et al., 1989., Gowda 2000
20.	<i>Senna tora</i> (L.) Roxb.	Leaves	An herb.; stem- erect, branched, subglabrous.; Leaves- paripinnately compound, obovate- oblong shape, more or less pubescence. Flowers – yellow, subsessile, Fruit- a pod.	Moisture (%) Crude fibre (%) Crude fat (%) Carbohydrate (%) Crude protein (%) Ash (%) Ca (mg/100g) Fe (mg/100g) Mg (mg/100g) Zn (mg/100g) Cu (mg/100g)	23 ± 0.52, 70.55., 12.82 + 0.15 54 ± 1.08, 27.07 + 0.10 6.01 ± 0.07., 4.24 2.02 + 0.82 69 ± 2.38, 9.78., 36.60 + 1.10 34 ± 1.16, 10.12., 11.63 + 0.20 15.01 ± 0.63, 14.63., 9.86 + 2.12 2.19, 3.52 + .40 16.45, 0.22 + 0.07 150.8, 0.86 + 0.12 3.4, 0.04 + 0.01 2.5,	Muhammad et al., 2018. Rathore et al.,2019. Kubmarawa et al.,2011.

malnourished children are in India. Half of the world's malnourished children reside in 3 countries: Bangladesh, India, and Pakistan (Jitendra Narayan *et al.* 2018).

According to the Global Hunger Index 2021, India ranks 101 out of 116 countries. The prevalence of malnourished children in India is nearly double and affects the mortality rate, productivity, and economic growth. (Klaus von Grebmer *et al.* 2021). Each year, nearly half of children in India are malnourished and almost a million children die before reaching one month of age. In India, 43% of children under 5 years are underweight and 48% are stunted, due to severe malnutrition (3 out of every 10 children are stunted). World population was growing at a 2 % annual rate from the sixties to the eighties. Since then, world population increased by 2.5 billion people to reach 7.7 billion worldwide in 2019. Population growth is and will remain a driver for food demand in the future, albeit at rates closer to 1 %. Still, it is not the sole driver, as per capita consumption has also been increasing at a rapid pace. The population is becoming one of the key factor for the increasing food insecurity. The demand for the food continuous along the population rate in the Urban areas.

Whole review was done about underutilized edible plant species of Fabaceae. It was found that most of them possess nutraceutical values when compared to the cultivated plants.

Conclusion

From the study it can be concluded that *Vigna umbellata*, *Vigna aconitifolia*, *Vigna angularis*, *Macrotyloma uniflorum*, *Sesbania grandiflora*, *Vicia faba*, *Mucuna pruriens*, *Canavalia ensiformis*, *Rhynchosia minima*, *Rhynchosia suaveolens*, *Rhynchosia rufescens*, *Canavalia rosea*, *Parkia roxburgii*, *Vigna unguiculata*, *Acacia nilotica*, *Cyamopsis tetragonoloba*, *Bauhinia variegata*, *Trigonella foenum – graecum*, *Millettia pinnata* and *Senna tora* are rich in protein, carbohydrate, crude fibre, crude fat, ash. These plants can give more nutrition to the human kind. Underutilized food crops are neglected as they are not so popularly known to the urban world. The present review is an effort to illustrate the nutritional values of underutilized plants of family Fabaceae in order to pave the way to undertake intensive researches on development of baby foods, energy drinks, health drinks etc. Moreover the above mentioned legume plants can be easily cultivated at large scale for further bioprospection investigations. This review throws light on nutritional contents of the plants which can be developed by food industries, agricultural, floristic and horticultural researches to produce more nutritious food that should be made affordable to the local population. Newer technology can also be developed to enhance nutritious values and can transfer technology to the local farmers directly generating revenue. We can recommend it for the further research work.

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