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### Assessment of physicochemical properties of minor fruits (aonla, bael, ber, jackfruit and kaitha)

**Anil Kumar, Pratibha Singh and Mahesh Singh**

**Abstract**

Physicochemical and nutritive evaluation of five minor fruit germplasms/varieties i.e Aonla (NA<sub>6</sub> and NA<sub>7</sub>), Bael (NB<sub>5</sub> and NB<sub>9</sub>), Ber (Karaka and Umran), Jackfruit (NJ<sub>2</sub> and NJ<sub>3</sub>) and Kaitha (K<sub>1</sub> and K<sub>2</sub>) resulted a slight variation within two varieties of each fruit pertaining to size of fruit, peel/shell per cent and pulp per cent. Specific gravity was higher in Ber-U (Ber- Umran) (0.99%) followed by Ber- K (Ber-Karaka), K<sub>1</sub>, K<sub>2</sub> and NA<sub>7</sub> (0.98%). Minimum specific gravity was recorded in NJ<sub>2</sub> (0.46%). Biochemical investigation of minor fruits, resulted a slight variation within two germplasms/varieties of each fruit pertaining to total mineral content, protein content and crude fibre. Total mineral content was higher in NB<sub>5</sub> (1.73 g/100g) followed by NB<sub>9</sub> (1.71 g/100g) and minimum total mineral content were noticed in K<sub>1</sub>. Protein and crude fibre was maximum in K<sub>2</sub> (6.92 g/100g) and NB<sub>5</sub> (6.38 g/100g). Lowest protein and crude fibre content were found in NA<sub>6</sub> (0.53 g/100g) and NA<sub>7</sub> (1.20 g/100g). On the whole germplasms/varieties Aonla (NA<sub>6</sub> and NA<sub>7</sub>), Bael (NB<sub>5</sub> and NB<sub>9</sub>), Ber (Karaka and Umran), Jackfruit (NJ<sub>2</sub> and NJ<sub>3</sub>) and Kaitha (K<sub>1</sub> and K<sub>2</sub>) were found best in terms of qualitative as well as physicochemical and nutritive evaluation.

**Keywords:** Minor fruits, size of fruit, peel/shell, pulp, specific gravity, total mineral, protein and crude fibre.

**Introduction**

India is the second largest producer of fruits in the world nearly covers 6.36 million hectares of area with a total production of over 88.82 million metric tonnes with productivity of 13.97 tonnes/ha. In Uttar Pradesh it is grown on 0.46 million hectares with production of 8.54 million metric tonnes, under fruit crops ranks first in terms of area, but production-wise it ranks third (Horticultural Statistics at a Glance, 2015-16) [9].

There are several fruits taken by human as its nutritional importance but several fruits are present in nature which are also nutritionally important and superior in quality but are rarely used by human because people are not aware of its nutritional importance, these fruits are known as minor fruits viz., Ber, Bael, Aonla, Kaitha, Jackfruit, Karonda, Imli etc. The around 72 to 73 per cent Bael pulp could be extracted, fruit weight ranged from 455 to 2010 g. The fruit colour varied from greenish to yellowish with yellow colour pulp. The average specific gravity and sphericity was 0.97 and 0.96 respectively (Kenghe and Potdar 2009) [12]. All ber varieties differed significantly on the basis of their physical analysis. Foladi was observed as one of the superior variety in terms of fruit size (13.29 cm<sup>2</sup>), fruit weight (36.99 g), stone size (2.09 cm<sup>2</sup>) and stone weight (2.31 g). However, maximum flesh ratio (10.59%) was in Gorh variety. Gorh was superior in terms of vitamin-C (176.45 mg/100g), protein (3.13%) and TSS (24.01%). The highest reducing sugars (5.64%) were observed in Khobani. Dehli White excelled in nonreducing sugars (6.12%) (Abbas *et al.* 2012) [11]. Fresh aonla fruits of cv. Chakaiya had fruit length (3.27 cm), fruit diameter (4.00 cm), fruit weight (37.27 g), pulp weight (33.11 g) and seed weight (4.16 g). Moisture, TSS, total sugars, reducing sugars, acidity, ascorbic acid, pectin, tannin, crude fibre, pH and browning were recorded as 86.50 per cent, 10.10 per cent, 8.53 per cent, 5.14 per cent, 1.85 per cent, 662 mg/100g, 1.93 per cent, 2.93 per cent, 3.07 per cent, 2.90 and 0.063, respectively (Daisy and Singh 2007) [4]. Physicochemical analysis of wood apple (Kaitha) revealed that the average fruit weight ranged from 140.08 to 256.65 g, fruit length and width from 6.50 to 8.40 cm and 6.16 to 7.43 cm respectively, specific gravity from 1.04 to 1.74, and pulp weight from 60.33 to 176.00 g, Total soluble solids ranged from 12.45 to 14.67<sup>0</sup> Brix, ascorbic acid from 4.87 to 6.26 mg (per

