



POTENTIALS AND PROSPECTS OF WILD EDIBLE FRUITS IN CENTRAL INDIA

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ABSTRACT

Wild edible fruits play an important role in nutrition, medicinal and traditional lifestyles of the local people. The study was carried out in Central India reveals that there are 4 species of wild edible fruits which are available throughout the calendar year. This region is rich in its biodiversity and tribal communities who are dependent on wild resources for the sustenance. Most of the people are either engaged in livelihood through agriculture or forestry-related options. The economical condition of the people is also below the national level as reflected in per capita income. Wild edible fruits of this region are not only consumed but are also sold in local markets. Some value-added products are also prepared for off season sale but the majority of benefits go either to middleman or the businessman. Most of the collectors cited a number of problems in relation to the popularity of wild edible plants. Forest collector people are mostly having primary education level and have the least access to market demand and rate fluctuation information. There is need train the primary collectors for producing quality products out of the wild fruits at the same time there is need to study the nutritional aspect to design better foods for future.

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INTRODUCTION

The wild edible fruits which have multiple uses such as food additives and medicine, contribute significantly to the food security and livelihood improvement of local communities. South and Southeast Asia are home to more than 500 fruit species. Unfortunately, there is no authentic data regarding the production and trade of wild tropical fruits produced worldwide, about 90 percent is consumed domestically (Hegde 2016). NTFPs are sold in the lean season when agriculture labor demand is low. Fluctuation in the price of the fruit rind is quite rampant and the harvesters do not have any control over it. Poor knowledge about the non-destructive methods coupled with a lack of initiatives for value addition and the market has become a hurdle in regulating the situation. International Institute for Environment and Development (1995) noted in its report that many wild edibles are nutritionally rich and can supplement nutritional requirements, especially vitamins and micronutrients. There is much diversity of wild edible fruits in India the major work done by Jeeva (2009) explore the horticulture potential of edible fruits used by the Khasi tribes of Meghalaya he reported 151 species belonging to 49 families and 86 genera.

Rashingam (2012) conducted ethnobotanical studies on wild plants he listed 38 wild edible fruit species belonging to 24 families used by Irula tribes of Coimbatore district of Tamilnadu. Bramha *et al.* (2013) listed 32 species of wild fruits belonging to 23 families of used by Bodo tribes of Kokrajhar in Assam.

Not much of works in relation to the wild edible fruit plants of Madhya Pradesh is available; the earliest of the works was done by Grigson (1949), who wrote an ethnographic account of the Marias of Bastar, he mentioned only a few well-known edible plants. Elwin (1947) has referred to about a dozen native species eaten by Maria boys and girls. Roy and Rao (1957) wrote on the dietary habits of the Marias of Bastar. Jain (1963) described 32 species belonging to 19 families being used by Gond tribes of Bastar district. In another work on wild edible fruit plants of Chanda forest of Dindori district (Singh and Ahirwar 2015 a) described 22 species belonging to 17 plant families. We conducted the study on wild edible fruits of two districts of Bilaspur and Anuppur in Central India. The main aim of this study was to find out the wild edible fruits of this region as it is rich in forest wealth and also no studies on this aspect have been recorded.

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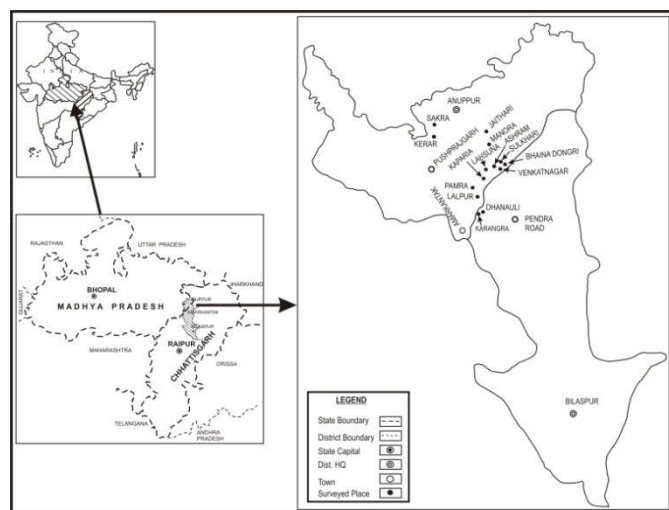


Figure 1 Study area for wild edible plants.

