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E-mail: [bjisir07@gmail.com](mailto:bjisir07@gmail.com)

## Studies on the Physiological and Biochemical Composition of Different ber (*Zizyphus mauritiana* Lamk.) Cultivars at Rajshahi

M. Ibrahim, M. Z. Shafique, M. O. H. Helali, M. M. Rahman, S. K. Biswas and M. S. Islam

*Fruits and Food Processing and Preservation Research Division, BCSIR Laboratories, Rajshahi, Bangladesh*

### Abstract

An investigation was carried out at the Bangladesh Council of Scientific and Industrial Research (BCSIR) Laboratories, Binodpur Bazar, Rajshahi during the period November 2006 to March 2007 to evaluate the physiological and biochemical composition of five cultivars of ber (jujube). Among the fruit cultivars, Thai kul produced the largest fruits (51.85 g each) having the highest pulp (92.38%) and juice (60%) and also the lowest vitamin C content (21.13 mg/100g). The fruit weight of the other cultivars varied from 9.60 to 45.09g. The seed weight ranged from 6.38 to 15.00%. Sugar content varied from 6.25% to 9.72% and starch content ranged from 0.715% to 0.963%. The apple kul had the highest qualitative score through organoleptic test while Thai kul had the lowest. The highest edible portion (pulp content) was in Narikeli kul (93.61%) and that of lowest in Apple kul (85.38%) and Local kul (85.38%) respectively. Considering all, fruit characters and yield are potential.

**Keywords:** Ber, Cultivar, Fruit characters, Quality, Yield.

### Introduction

The ber or jujube (*Zizyphus mauritiana* Lamk) locally known as 'kul' or 'boroi' is a popular fruit in Bangladesh. It is gaining popularity with the growers because of its higher yield, good return and suitability for the arid and semi-arid regions of Bangladesh where most of the other fruit crops can not be grown either due to lack of proper irrigation facilities or adverse climatic and soil condition (Bose and Mitra, 1990). Ber is a cross pollinated crop and generally propagated by seeds. As such variability exists among these genotypes. Improved varieties are multiplied by vegetative propagation and are mostly cultivated in Satkhira, Rajshahi and Comilla (Rahman *et al.*, 2003). The ber is a highly nutritive fruit (Bal, *et al.* 1984). It is also a good source of vitamins and minerals. The physiological and biochemical characteristics are the qualitative indexes of any fruit for fresh consumption. Little information about its export is still unknown though it has a great export potential (Shafiqul Islam *et al.*, 2004). Among the main constituents of this fruit, carbohydrate and organic acids contribute a great deal to the food value of the fruit (Salunkhe and Kadam, 1995). Awareness, in respect of improved ber (jujube) production, is lacking. In view of the above aspects, the present study has been undertaken to throw light on some of the constituents of ber with a view to apprehending the fruit as sup-

plementary food having a good taste and calorific value (120-130 cal/100g) as well as to select the varieties for plantation with a hope to be a member of the ber exporting countries.

### Materials and Methods

The present experiment was carried out at BCSIR Laboratories, Rajshahi during the period November 2006 to March 2007. The bers used for this experiment were collected from the experimental ber research garden of BCSIR Laboratories, Rajshahi to get a clear picture about the constituent and quality of the ber cultivars. Only sound and firm ripe 50 bers of averagely uniform size, shape and colour were taken for each cultivar in this experiment. The cultivars of ber under experiment were namely Taiwan kul, Thai kul, Apple kul, Narikeli kul and Local kul. The bers were cleaned, weighed and the stone was separated. The physical characteristics of the bers viz. whole weight of ber, weight of stone and weight of pulp (edible portion) were determined and recorded in Table I. The total soluble solids (TSS) were determined with a hand refractometer (Egan *et al.*, 1985). Sugar and starch were determined by colorimetric method (Mahadevan and Sridhar, 1982; Jayaraman, 1981; Ibrahim, 2001). Reducing sugar was estimated following DNS

\*Corresponding Author, Email:

method (Miller, 1959), vitamin C was determined titrimetrically using 2,6-dichlorophenolindophenol (Dobois *et al.*, 1951), acidity was determined titrimetrically with the visual acid-base method (Ranganna, 1986), the pH was determined with a digital pH meter (Ibrahim, 2001) and the moisture content and the dry matters were measured by oven drying method (Karmas, 1980). The chemical compositions of the five ber cultivars were determined and the results are recorded in Table IIa and IIb. The above data were statistically analysed and the mean of different parameters were compared by least significant difference (LSD) test. The organoleptic test and the physical characters were carried out and evaluated by a panel of seven judges.