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100g), reducing from 2.70 to 3.11%, non-reducing sugar from 4.90 to 6.79% and total sugar from 7.60 to 9.74%. (Pandey *et al.* 2013) [16].

### Materials and Methods

In the course of present investigation entitled "Assessment of physicochemical properties of minor fruits (Aonla, Bael, Ber, Jackfruit and Kaitha)". The experiment was carried out in Student's Instructional Farm and Research Laboratory of the Department of Biochemistry, N.D. University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P) India. Five minor fruits germplasms/varieties namely Aonla (NA<sub>6</sub> and NA<sub>7</sub>), Bael (NB<sub>5</sub> and NB<sub>9</sub>), Ber (Karak and Umran), Jackfruit (NJ<sub>2</sub> and NJ<sub>3</sub>) and Kaitha (K<sub>1</sub> and K<sub>2</sub>) were collected from Horticulture Nursery, N.D.U.A.&T, Kumarganj, Faizabad. The samples were used for the physicochemical observations, the size of fruits were recorded from scale in cm.

The delicate peel may be removed with forceps or one may scrap it if possible. Lye peeling method may also be used. However peel weight should be taken immediately after its removal so as to avoid moisture loss. Peel per cent is expressed as weight of peels obtained on the fresh weight basis as gm per 100 gm fruit.

The pulp was calculated by deducting the weight of seed, peel and fibre from the total weight of the fruit, per cent pulp was obtained in relation to the total weight of the fruit.

Specific gravity of fruits were determined by water displacement method. Specific gravity was calculated by the following formula.

$$\text{sp. g} = \frac{\text{weight(g)}}{\text{vol (ml)}}$$

Total mineral content in fruit was estimated with the help by Hart and Fisher method (1971) [8]. Two gm oven dried sample was transferred into ash filter paper. The ignition of sample was carried out on non-luminous flame in pre weighted silica crucible to volatilize as much of the organic matter until no more smoke is given out by material. The crucible was placed into a muffle furnace maintained at 525-550 °C for about 5-6 hours to destroy the organic matter. After expiry of the period the crucible was transferred into dessicator for cooling to avoid adsorption of moisture by sample ash. The cold ash along with silica crucible was weighed and the result was calculated and reported on moisture free basis.

$$\text{Total Mineral Content (\%)} = \frac{\text{wt. of ash}}{\text{wt. of sample}} \times 100$$

Weight of ash = weight of silica crucible + sample - weight of crucible + ash

or

$$W = W_2 - W_1$$

Protein content was determined by Lowery's method (1951) [13] which depends, on the quantitative colour obtained from the reaction of protein with folincioalcau,s reagent. The colour thus obtained was due to reaction of alkaline copper reagent with protein and reduction of phosphomolybdeic and phosphotungstic acid by tyrosine and tryptophan present in protein and results were express as g /100 g.

The Crude fibre content in fruits was analysed by method as described by "Hart and Fisher (1971)" and result was recorded in g/100 g. The percentage of crude fibre present in the sample was calculated by formula given below:

$$\text{Crude Fibre (\%)} = \frac{w_1 - w_2}{w_3} \times 100$$

where

w<sub>1</sub>= weight of gooch crucible + sample

w<sub>2</sub>= weight gooch crucible +sample after removing from oven.