METHODOLOGY

The study area composed of 2 districts Anuppur in Madhya Pradesh and Bilaspur in Chhattisgarh. In Anuppur district 11 villages while in Bilaspur district 3 villages were consulted for study (Figure 1). All the study areas had a majority of people engaged in Agriculture and small business. A total of 67 people were interviewed which mainly comprised of farmers and businessman. A framed questionnaire was prepared for recording the response of the participant. Efforts were made to include most of the people engaged in either consumption or selling of these wild edible fruits. There are 7 local markets like Amarkantak, Anuppur, Dhanauli, Jaithari, Lalpur, Pendra road and Venkat Nagar where from the locals either purchased or sold these wild edible fruits. The quantum of fruit produced was weighed using a field balance to estimate the quantity sold. The per kilogram market rates of these value-added products were collected from the local collectors, middleman and sellers. After the documentation and economic assessment of the wild edible fruits a separate framed questionnaire was prepared to compare the same with the commercially sold fruits. This was done to assess the strengths and weakness of both the fruit sources i.e. wild and commercial ones.

DISCUSSION

Taxonomical diversity and season

There are 46 wild edible fruit plants are recorded in 36 genera and 25 families. Among these Moraceae was the largest family contributing 6 species, Rutaceae and Anacardiaceae contributing 4 species each. Myrtaceae, Solanaceae contributed 3 species each (Table 1). In respect of Madhya Pradesh Jain (1963) listed 33 wild edible fruit species belonging 26 genus and 19 families in Bastar district. Singh and Ahirwar (2015 a) listed 22 wild fruits belonging to 18 genus and 18 families in Chanda forest district Dindori. In Bandhavgarh National park documentation by Singh and Ahirwar (2015 b), listed 20 species of wild fruits belonging to 16 genus and 16 families. Shrivastava (1994) listed 10 wild edible fruits in their survey belonging to 10 genus and 9 families from Chhindwara district. In Chhattisgarh Neelam *et al.* (2016) describes 30 wild edible fruits species belonging to 21 genus with 18 families. Thakur and Bajpai (2011) documented 16 fruits species in respect to Ethnobotanical studies, it consists of 16 genus and 13 families.

