REVIEW ARTICLE

PROSPECTS OF VALUE ADDITION IN INDIGINIOUS FRUITS OF ASSAM –A MINI REVIEW

Sanchayeeta Gohain*, H. Mazumdar[1], M. Neog[2] and H.C. Bhattacharyya[2]

Krishi Vigyan Kendra, Tinsukia, Assam
[1]Krishi Vigyan Kendra, Baksa-781354, Assam
[2]Directorate of Extension Education, Assam Agricultural University, Jorhat-785013

Received-04.10.2021, Revised-22.10.2021, Accepted-29.10.2021

Abstract: The north eastern region of India, particularly Assam is one of the biodiversity hotspots and is considered as the centre of origin of certain crop species like citrus, banana etc. Many of the minor and indigenous fruits are found in Assam which grows wild and found also in homestead (Bari) garden. These fruits are nutritious, possesses medicinal and therapeutic properties. There are immense potentialities of preparation of high nutritive value products from these crops through processing and value addition. Among the different indigenous minor fruits viz., Kordoi (*Averrhoa carambola* Linn.), Outenga (*Dillenia indica* Linn.), Bhimkol (*Musa balbisiana* L), Rebabtenga (*Citrus grandis* L), Mirikatenga (*Parameria polyneura* Hk.f.), Amlakhi (*Phyllanthus emblica* Linn.), Kujithekera (*Garcinia cowa* Roxb.), Bael (*Aealemar melos* Correa), Roselle fruit (*Hibiscus sabdariffa* L.) . Borthekera (*Garcinia pedunculata* Roxb.), Jack fruit (*Artocarpus heterophyllus* Lam.),Jamun (*Syzygium cumini* Linn.(Skeels),Nagatenga (*Rhus semialata* Murr.)have high potential for value addition. These fruits are mostly consumed by the local people as fresh as well as processed products. 'Ready to serve' (RTS) beverages can easily be extracted from ripe fruits of Outenga, Kordoi, Bael. Jam, jelly, squash may be prepared from ripe fruits of Kordoi, Outenga, Kujithekera, Roselle ,Nagatenga, Bhimkol. Good quality pickles could be made available from Amlakhi, Kujithekera, Borthekera, Mirikatenga. Delicious juices could be prepared from Bael, Kordoi, Rebabtenga.. From ripe Jack fruit bulbs jackfruit toffee, lather and jam can be prepared as well as from the seeds of jackfruit; good quality flour can be prepared. Wines can also be prepared from ripe Jackfruit, Jamun and Roselle. Sweet candy may be prepared from Amlakhi, Kujithekera, Mirikatenga. Minimally processed ready-to-cook jack fruit can also be a business venture for the farmers. Thus, value addition in minor and indigenous fruits could be one of the appropriate options to enhance farmer's income in Assam.

Keywords: Minor, Indigenous, Fruits, Value Addition, Income

INTRODUCTION

The north eastern region of India particularly Assam has the potential for growing a large number of minor and indigenous fruit crops. Minor fruits are characterized by the fact that they are locally abundant, but restricted in their geographical dispersion with a high use value and they are widely adaptable to agro-ecological niches/marginal areas. Assam's economy since long is been mainly based on agriculture. 75 per cent of the population is directly or indirectly dependent on agriculture which accommodates 53 per cent of the total workforce of the state. Horticulture crops occupy about 15 per cent of the gross cultivated area of Assam. Minor and indigenous fruits plays a important role in maintaining livelihoods and nutritional security for many people in Assam. They also contribute to the diversity and the stability of agro-ecosystem.These fruits are rich in vitamins, minerals and dietary fibre and therefore, are an essential ingredient of a healthy diet. Although some fruits have already been recommended for commercial planting, it is apparent that there are a lot more fruit types that await future exploitation .With the increasing recognition of their food values in the human diet, these crops are gaining commercial importance. Value addition through food processing of these minor and indigenous fruits can help to generate gainful self-employment for small farmers and weaker sections of the rural society, and could be one of the easiest and low investing, yet promising alternative. There is great scope for processing and value addition to the underutilized fruits into various products like jam, jelly, preserve, candy, confectionery, pickle, fruit drinks, dried products etc

Prospects of value addition: The minor fruits are in general accepted as being rich in vitamins, minerals and dietary fibre and therefore, are an essential ingredient of a healthy diet. Apart from nutritive value, theses fruits are more important for medicinal purposes. There are immense prospects for preparation of high nutritive value products through processing and value addition. Assam has a long list of these minor fruits with high potential for processing. Value addition of these fruits is necessary as it ensures fair returns to the growers to improve their economic condition and also helps to mitigate the problem of underemployment during off-season in the agricultural sectors. Processing and value addition of these crops through scientific technology could be one of the promising aspect to enhance the production of the state.

