

A Comparative Study on the Physico-Chemical Compositions of the Different Varieties of Litchi Produced in the Rajshahi Region

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Introduction

Litchi (*Litchi chinensis* Sonn.) is a subtropical, delicious, nutritious, juicy flavoured aril producing fruit. It is a very popular fruit of Bangladesh. Besides of its food value it fetches a very fancy price in market in May and early June when few other fruits are available. Viewing the nutritional and biochemical importances of litchi fruit in health and diseases, researches were made, specially in India, on their physico-chemical compositions¹⁻⁴. In Bangladesh, a few research works were done on litchi cultivars mostly in propagation⁵⁻⁸.

The present investigation was under taken with a view to make a comparative study on the physico-chemical compositions of litchi cultivars at premature (20 days before harvesting of fruit) and mature (just after harvesting) stages.

Materials and Methods

Six good quality litchi cultivars were collected from Bangladesh Agricultural Research Institute, Shampur, Rajshahi, and four local cultivars were collected from Rajshahi. All the reagents used are of analytical grade and the estimation was done duplicately for each parameter.

The total titratable acidity was estimated by Follin's method⁹, and specific gravity of litchi-pulp was determined by means of specific gravity bottle using the formula as reported¹⁰.

Vitamin C content of the pulp was estimated by Bessey's titrimetric method¹¹. Protein content was determined by the Micro-Kjeldhal method¹². The total lipid content of litchi-pulp was estimated following the method of Bligh and Dyer¹³.

Sugar content was determined colorimetrically following the Anthrone method¹⁴ and the procedure was given below : 4-5 gm of litchi-pulp was homogenized with water and the mixture was filtered. Polysaccharide was precipitated by adding ethanol to the filtrate (2:1, v/v). After overnight standing at room temperature the precipitate was collected by centrifugation. The dry precipitate was dissolved in 1M HCl and heated to about 70°C for 10 min. The final extract was used for estimation using glucose as a standard sugar. For free sugar estimation using glucose as a standard sugar. For free sugar estimation the supernatant was evaporated to about 1/4th of the original volume and then followed the procedure as described above.

Total soluble sugar (TSS) content of the litchi-pulp was determined from the percentage scale of Refractometer (Model : ATAGO, Tokyo, no. 45469). Calcium content was determined by titrimetric method⁹, and iron and zinc contents were determined by the method of Davis and Hilary¹⁵ using Atomic Absorption Spectrophotometer.

Result

The nutrient contents are expressed as gm or mg per 100gm of litchi-pulp. The

pH, specific gravity and total titratable acidity of litchi-pulp were given in Table-1. The results clearly revealed that the pH of litchi-pulp was in acidic region at all stages, and the pH of pulp decreased with the changes of maturity. Total titratable acidity determination of pulp also confirmed the above findings. The specific gravity of pulp was found to be varied between 1.002 to 1.046 in premature stage and 1.035 to 1.057 in mature stage.

Table 1. PH, specific activity and total titratable acidity of litchi-pulp at different stages.

Name of cultivar	PH		Specific gravity		Total titratable acidity (ml of 0.1 IN NaOH required per 100 gm of pulp)	
	Premature	Mature	Premature	Mature	Premature	Mature
Bombai-1	3.15±0.03	4.35±0.04	1.029	1.036	123.20±0.6	57.74±0.3
Bombai-2	3.20±0.02	4.50±0.03	1.031	1.042	115.52±0.8	55.23±0.2
Green	3.20±0.02	4.25±0.03	1.022	1.035	140.20±0.4	58.20±0.4
Madrajee	3.00±0.01	4.20±0.02	1.048	1.057	122.64±0.7	63.60±0.3
China-3	3.45±0.01	4.40±0.01	1.039	1.048	96.64±0.5	56.40±0.4
Bedana	3.40±0.02	4.10±0.02	1.043	1.044	99.84±0.4	65.80±0.5
Local-1	2.85±0.02	3.62±0.03	1.025	1.077	142.72±0.7	71.40±0.6
Local-2	2.90±0.01	4.00±0.01	1.034	1.052	136.52±0.5	66.00±0.4
Local-3	2.75±0.02	3.55±0.01	1.040	1.046	151.30±0.6	73.15±0.3
Local-4	2.95±0.03	3.85±0.02	1.032	1.038	139.26±0.4	69.00±0.2

Table 2. Moisture, ash and vitamin C contents of litchi-pulp at different stages.