Table 1 Diversity of wild edible fruit species with season

S.No	Species	Local name	Family	Season
1	<i>Annona squamosa</i>	Sitaphal	Annonaceae	Nov-Jan
2	<i>Bauhinia vahlii</i>	Mohlain	Fabaceae	Dec-Mar
3	<i>Bridelia retusa</i>	Kasai	Phyllanthaceae	Sep-Jan
4	<i>Buchanania lanzan</i>	Char	Anacardiaceae	Apr-Jun
5	<i>Careya arborea</i>	Kumbhi	Lecithidiaceae	Mar-May
6	<i>Carissa sapinarum</i>	Karonda	Apocynaceae	Jul-Sep
7	<i>Cissua vitifera</i>	Ban Angur	Vitaceae	Aug-Nov
8	<i>Citrus medica</i>	Atterra	Rutaceae	Dec-Mar
9	<i>Diospyros melanoxylon</i>	Tendu	Ebanaceae	Jan-Apr
10	<i>Ficus auriculata</i>	Ghui	Moraceae	Oct-Dec
11	<i>Ficus bengalensis</i>	Barr	Moraceae	Feb-Apr
12	<i>Ficus hispida</i>	Dumar	Moraceae	Nov-Jan
13	<i>Ficus semicordata</i>	Ghui Dumar	Moraceae	Mar-May
14	<i>Flacourtia indica</i>	Kakai	Salicaceae	Aug-Oct
15	<i>Ixora pavetta</i>	Ambrolla	Rubiaceae	Oct-Dec
16	<i>Lantana camara</i>	Barmasia	Verbenaceae	All year
17	<i>Opuntia stricta</i>	Nagfani	Cactaceae	Apr-May
18	<i>Passiflora foetida</i>	Karo Pani	Passifloraceae	Nov-Jan
19	<i>Phyllanthus emblica</i>	Aanwra	Phyllanthaceae	Dec-Feb
20	<i>Phoenix sylvestris</i>	Chindi	Arecaceae	Mar-May
21	<i>Psidium guajava</i>	Bihi	Myrtaceae	Jan-Mar
23	<i>Schleichera oleosa</i>	Kosum	Sapindaceae	Nov-Jan
24	<i>Semecarpus anacardium</i>	Bhelwa	Anacardiaceae	Jan-Apr
25	<i>Solanum nigrum</i>	Mukkaiyya	Solanaceae	All year
26	<i>Solanum virginianum</i>	Bhat Kattaiyya	Solanaceae	Jul-Aug
27	<i>Szygium cerasoides</i>	Chirai Jamun	Myrtaceae	Jun-Aug
28	<i>Szygium cumini</i>	Jamun	Myrtaceae	Jun-Aug
29	<i>Tamarindus indica</i>	Imli	Fabaceae	Dec-Mar
30	<i>Tetrastigma lanceolarum</i>	Dottey	Vitaceae	Jun-Aug
31	<i>Trapa natans</i>	Singhara	Lythraceae	Oct-Dec
32	<i>Ziziphus mauritina</i>	Boir	Rhamnaceae	Dec-Mar
33	<i>Mangifera sylvvestris</i>	Kinkini Aam	Anacardiaceae	Apr-Jun
34	<i>Ziziphus oenopia</i>	Jarwa Boir	Rhamnaceae	Nov-Jan
35	<i>Limonia acidissima</i>	Kaintha	Rutaceae	Nov-Jan
36	<i>Terminalia chebula</i>	Harra	Combretaceae	Oct-Jan
37	<i>Terminalia bellerica</i>	Baheda	Combretaceae	May-Jun
38	<i>Aegle marmelos</i>	Bel	Rutaceae	Jan-Apr
39	<i>Murraya koenigii</i>	Mitha neem	Meliaceae	May-Sep
40	<i>Artocarpus lakoocha</i>	Barher	Moraceae	May-Oct
41	<i>Glycosmis pentaphylla</i>	Labher	Rutaceae	Nov-Apr
42	<i>Mangifera indica</i>	Aam	Anacardiaceae	Apr-Jun
43	<i>Ficus racemosa</i>	Gular	Moraceae	Mar-Jul
44	<i>Neolamarkia cadamba</i>	Kadam	Rubiaceae	Oct-Mar
45	<i>Manilkara hexandra</i>	Khirmi	Sapotaceae	Apr-Jun
46	<i>Moringa oleifera</i>	Munga	Moringaceae	May-Oct

Fruiting season of these fruits vary with respect to time or month. November-December and October is the best month for fruiting. The fruiting, however, varies from species to species. The phenological characters, especially flowering and fruiting are the essential elements to understand ways of conservation measures for the particular species (Jeeva 2009). From recorded fruit species in the month of December 5 fruit plants like *Bauhinia vahlii*, *Phyllanthus emblica*, *Citrus medica*, *Tamarindus indica*, *Ziziphus mauritina* fruiting this month. And in the month of October plants like *Ficus auriculata*, *Ixora pavetta*, *Trapa natans*, *Terminalia chebula*, *Neolamarkia cadamba* are fruiting. 6 plants have the fruiting season in November. As far as the fruiting season is concerned 12.8% of plants produced fruits during November-January, followed by April-June 10.6%, December-March 8.5%. As far as seasons are concerned *Lantana camara* and *Solanum nigrum* were found throughout the year. The seasonal availability of wild fruits does have an effect to a certain extent, it is important to note that most of the fruits are available during winters and early spring. The flowering starts between January and March, in the case of the majority of the species, which accounted for about 52 per cent of the total plant species described. Maikhuri *et al.* 1994 reported the

seasonal availability of 13 species of wild edible fruits from Garhwal, India; however, none of the studies from Central India seems to be having any indications regarding the seasonality of the wild edible fruits.