*Corresponding Author

Table 1. A few minor and indigenous fruits of Assam

Local Name	Common Name	Botanical Name	Family
Poniol	Governers plum	*Flacourtia ramontchi* L' Herit	Flacourtiaceae
Leteku	Sapida	*Baccaurea sapida* Muell-Arg.	Euphorbiaceae
Kordoi	Carambola	*Averrhoa carambola* Linn	Oxalidaceae
MirikaTenga		*Parameria polyneura* Hook.f.	Apocynaceae
Naga-tenga		*Rhus semialata* Murr.	Anacardiaceae
Ou-tenga	Dillenia	*Dillenia indica* Linn	Dilleniaceae
Kuji-Thekera	Cowa	*Garcinia cowa* Roxb.	Guttifereae
Paramlakhi	Star Gooseberry	*Phyllanthus acidus* Skeels	Euphorbiaceae
Bogori	Ber	*Ziziphus mauritiana* Lam	Rhamnaceae
Thereju		*Prunus jenkinsii* Hook. f.	Rosaceae
Amlakhi	Aonla	*Emblica officinalis* Gaertn	Euphorbiaceae
Jalphai		*Elaeocarpus floribundus* Bl.	Elaeocarpaceae
Banpitha	Indian star apple	*Chrysophyllum roxburghii* G.Don.	Sapotaceae
Tepor-tenga	---	*Garcinia xanthomonus* Hook.f.	Guttifereae
Gulabjaman	Rose apple	*Syzigium jambos (*Linn)Alston	Myrtaceae
Atlas	Custard apple	*Annona squamosal* (Linn.)Alston.	Annonaceae
Kalajamun	Jamun	*Syzigium jambos (*Linn)Skeels	Guttifereae
Borthekera	--	*Garcinia pedunculata* Roxb.	Guttifereae
Rupohithekera	--	*Garcinia lanceaefolia* Roxb	Guttifereae
Nuni	Mulberry	*Morus australis* Pair	Moraceae
Amora	Indian hog plum	*Spondias pinnata* (Linn. f) Kurz	Anacardiaceae
Teteli	Tamarind	*Tamarmdus indica* Linn	Leguminoseae
Silikha	Chebulie myrobalan	*Terminalia chebula* Retz	Combractaceae
Bhomora	Beleric myrobalan	*Terminalia bellirica* Roxb	Combractaceae
Nara-bagari	Peach	*Prunus persica* Batch.	Rosaceae
Ahom-bagari	Plum	*Prunus domestica* Lion.	Rosaceae

Source : Neog & Mohan (1994)

Table 2. Bio-chemical properties of important minor and indigenous fruits of Assam

Fruits	Moisture (%)	Protein (g)	Fat (g)	Minerals	Fibre (g)	Carbohydrates (g)
Amlakhi	81.80	0.50	0.10	0.50	3.40	13.70
Bael	61.50	1.80	0.30	1.70	2.90	31.80
Jamun	83.70	0.70	0.30	0.40	0.90	14.00
Jack fruit	73.60	1.90	0.10	0.90	1.10	19.80
OuTenga	83.30	2.30	0.592	3.54	1.60	9.05
Kordoi	91.50	0.85	0.15	0.40	0.90	9.38
Kujithekera	92.91	2.43	0.27	1.75	10.34	55.84

Borthekera	89.30	4.65	0.27.	1.63	9.57	56.85
Roselle	12.81	7.51	0.46	11.24	11.10	69.62
Nagatenga	91.26	1.36	1.02	0.387	3.51	21.89

Source: Annon(2002),Gopalan *et al*. (1978), Gogoi (2007) , Firdusi, (2008).

Table 3. Physical properties of important minor and indigenous fruits

Name of fruit	Fruit length(cm)	Fruit Diameter (cm)	Fruit Wt(g)
Amlakhi	---	38.80 ± 2.18	31.80 ± 5.96
Bael	--	12.96	1120
Jamun	2.73±0.174	2.10±0.202	6.71
Jack fruit	40.4	32.35	7.12
Outanga	11.5	5–12	604.42
Kordoi	10.17	5.45	59.91
Kujithekera	10.59	----	170.55
Borthekera	11.94	8-12 cm	120.80
Roselle	4.84 ± 0.26	---	0.0355
Nagatenda	5.00	1.1-1.3	670 mg
RababTenga	11.05	11.40	575.00

Source: Annon(2002),Patel *et al* (2010), Gogoi (2007) , Firdusi, (2008).