## Results and Discussion

The fruit characteristics i.e. physical characteristics are presented in Table I. Significant differences were observed in the study among the cultivars in respect of most of the characteristics. It is seen that the highest pulp content (edible portion) was found in Narikeli kul (93.61%) followed by Thai kul (92.38%) and Taiwan kul (91.29%). Rahman *et al.* (2003) also observed similar results in other ber cultivars. The pulp contents of varieties are almost similar. This table also represents the fruit weight (whole weight) of different ber cultivars ranged 9.60 g to 51.00 g with marked difference among them. Thai kul was found to be the highest fruit weight and Apple kul the lowest one. Among the varieties the seed weight (i.e. weight of stone) of the fruit was maximum (15.00%) in Local kul followed by Apple kul (14.06%). As regards to the percentage of fruit juice per fruit, which was maximum in Thai kul (60%) followed by Taiwan and Apple kul which were significantly different from each other. It is also seen that the highest moisture content was found in Thai kul (86.40%) followed by Apple kul (84.14%) and Taiwan kul (83.72%). The moisture contents of other varieties are almost near to similar. The total solids content of these ber cultivars ranged from 13.60% to

26.33%. The data revealed the significant difference among these cultivars in respect of total soluble solids. The total soluble solids were highest in Narikeli kul (16.00%) which was followed by Local kul (15.00%). Lowest total soluble solids were recorded in Taiwan kul (10.00%).

The biochemical characteristics among the ber cultivars were studied and found to be significantly difference. The results (Table II) revealed that the highest total sugar content in Narikeli kul (9.72%) followed by Local kul (8.65%) and Apple kul (8.45%). Lowest sugar content was recorded in Taiwan kul (6.52). Similar results were also observed from this table for reducing sugar, non-reducing sugar and starch content which ranged from 2.37% to 3.34%, 4.15% to 6.38% and 0.715% to 0.963% respectively. The pH varied from 3.9 to 4.76 in different varieties and the sugar-acid ratio ranged from 11.45 to 24.76. Among the ber cultivars, the acid content was maximum in Local kul (0.755%) which was determined as citric acid followed by Apple kul (0.655% as citric acid) and Narideli kul (0.546% as citric acid) whereas minimum was found in Thai kul (0.296%), vitamin C is the most important component in ber fruits which was found to be highest in Local kul (58.93 mg/100 g) and Apple kul (33.39 mg/100g) while the lowest was in Thai kul (21.13 mg/100 g). Ascorbic acid content varied from 39 to 166 mg/100 g in number of Indian cultivars of ber as reported by Pareek (1983). Latiff (1989) also reported 50-150 mg/100g ascorbic acid in ber fruit.

Consumer's acceptability of ber depends mainly on appearance and taste. Hence, organoleptic tests of the fruits were carried out by seven judges and remarks on skin, colour, flavour, taste, texture and sweetness were recorded. Abbas *et al* (1990) also conducted similar study on ber fruit taking parameters of skin, colour, flavour, taste and texture. The results of the preferential comments from the panel members were summarized and converted into acceptability scores (Table III). In the study, the cultivars Apple kul(717) made the highest scores in total acceptability followed by Narikeli kul (704) Local kul (688), Taiwan kul (651) and Thai kul (622) respectively. The results revealed that physiological and biochemical parameters of ber cultivars differed significantly from one another which are supposed to be different genetic make up of the variety and also their total fruit development period and the ripening season. The findings also indicate that Apple kul is the most suitable cultivar for table purpose, canning and other products. However, further study could be made on the physiological and biochemical characteristics of different ber cultivars of Bangladesh.

**Table I. The physical characters of different ber cultivars**

Name of ber cultivars	Whole weight (g)	Weight of pulp (%)	Weight of stone (%)	Percentage of juice
Taiwan kul	45.03	91.29	08.71	50.00
Thai kul	51.85	92.38	07.62	60.00
Apple kul	09.60	85.94	14.06	40.00
Narikeli kul	25.85	93.61	06.38	34.00
Local kul	13.00	85.38	15.00	30.00
LSD (5%)	00.09	00.02	00.05	02.44
LSD (1%)	00.13	00.17	00.07	03.55

**Table IIa. The Biochemical characters of different ber cultivars**

Name of ber cultivars	*TS (%)	**TSS (%)	Moisture (%)	Ascorbic Acid (mg/100g)	Acidity (%) as citric acid
Taiwan kul	13.6	10.00	86.40	24.18	0.320
Thai kul	16.28	11.00	83.72	21.13	0.296
Apple kul	15.86	10.00	84.14	33.39	0.655
Narikeli kul	26.33	16.00	73.64	40.91	0.546
Local kul	21.51	15.00	78.49	58.93	0.755
LSD (5%)	00.11	00.47	00.09	00.17	0.097
LSD (1%)	00.15	00.68	00.12	00.25	0.141

\*TS = Total solids, \*\*TSS = Total soluble solids

**Table IIb. The Biochemical characters of different ber cultivars**

Name of ber cultivars	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)	Starch (%)	Sugar-acid ratio
Taiwan kul	6.52	2.37	4.15	0.860	20.38
Thai kul	7.33	2.65	4.68	0.715	24.76
Apple kul	8.45	3.03	5.42	0.823	12.90
Narikeli kul	9.72	3.34	6.38	0.963	17.80
Local kul	8.65	3.15	6.50	0.852	11.46
LSD (4%)	0.04	0.04	0.14	0.007	00.03
LSD (1%)	0.05	0.06	0.20	0.010	00.04

**Table III. The grading of five ber cultivars as judged by the panel of seven judges based on consumer's acceptability.**

Name of ber Cultivars	Skin colour	Shape	Flavour	Taste	Texture	Sweetness	Total
Taiwan kul	85	95	132	112	122	105	651
Thai kul	103	118	78	105	95	123	622
Apple kul	139	129	126	123	97	103	717
Narikeli kul	94	105	145	123	103	134	704
Local kul	120	102	117	116	112	121	688

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