Economic value

Among fruits species, *Buchanannia lanzan* and *Trapa natans* have a high market price 35-40 ₹ per kilogram then *Mangifera indica* (30-40 ₹ /kg), *Aegle marmelos* (20-25), *Szygium cumini* (25-30 ₹).fruit species like *Moringa oleifera* and *Semecarpus anacardium* have market price 2 -5 ₹ /kg. 5-10 ₹ for *Anona squamosa* and *Phoenix sylvestris*. Quantities of fruits vary from species. *Mangifera indica* have high quantity 50 ₹/ kg per season, *Anona squamosa* and *Trapa natans* have high selling quantity approximately 30-40 ₹/ kg per season, then *Tamarindus indica* has quantity 20-30 ₹/ kg per season. *Zizyphus mauritina* 30 ₹/ kg per season. *Psidium guajava* 20-30 ₹/ kg per season. Some species have less quantity like *Aegle marmelos*, *Terminalia belerica* have 5-6 ₹/kg per season. A total of 20 species were sold in markets out of 46 species (Table 2).

Table 2 Species sold with their markets rates and quantity produced.

S.No	Species	Market Price (Rs)	*Quantity (Kg)
1	<i>Aegle marmelos</i>	20 to 25	5 ± 0.61
2	<i>Annona squamosa</i>	5 to 10	35 ± 0.48
3	<i>Buchanannia lanzan</i>	35 to 40	19 ± 0.91
4	<i>Carissa spinarum</i>	10to 50	7 ± 0.90
5	<i>Citrus medica</i>	5 to 10	8 ± 0.99
6	<i>Diospyros melanoxylon</i>	15 to 20	15 ± 1.03
7	<i>Mangifera indica</i>	30 to 40	38 ± 0.93
8	<i>Moringa oleifera</i>	2 to 5	22 ± 2.06
9	<i>Phoenix sylvestris</i>	5 to 10	7 ± 2.06
10	<i>Phyllanthus emblica</i>	30 to 40	35 ± 2.73
11	<i>Psidium guajava</i>	15to20	22 ± 0.77
12	<i>Semecarpus anacardium</i>	2to 5	7 ± 1.45
13	<i>Szygium cerasoides</i>	15to20	7 ± 1.32
14	<i>Szygium cumini</i>	25 to 30	17 ± 1.00
15	<i>Tamarindus indica</i>	10 to 15	23 ± 1.32
16	<i>Terminalia bellirica</i>	5 to 10	5 ± 1.13
17	<i>Terminalia chebula</i>	10	9 ± 0.88
18	<i>Trapa natans</i>	35 to 40	36 ± 3.13
19	<i>Zizyphus mauritina</i>	20	30 ± 1.93
20	<i>Zizyphus oenopia</i>	10 to 15	7 ± 1.12

* Mean ± Standard deviation.

Some species like *Lantana camara*, *Solanum nigrum*, *Ixora pavetta*, *Neolamarkia cadamba* are not preferred by customers. In Mekal hill region a total of 20 species is sold in the local markets like Pendra Road, Anuppur, Amarkantak, Venkat Nagar, Jaithari. *Buchanania lanzan* and *Trapa natans* were the most economically valued fruits which fetched ₹ 35-40/kg to primary collectors, followed by *Phyllanthus emblica* and *Aegle marmelos* which were having rates of 30-40 ₹/kg. Plants like *Citrus medica* (₹ 2-5/kg) and *Semecarpus anacardium* 5-10 ₹ /kg economic returns to primary collectors. This is because of fact that these fruits are not very much preferred by customers. The most quantity of fruits collected were *Mangifera indica* (38 ± 0.93 kg), followed by *Moringa oleifera* (22 ± 2.06 kg), *Phyllanthus emblica* (35 ± 2.73 kg), *Trapa natans* (36 ± 3.13 kg), *Tamarindus indica* (23 ± 1.32 kg) and *Zizyphus mauritina* (30 30 ± 1.93 kg). Jain (1963) reported *Diospyros melonxylon* were sold in weekly markets, in March 1963 their rate at Jagdalpur was 6 paise for about 20 fruits. *Semecarpus anacardium* was sold at 50 paise for 1 kilogram.