Different Value Added Products

Jam

Jam is a product formulated from a minimum fruit content of 40% (30% for citric) and a final soluble solid content of 45^0 Brix. Among the various minor fruits, Jackfruit Jam is a promising product as Jackfruit is a good source of pectin and with its high fibre content,nutrient compositions and sensory attributes can successfully be used for the preparation of jam. Production of anola Jam is one ensuring business opportunity for the farmers to double the income which can be prepared by the method standardised by Goyal *et al* (2008) with an end point of 68.5 degreebrix. Fruit jam can be prepared from the ripe fruit pulp of Borthekera using sugar as a preservative, by volume reduction methods which has a self life up to 6 months (Biswas *et al*, 2017) . Production of Carambola Jam is one nutritious and beneficial venture for health serving as it is a good source of anti-oxidants, minerals and dietary fibre(Manalisa *et al* , 2014)

Squash

Squash is anon alcoholic concentrated syrup . Production of squash from ripe Borthekera fruits which is a condense form of the fruit juice can be a new initiative which can be used as cooling drink in warm weather and has the health benefit also (Biswas *et al* 2008).Bael fruit can be processed into a delicious squash with an ideal composition of 50 per cent extracted pulp, 50^0 Brixand 1 per cent acidity. The squash was chemically preserve by addition of 300 ppm SO_2 (Roy and Singh, 1979).Kordoi fruit can also be processed for preparation of squash. Production of Jackfruit squash is another venture which can be opted by the farmers with a formulation of 35% fruit pulp, 45 % TSS and 1.2 % acidity (Saxena *et al* 2013). Due to the high ascorbic acid content, Outenga can be utilized for the preparation of tangy squash. Nagatenga fruits can be processed for a tasty spicy squash which method was standardised by Firdusi, (2008). Ripe fruits of Kujithekera can be processed to develop fruit squash which can be stored up to 6 months. (Firdusi, 2008)

Read to Serve (RTS) Beverage

Jamun with its juicy fruit pulp which contains resin, gallic acid, tannin and anthocyanin can be processed into a RTS beverage, with 25 per cent juice, 18ºBrix and 0.6 per cent acidity(Khurdiya and Roy ,1985). For preparation of Jackfruit RTS beverages , a formulation of 16% fruit pulp, 14% TSS and .2% acidity was selected by Saxena *et al* .(2013) .Various blended RTS can be sucessellfully prepared from Bael fruit. RTS beverage from Bael and citrus fruit blend was preapared by Nagpal and Rajalakhimi(2009),RTS with Bael and termerind with Jaljira was optimized by Kenghe and Zambare (2009) . RTS beverages can also be prepared from Outenga fruit (Saikia and Dutta ,1995)

Fruit Juice

One important minor fruit which fruit juice can be commercialised is Beal due to the refreshing effect of the juice Jamun juice can also be popularised which has a high iron content as well as anthocyanin and others soluble constitutes by grating the fruit , heating upto 70% C and passing the heated mass through a basket press (Ramanjaneya, 1985) . Another minor fruit which juice has a high potential for commercialization is amlakhi fruit due to its high medicinal value and vitamin C content. Refreshing juice from RababTenga can be prepared by the method standardised by AAU. (Annon, 2002)

Candy

A fruit impregnated with sugar, removed, drained and dried is called as fruit candy. It should have maximum 75 per cent of total soluble solids. Aonla candy is a popular value added product prepared by dipping the fruits in 2 per cent salt solution for 24 hours. Thenfruits are washed and dipped in 2 per cent salt solution for 24 hours. The fruit are thoroughlywashed and blanched in boiling water for 5 minutesand steeped in 50 ºBrix syrup solution for 24 hours.The next day steeping is done in 60º Brix for 24hours. Again steeping is done in 70º Brix for 72hours. Excess syrup is drained. The fruit are driedto 15 per cent moisture content and coated with powdered sugar/pectin. Production of sweet candy from Borthekera, Kujithekera and MirikaTenga can be achieved with a pre-treatment with 2% lime solution and addition of .2% KMS and initial steeping in 500 Brix sugar syrup (Yumnam, 2013)