w<sub>3</sub>= weight of sample

### Results and Discussion

The data regarding to the size and peel per cent of fruits were given in Table 1 and 2. The range of variability in selected two varieties of five fruits viz. Aonla (NA<sub>6</sub> and NA<sub>7</sub>), Bael (NB<sub>5</sub> and NB<sub>9</sub>), Ber (Karak and Umran), Jackfruit (NJ<sub>2</sub> and NJ<sub>3</sub>) and Kaitha (K<sub>1</sub> and K<sub>2</sub>) were found non-significant variations in terms of length, diameter and peel per cent. The variations were recorded having 3.21 to 3.51cm. (length) and 3.88 to 4.01 (breadth) and peel content was not found in Aonla fruit, 9.03 to 10.56cm. (length) and 10.74 to 11.05 cm. (breadth) and 20.32 to 20.51 per cent (shell) for Bael fruit, 4.28 to 4.31 cm. (length) and 2.21 to 3.18 cm. (breadth), and 5.95 to 6.11 per cent (peel) for Ber fruit, 34.10 to 35.14 cm. (length) and 18.98 to 19.95 cm. (breadth) and 50.30 to 50.52 per cent (peel) for jackfruit, 6.57 to 7.56cm. (length) and 5.96 to 6.98 cm. (breadth) and 17.11 to 17.54 per cent (shell) for Kaitha fruit, respectively. Similar results were witnessed by Ram (1996) in two varieties of Bael (NB<sub>5</sub> and NB<sub>9</sub>). Kaushik *et al.* (2000) [11] also supported in Ber fruit regarding length in case of Umran variety which varied from 2.0 cm. to 5.4 cm. Similar results were found Pathak and Chakraborty (2006) [17] in jackfruit. The Aonla fruits had fruit length (3.27 cm) and fruit diameter (4.00 cm) respectively (Daisy and Singh 2007) [4] and peel content was absent in aonla by Dwivedi *et al.* (2015) [6]. The average of Kaitha fruit length and width from 6.50 to 8.40 cm and 6.16 to 7.43 cm respectively (Pandey *et al.* 2013) [16]. Variability in physical composition may possibly due to differences in variety, climatic conditions and locations.

**Table 2:** Size of minor fruit germplasms/varieties

Germplasms	2013-14		2014-15	
	Size of fruit		Size of fruit	
	Length(cm)	Breadth(cm)	Length(cm)	Breadth(cm)
NA-6	3.58	4.01	3.61	4.03
NA-7	3.21	3.88	3.23	3.91
NB-5	9.03	10.74	9.05	10.76
NB-9	10.56	11.05	10.58	11.07
BER-K	4.28	3.18	4.27	3.19
BER-U	4.31	2.21	4.33	2.22
K-1	6.57	5.96	6.56	5.94
K-2	7.56	6.98	7.55	6.97
NJ-2	34.10	18.98	34.12	18.96
NJ-3	35.14	19.95	35.15	19.94

The data containing to the pulp per cent of minor fruits viz. Aonla, Bael, Ber, Jackfruit and Kaitha were given in Table 2 were resulted a slight variation within two varieties of each fruit. The range of variability in selected two varieties of five fruit viz. Aonla (NA<sub>6</sub> and NA<sub>7</sub>), Bael (NB<sub>5</sub> and NB<sub>9</sub>), Ber (Karaka and Umran), Jackfruit (NJ<sub>2</sub> and NJ<sub>3</sub>) and Kaitha (K<sub>1</sub> and K<sub>2</sub>) were found non-significant variations in respect of pulp per cent. The variations were recorded ranging from 90.78 to 91.81 per cent (Aonla), 65.12 to 68.79 per cent (Bael), 28.96 to 30.92 per cent (Ber), 32.48 to 33.40 per cent

(Jackfruit), 47.66 to 50.10 per cent (Kaitha). Mehta *et al.* (2002) [15] recorded the pulp content (95.44%) in four aonla cultivars. Yadav *et al.* (2005) [25] reported the pulp weight (24.59 g) in some ber cultivars. Ram (1996) observed that NB<sub>5</sub> was higher pulp per cent as compared to NB<sub>9</sub>. Chopra *et al.* (2003) [3] reported 46.64 per cent pulp found in wood apple and also noticed pulp content 60.33 to 176.00 g/100g in Kaitha by Pandey *et al.* (2013) [16]. Jagadeesh *et al.* (2010) [10] evaluated the flake mass (74.79%), bulb mass (71.17%) and single bulb mass (50.11%) in jackfruit cultivars.