Value addition

A total of 14 species according to the local people were having additional values like medicines, pickles, chutney, oil etc. The most valuable species were *Mangifera indica* and *Phyllanthus emblica* which were dried and used as pickles as well as medicines (Table 3).

Table 3 Species with their value addition by the locals.

S.No	Species	Oil	Medicine	Pickle	Chutney	Dried
1	<i>Aegle marmelos</i>	-	√	-	-	-
2	<i>Anona squamosa</i>	-	√	-	-	-
3	<i>Buchannia lanzan</i>	-	-	-	-	√
4	<i>Carissa spinarum</i>	-	-	√	√	-
5	<i>Citrus medica</i>	-	-	√	-	√
6	<i>Emblca officalis</i>	√	√	√	-	√
7	<i>Mangifera indica</i>	-	-	√	√	√
8	<i>Schleichera oleosa</i>	√	-	-	-	-
9	<i>Semecarpus anacardium</i>	√	-	-	-	√
10	<i>Szygium cumini</i>	-	√	-	-	-
11	<i>Tamarindus indica</i>	-	-	√	√	√
12	<i>Terminalia belerica</i>	-	√	-	-	√
13	<i>Terminalia chebula</i>	-	√	-	-	√
14	<i>Zizyphus mauritina</i>	-	-	√	-	√

-Absent √ Present

In a study by Yogendra Thakur (2011) reported that *Ficus hispida* was used as a pickle, *Coccinea grandis* as a vegetable, *Momordica dioca* and *Solanum incanum* as vegetable. There were 6 plant species having medicinal values followed by 6 species were used as pickles, 8 species were dried for future use. 3 species (*Terminalia chebula*, *Terminalia bellirica* and *Phyllanthus emblica*) were powdered and 2 were used as oil production. *Mangifera indica* dried and powdered and used them as souring agent whilst *Terminalia chebula* and *Terminalia belrica* were powdered mainly for the digestive purpose. *Buchanania lanzan* oil is used during festivals while *Semecarpus anacardium* is used by locals in cracked healing and ringworm infection. *Ficus racemosa* used as Antidiuretic, *Psidium guajava* is used in the treatment of Diarrhea, and *Szygium cumini* is used in Toothache (Sathyavati and Janardhanan 2011). *Terminalia bellirica* have many uses in treatment of diseases, the seed of this eaten by the local people for curing gastric problems and stomach disorders Tapan seal (2011). The fruits of this plant are used in piles, dropsy, leprosy, biliousness, dyspepsia and headache (Chopra *et al.*, 2006). *Ficus hispida* the fruits are recommended in the treatment of jaundice (Dhore *et al.*, 2012). The fruits of *Zizyphus mauritiana* used for candy making (Sankaran *et al.*2006). A mixture of jamun juice and mango juice in equal quantity is very good for quenching thirst for diabetic patients. The powdered seeds have reputation for being useful in the treatment of diabetes. The major unsaturated fatty acid found in Mahua (*Madhuca indica*) oil is linoleic acid, which has therapeutic use in reducing blood cholesterol thereby making it especially useful for heart patients. Oil obtained from *Madhuca indica* is also reported to be used as toilet soap, grease for machinery and candles. A separate study by Thakur and Bajpai (2011) reported *Agele marmelos* for fruit juice and cooling agent, *Cordia dichotoma* for vegetable and pickles, *Mordia tinctoria* used in fever and muscular pain. Maikhuri *et al.* 1994 reported cost-benefit analysis of wild edible plants when they are sold as marketable products such as jam, sauce, juice; it was found that *Hippophae rhamnoides* had highest monetary return followed by *Rubus ellipticus*. There are 13 species from which value added products are made like

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pickles, oil, medicines, chutney and dried. In our study we found *Emblica officinalis*, *Mangifera indica* and *Tamarindus indica* tick the most number of boxes when viewed in relation to value addition.