Pickles

The preservation of fruit or vegetables in common salt or vinegar is called pickling.A good value added product from Jackfruit is pickle where the tender fruits are selected . Other minor fruits like Nagatenga ,Kordoi, Amlokhi and Mirikatenga can also be processed for preparation of pickle. In case of Borthekera both salty and sweet pickle can be prepared where the product has a self life of 10 months and consumer acceptability of 9 and 8 respectively (Biswas *et al*, 2017). *Kujithekera* can also be processed to develop pickle (Firdusi , 2007)

Wine

The Jamun pulp contains significant amounts off fermentable sugar, which may be used for alcoholic fermentation (Chowdhury and Ray,2007) and hence preparation of red wine from Jamun can be an encouraging value added product with which has an alcohol content of 10.30%. Roselle can also be processed into production of red wine which has a high anthocyanin content (Kalita ,2005).Wine can also be prepared from other minor fruits like Bhimkol and jackfruit also which can be lucrative venture for the farmers.(Kalita , 2005)

Jelly

High quality rich coloured jelly can be prepared from jamun with addition of pectin or combining the jamun with the fruits that are significant sources of pectin like guavas(unripe or sour)(Barret,1928). Jelly can also be prepared from roselle fruit with the combination of Roselle extract 40% + sugar 60% + pectin 0.5% + citric acid 0.5%(Zaman, 2013). Due to the good pectin content(5.11%), rich jelly can be prepared from Kordoi fruit.

Powder

Bhimkol can be processed for production of Bananna Powder (8.1% moisture on fresh weight basis) can be used as a component in composite extruded product or as a mix for cereal or millet based breakfast product with a self life of 6 months under refrigerated condition. (Das *et al*, 2013). Banana power (Bhimkol) possess a good nutritive value and only supplementation of protein, essential for use in development of weaning food.(Mahanta ,1996) Dry fruit power can be prepared from Borthekera with an antioxidant activity 764.8 Ic value and self life of 9 months (Biswas *et al*)

Minimally processed product

A very good quality minimally processed ready-to-cook jack fruit product can be prepared from jack fruit by the method standardised by ICAR, Barapani which can be stored up to 6-8 months (Deka *et al*, 2006). The seeds of jackfruit can be effectively processed into flour which is almost identical to wheat flour with an excellent keeping quality and this low cost flour can be used in bakery industry (Firdusi , 2007)

Table 4. Biochemical quality of some value added products

Products	Reducing sugar (%)	TSS (%)	Protein (%)	Fat (%)	Carbohydrate (%)
Kujithekera Pickle	19.86	68.3	1.17	17.56	30.15
Kujithekera Candy	77.21	70.3	.77	.06	77.21
Kujithekera Squash	38.61	46.73	.38	.30	50.45
Banana Power	25.73		4.26	.092	
Nagatenga Spicy Squash	45.70	43.33	.39	.90	66.24

Source : Firdusi (2007)

CONCLUSION

Minor and indigenous fruits play an important role in maintaining livelihood and nutritional security for many people in developing countries and also help in closing food gaps during periods of drought or scarcity. Unfortunately indigenous underutilized wild fruitshave been given very little attention both in research and extension, though they arevery important in diet .The minor fruits has the natural advantages in terms of variation, production, nutrition and medicinal properties, but the area of value addition is not explored and untapped commercially till date. Emphasis should also be given in organised cultivation of the fruit trees as a large quantity of state's minor fruit production is limited to the Bari system. There is an ample scope for increasing this trend of value addition in minor fruits, which will open a new era in employment generation and increasing the farm income of the rural mass of the state

REFERENCES

Baruah, B. (2014). Processing and value addition of Jackfruit . *PhD Thesis*, submitted to Assam Agricultural University.

Barooah, N. (2006). Process development for production and quality evaluation of Banana powder. *PhD Thesis*, submitted to Assam Agricultural University.

Biswas, S. C., Hazarika, P., Dutta, N.B. and Sarmah, H. (2017). Few noval value added products prepared from fruits of *Garcinia pedunculata* Roxb.ex Buch-Ham. *Research Journal of Chemical sciences* **7**(3): 23-19.

Deka, B.C., Thirugnanavel, A., Patel, R.K., Nath, A. and Deshmukh, N. (2012). Horticultural diversity in North East India and its improvement for value addition. *Indian J. Genet*., **72**(2):157-167.

Das, P., Devi, R., Dutta, A.S., Boro, R.C. and Sarmah, T.C. (2015). Studies on nutritional components, antioxidant activities and microbial load in simple processed product developed from Banana (cv. Bhimkol). *Asian J. Che*. **28**(1):47-50.