**Table 2:** Shell/peel and Flesh/pulp content of minor fruit germplasms/varieties

Germplasms	2013-14		2014-15	
	Shell/peel (%)	Flesh/pulp (%)	Shell/peel (%)	Flesh/pulp (%)
NA-6	-	90.78	-	90.81
NA-7	-	91.81	-	92.90
NB-5	20.32	68.79	20.31	68.82
NB-9	20.51	65.12	20.50	65.14
BER-K	6.11	28.96	6.09	29.16
BER-U	5.95	30.92	5.95	31.92
K-1	17.11	47.66	17.12	47.67
K-2	17.54	50.10	17.53	50.12
NJ-2	50.30	32.48	50.30	32.47
NJ-3	52.22	33.40	52.23	33.41
C D at 5%	0.02	0.02	0.02	0.02

The data pertaining to specific gravity of minor fruits viz. Aonla, Bael, Ber, Jackfruit and Kaitha were given in Table 3 and resulted a slight variation within two varieties of each fruit. The range of variability in selected two varieties of five fruit viz. Aonla (NA<sub>6</sub> and NA<sub>7</sub>), Bael (NB<sub>5</sub> and NB<sub>9</sub>), Ber (Karaka and Umran), Jackfruit (NJ<sub>2</sub> and NJ<sub>3</sub>) and Kaitha (K<sub>1</sub> and K<sub>2</sub>) were found non-significant variations in respect of specific gravity. The variations in terms of specific gravity in five different fruits were recorded i.e. 0.97 to 0.98 per cent (Aonla), 0.94 to 0.95 per cent (Bael), 0.98 to 0.99 per cent (Ber), 0.46 to 0.47 per cent (Jackfruit) and 0.98 per cent in (Kaitha). Singh and Singh (2015) [22] observed 1.02 to 1.03 per cent specific gravity in aonla fruit. Specific gravity from 1.04 to 1.74 was reported by (Pandey *et al.* 2013) [16] in respect of Kaitha fruits. Marimuthu and Thirumaran (2003) [14] reported 0.99 to 1.03 per cent specific gravity in Ber fruit. The timer is of light weight and specific gravity 0.46 at green condition in jackfruit (Ali *et al.* 2012) [2]. Variability in physical composition may possibly due to differences in variety, climatic conditions and locations. Specific gravity in fruit was witnessed inverse proportional to volume as the volume decreases due to loss of moisture content during storage however, specific gravity increases.

**Table 3:** Specific gravity (%) of minor fruit germplasms/varieties

Germplasms	2013-14	2014-15
NA-6	0.97	0.98
NA-7	0.98	0.98
NB-5	0.94	0.96
NB-9	0.95	0.95
BER-K	0.98	0.99
BER-U	0.99	1.05
K-1	0.98	1.03
K-2	0.98	0.98
NJ-2	0.46	0.46
NJ-3	0.47	0.47
C D at 5%	0.02	0.03

The data pertaining to minerals content of minor fruits viz. Aonla, Bael, Ber, Jackfruit and Kaitha were given in Table 4

were resulted a slight variation within two varieties of each fruit pertaining to mineral content. The range of variability in selected two varieties of five fruit viz. Aonla (NA<sub>6</sub> and NA<sub>7</sub>), Bael (NB<sub>5</sub> and NB<sub>9</sub>), Ber (Karaka and Umran), Jackfruit (NJ<sub>2</sub> and NJ<sub>3</sub>) and Kaitha (K<sub>1</sub> and K<sub>2</sub>) were found significant variations in mineral content. The variations were recorded from 0.80 to 0.90 g/100g (Aonla), 1.71 to 1.73 g/100g (Bael), 0.69 to 0.75 g/100g (Ber), 0.87 to 0.90 g/100g (Jackfruit), 0.39 to 0.40 g/100g (Kaitha). Similar findings were reported by Gopalan and Rama (1993) [7] that Bael fruit contain 1.7 g/100g minerals. Sood *et al.* (1980) [23] found 0.34-0.72 g/100g mineral content in seven commercial varieties of jujube fruit. Dasaraju and Gottumukla (2014) [5] reported that (0.70%) mineral content in aonla fruit.