Marketability of value added products

Out of 14 species considered for value addition, 12 species were having products those are sold in local markets. 5 products were sold out of these 12 wild edible fruits namely dried fruit, dried powder, dried seed, marmalade, and pickle. (Table No. 3 & 4). Value added products of species like *Aegle marmelos*, *Emblica officinalis*, *Terminalia bellirica* and *Terminalia chebula* were also important due to their medicinal properties. 3 species were economically less preferred those are *Mangifera indica*, *Emblica officinalis* and *Zizyphus mauritina* fetched the least price for primary collectors probably due to their high production. Dried seed of *Buchanania lanzan* have highest market price 950 ± 50 ₹/kg but again a primary collector gets only 156.67 ± 40.41 ₹/kg (16.67%). In the case of *Aegle marmelos* forest collector rate is 80 ± 17.2 ₹/kg (16.39%); while middle man rate is 130 ± 10 ₹/kg and that of market price are 493.34 ± 11.54 ₹ /kg (26.38%). On an average the primary collectors get only 15.87% while the middleman gets 66.67% share of the market price. These products are continuously sold in the market at good price but primary collectors are not getting much benefit than middleman and businessman.

Emblica was most valuable in view of medicine, taste, and health. While jamun and guava were mainly used for taste. Harra is used for both health and medicine. It is also dried for future use. Jujube and custard also have good taste. Shumsky *et al.* 2014 described 6 motivational factors for preference of wild edible plants like fun, taste, hunger, vitamin, medicinal and vegetable he cited most significant motivational factors were fun, hunger, and vegetable value at 99.9 % CI. 6 reasons for non-promotion of wild edible fruit plant species like quantity produced, price, seasonality, storage problems, value addition and support for the farmers were identified.