Firdusi, N.S. (2008). Physico –biochemical characterization and value addition to selected minor fruits of Assam . *PhD Thesis*, submitted to Assam Agricultural University.

Annon (2002). Final report of Ad-hoc Scheme on preservation and processing of some important indigenous fruits of Northeast India with especial reference to Assam (1999-2002). Assam Agricultural University.

Gogoi, A.K. (2008). Minimal processing for short term preservation of jackfruit bulbs . *Masters Thesis* , submitted to Assam Agricultural University.

Gogoi, B. (2007). Morpho-biochemical characterization of *Garcinia* species of Assam. *PhD Thesis*, submitted to Assam Agricultural University

Gopalan, C., RamaSastri, B.V. and Balasubramanian, S.C. (1978). Nutritive value of Indian foods. National Institute of Nutrition, ICMR.

Goyal, R.K., Patil, R.T., Kingsley, A.R.P., Walia, H. and Kumar, P. (2008). Status of post harvest technology of Anola in India-a review . *American J. Food Techno*. **3**(1): 13-23.

Kalita, N. (2007). Technological assessment of the development process of wines from locally available horticultural crops of Assam . *PhD Thesis*, submitted to Assam Agricultural University.

Kotoky, U. (2000). Studies on growth, development, yield and quality of Banana cultivar Bhimkol and Athiakal. *PhD Thesis*, submitted to Assam Agricultural University.

Khurdiya, D.S. and Roy, S.K. (1985). Processing of jamun fruit into a ready to serve beverage. *J. Food Sci. Technol*. **22**(5): 27-30.

Kenghe, R.N. and Zambare, A.V. (2009). Effect of preservation on biochemical qualities of blended Bael RTS. BEV. Food World **36**(4): 51-52.

Monalisa, K., Islam, M. Z., Asif-Ul-Alam, S. M. and Hoque, M.M. (2014). Valorization and Storage Stability Assessment of Underutilized Fruit Carambola (Averrhoa carambola) in Bangladesh. *American J. Food Sci and Techn*. **2**(4):134-138.

Malakar, P. (2010). Dehydration of Banana blossom for preservation and development of ready to cook products . *Masters Thesis*, submitted to Assam Agricultural University.

Mahanta, P.K. (1996). Development of a banana (cv Bhimkol) based weaning food. *PhD Thesis* submitted to Assam Agricultural University.

Neog, M. and Mohan, N.K. (1994). Minor and less known fruits of Assam, *Indian Hort* , **39**:28-31.

Patel, R.K., De, L.C., Singh, A. and Deka, B.C. (2010). Lesser Known Edible Fruits of North Eastern India. *Underutilized and Underexploited Horticultural Crops*. 5: 163-173.

Phukan, P,T. and Das, P. (2017). Diversity of some minor fruits of North East India. *International J Agri and Environ Res*. **3**(1):2410-2416.

Ramanjaneya, K.H. (1985). Studies on some aspects of jamun (Syzygium cuminii skeels) and its processing. *PhD Thesis*, submitted to IARI, New Delhi.

Saikia, L. and Dutta, R. (1991). Studies on the Physico-chemical and organoleptic changes associate with fruit development of outenga *(Dillenia indica)*. Abstract ofpapers: IX Indian convention of Food Scientists and Technologists onApplication of Biotechnology in development of Food Processing Industries.15-17 May, 1991, Mysore.

Saikia, L. and Dutta, R. (1993). Effect of blanching on yield, composition and quality of outenga *(Dillenia indica)* fruit juice. Abstract of papers: 3rd International FoodConvention, 7-12 Sept., 1993, Mysore pp 175.

Saikia, L. and Dutta, R. (1995) Processing of Outenga *(Dillenia indica)* fruit for RTS beverages. *Indian Food packer*. 25-32.

Saikia, M. (2005). Wild edible fruits consumed by people of Upper Assam, NE India, *World J of Pharmaceutical Sciences*, 1138-1144.

Saxena, T.M., Saxena, A. and Raju, P.S. (2013). Development of value added products from Jackfruit (*Artocarpus heterophyllus* L.) for small and medium enterprises. *Indian Food Packer*, March –April: 95-104.

Yumnam, R. (2013). Value addition of some indigenous fruits through the preparation of preserve and candy. *Masters Thesis*, submitted to Assam agricultural University.

Zaman, U.H. (2013). Effect of storage on physicochemical, antioxidant and organoleptic properties of developed products from roselle calyces. *Masters Thesis*, submitted to Assam Agricultural University.