**Table 4:** Total mineral content of minor fruit germplasms/varieties

Germplasms	2013-14	2014-15
	Total mineral (g/100g)	Total mineral (g/100g)
NA-6	0.80	0.84
NA-7	0.90	0.91
NB-5	1.73	1.75
NB-9	1.71	1.76
BER-K	0.69	0.70
BER-U	0.75	0.75
K-1	0.39	0.37
K-2	0.40	0.43
NJ-2	0.90	0.93
NJ-3	0.87	0.90
C D at 5%	0.08	0.04

The data pertaining to protein content of minor fruits viz. Aonla, Bael, Ber, Jackfruit and Kaitha were given in Table 5 and resulted a slight variation within two varieties of each fruit. The range of variability in selected two varieties of five fruit viz. Aonla (NA<sub>6</sub> and NA<sub>7</sub>), Bael (NB<sub>5</sub> and NB<sub>9</sub>), Ber (Karaka and Umran), Jackfruit (NJ<sub>2</sub> and NJ<sub>3</sub>) and Kaitha (K<sub>1</sub> and K<sub>2</sub>) were found non-significant variations in respect of protein content. The variations were recorded from 0.53 to 0.64 g/100g (Aonla), 1.73 to 1.79 g/100g (Bael), 1.59 to 1.70

g/100g (Ber), 4.40 to 4.82 g/100g (Jackfruit), 6.85 to 6.92 g/100g (Kaitha). Dasaroju and Gottumukkla (2014) reported that (0.50%) protein content in aonla fruit. Similar results were witnessed by Rani *et al.* (2013) [21] reported 0.88g/100g protein in aonla fruit. Raju *et al.* (2014) [19] found 1.58 to 2.76 g/100g crude protein in three cultivars of bael fruit. Uddin and Hussain (2012) [24] found 0.20 to 1.52 per cent protein in ber fruit. Kaitha fruit contain (6.30 g/100) protein content by Poongodi *et al.* (2013) [18].

**Table 5:** Protein content of minor fruit germplasms/varieties

Germplasms	2013-14	2014-15
	Protein (g/100g)	Protein (g/100g)
NA-6	0.53	0.53
NA-7	0.64	0.64
NB-5	1.71	1.73
NB-9	1.77	1.79
BER-K	1.59	1.55
BER-U	1.70	1.75
K-1	6.85	6.89
K-2	6.92	6.94
NJ-2	4.40	4.41
NJ-3	4.82	4.82
C D at 5%	0.03	0.03

The data pertaining to crude fibre content of minor fruits viz. Aonla, Bael, Ber, Jackfruit and Kaitha were showed in Table 6 and resulted a slight variation within two varieties of each fruit. The range of variability in selected two varieties of five fruit viz. Aonla (NA<sub>6</sub> and NA<sub>7</sub>), Bael (NB<sub>5</sub> and NB<sub>9</sub>), Ber (Karaka and Umran), Jackfruit (NJ<sub>2</sub> and NJ<sub>3</sub>) and Kaitha (K<sub>1</sub> and K<sub>2</sub>) were found non-significant variations in respect of crude fibre content. The variations were recorded from 1.20 to 2.82 g/100g (Aonla), 4.46 to 6.38 g/100g (Bael), 2.28 to 2.52 g/100g (Ber), 4.96 to 5.60 g/100g (Jackfruit), 2.97 to 3.13 g/100g (Kaitha). Daisy and Singh (2007) [4] reported the crude fibre (3.07) per cent in Aonla cultivars. Similar results were witnessed by Ram (1996) [20] reported 6.38 and 4.49g/100g crude fibre in NB<sub>5</sub> and NB<sub>9</sub> varieties of Bael fruit. Sood *et al.* (1980) [23] found 0.87 to 3.84 g/100g crude fibre in seven commercial varieties of jujube fruit. Chopra *et al.* (2003) [3] found 2.90 per cent crude fibre in wood apple fruit.

**Table 6:** Crude fibre content in minor fruit germplasms/varieties

Germplasms	2013-14	2014-15
	Crude fibre (g/100g)	Crude fibre (g/100g)
NA-6	2.82	2.82
NA-7	1.20	1.20
NB-5	6.38	6.38
NB-9	4.46	4.47
BER-K	2.52	2.52
BER-U	2.28	2.27
K-1	2.97	2.93
K-2	3.13	3.10
NJ-2	5.60	5.60
NJ-3	4.96	4.94
C D at 5%	0.05	0.05

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