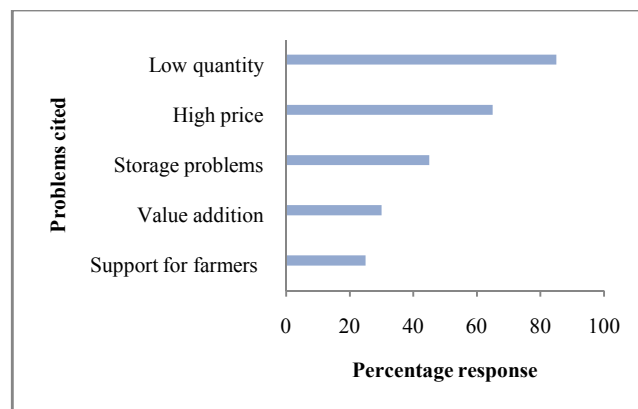


Figure 3 Cited reasons for non promotion of wild edible fruits

Table 4 Value added products sale profit margins

S.No.	Fruit (Item)	Forest collector rate (Rs)	Middleman rate (Rs)	Market rate (Rs)
1	<i>Aegle marmelos</i> (Marmalade)	80 ± 17.32	130 ± 10	493.34 ± 11.54
2	<i>Buchanania lanzan</i> (Dried seed)	156.67 ± 40.41	850 ± 50	950 ± 50
3	<i>Carissa spinarum</i> (Pickle)	76.66 ± 5.7	263.33 ± 15.2	346.66 ± 5.7
4	<i>Emblica officinalis</i> (Dried powder)	35 ± 8.6	316 ± 15.2	466.66 ± 57.73
5	<i>Emblica officinalis</i> (Marmalade)	31.66 ± 7.6	280 ± 20	176.6 ± 25.16
6	<i>Mangifera indica</i> (Pickle)	23.33 ± 5.7	63.33 ± 15.2	143.33 ± 20.81
7	<i>Mangifera indica</i> (Dried powder)	80 ± 10	130 ± 10	170 ± 20
8	<i>Semecarpus anacardium</i> (Dried fruit)	30 ± 5	75 ± 6.72	343.33 ± 20.18
9	<i>Tamarindus indica</i> (Dried fruit)	66.66 ± 5.7	103.33 ± 23.09	113.33 ± 11.54
10	<i>Terminalia belerica</i> (Dried powder)	33.33 ± 5.7	176.66 ± 25.16	343.33 ± 40.4
11	<i>Terminalia chebula</i> (Dried powder)	36.66 ± 11.55	163.33 ± 15.27	323.33 ± 25.16
12	<i>Zizyphus mauritina</i> (Dried powder)	30 ± 5	163.33 ± 15.27	250 ± 50

Comparison with commercial fruits

Commercially available fruits like Banana, Grapes, Pomegranate, Mango and Apple mainly included in the survey. Apple is used continuously by 95% customers, followed by banana 90%, pomegranate 55% and grapes 30% (Figure 2). 6 fruit species like custard, jujube, emblica, jamun, guava and harra was included for their value additions. Different value addition parameters like health, medicine, taste and non-polluted.

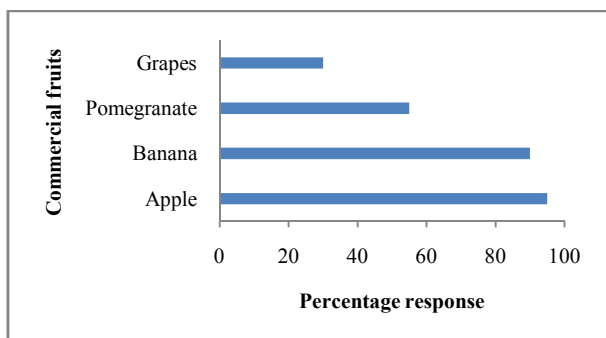


Figure 2 Preference for commercial fruits as per respondents.

The response in each category analysis shows that 85% people felt that both quantity produced is low and these fruits were not available throughout the year. 65% people felt that it was price of these fruits, while 45% people opined of storage problems, 30% felt that there is a need for value addition of these products while 25% told that there is a need for supporting the farmers (Figure 3).

Hence it could be said that seasonality coupled with their availability perhaps limits their popularity as compared to wild fruits.

CONCLUSION

In this part of central India, nature and biodiversity is intact and is richly supplemented by the indigenous culture. Forestry plays an important role in life and livelihood of the local communities here. Wild edible fruits play an important role in food and economic aspects of poor villagers and farmers. Out of 20 species 50% are being commercially sold like *Anona squamosa*, *Buchanania lanzan*, *Diospyros melanoxylon*, *Moringa oleifera*, *Phyllanthus emblica*, *Psidium guajava*, *Zygiium cumini*, *Tamarindus indica*, *Trapa natans* and

Zizyphus mauritania. About 14 species of wild edible plants are considered for value addition as oil, medicine, pickle, chutney and dried. Banana and Apples were most preferred commercial fruits as they were available throughout the year in markets. People cited 5 problems for non promotion of wild edible fruits and prominent among low quantity, high price, storage problems and value addition. 10 value added products were found to be sold commercially in local markets however it is also found that the primary collectors are getting fewer prices than the middle man and market rates. Therefore there is need to encourage primary collector and also provide them technical know how to prepare better products. Previous works on wild edible fruits are confined only to the listing of these species and no works on economic values were addressed. Wild fruits are also very important in view of health perspective, wild fruits are rich in essential nutrients and free from the harmful chemicals. It is necessary to identify the problems and prospects of these plants as this play an important role in nutrition and economy of poor communities living around forest areas.

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