Name of cultivar	Moisture(gm%)		Ash gm%		Vitamin C (mg%)	
	Premature	Mature	Premature	Mature	Premature	Mature
Bombai-1	82.67±0.5	81.14±0.2	0.48±0.01	0.59±0.02	15.70±0.6	2.95±0.2
Bombai-2	82.49±0.6	81.07±0.3	0.46±0.01	0.63±0.03	13.84±0.4	3.22±0.1
Green	85.63±0.4	82.14±0.2	0.43±0.02	0.70±0.02	19.36±0.5	2.94±0.3
Madrajee	81.14±0.3	80.07±0.4	0.53±0.02	0.64±0.03	22.41±0.8	4.5±0.2
China-3	82.79±0.6	81.20±0.2	0.51±0.01	0.69±0.02	19.84±0.7	0.74±0.1
Bedana	83.83±0.5	81.48±0.4	0.36±0.02	0.52±0.01	18.72±0.4	8.22±0.5
Local-1	84.85±0.4	80.19±0.1	0.41±0.01	0.55±0.03	16.88±0.5	9.40±0.4
Local-2	85.63±0.3	81.40±0.3	0.37±0.03	0.53±0.02	21.79±0.6	10.55±0.5
Local-3	83.21±0.4	82.44±0.3	0.42±0.02	0.51±0.03	21.58±0.4	17.42±0.6
Local-4	83.77±0.4	82.58±0.2	0.46±0.01	0.74±0.02	25.70±0.5	21.40±0.6

Table 3 : Protein and lipid contents of litchi-pulp at different stages.

Name of cultivar	Protein (gm%)		Lipid (gm%)	
	Premature	Mature	Premature	Mature
Bombai-1	0.95±0.03	1.41±0.05	0.40±0.02	0.51±0.03
Bombai-2	0.88±0.02	1.36±0.03	0.45±0.01	0.54±0.02
Green	1.48±0.05	2.02±0.04	0.47±0.02	0.58±0.03
Madrajee	1.02±0.02	1.43±0.03	0.53±0.03	0.65±0.02
China-3	1.23±0.05	1.81±0.04	0.31±0.01	0.44±0.02
Bedana	1.93±0.03	1.24±0.02	0.29±0.01	0.43±0.03
Local-1	1.12±0.02	1.46±0.04	0.33±0.02	0.48±0.04
Local-2	1.14±0.01	1.39±0.02	0.21±0.01	0.38±0.03
Local-3	1.17±0.03	1.47±0.04	0.24±0.02	0.46±0.04
Local-4	1.01±0.01	1.37±0.03	0.17±0.01	0.42±0.02

Table 4 : Amount of free sugar, polysaccharide and TSS present in litchi-pulp at different stages.

Name of cultivar	Free sugar (gm%)		Polysaccharide(gm%)		TSS (gm%)	
	Premature	Mature	Premature	Mature	Premature	Mature
Bombai-1	5.59±0.3	10.00±0.5	3.50±0.05	4.53±0.07	14.00±0.8	18.20±1.2
Bombai-2	5.02±0.4	10.20±0.6	3.75±0.03	4.64±0.05	15.20±0.7	18.60±1.4
Green	5.67±0.2	8.21±0.4	3.93±0.03	5.00±0.04	13.90±0.6	17.40±1.0
Madrajee	4.89±0.3	8.20±0.2	4.15±0.04	5.70±0.03	14.30±0.5	17.70±0.9
China-3	5.60±0.4	9.50±0.3	4.11±0.05	4.86±0.04	14.60±0.7	18.00±1.1
Bedana	5.01±0.2	9.12±0.4	3.89±0.03	4.88±0.05	13.56±0.8	17.00±1.2
Local-1	5.11±0.4	6.67±0.2	3.58±0.02	5.96±0.06	14.00±0.6	16.25±0.9
Local-2	4.41±0.3	6.50±0.4	3.82±0.03	6.32±0.07	11.00±0.5	15.80±1.0
Local-3	3.91±0.2	6.19±0.5	3.65±0.04	6.65±0.05	12.00±0.7	16.20±0.8
Local-4	3.43±0.2	6.01±0.3	3.95±0.02	6.57±0.04	10.70±0.5	15.50±0.7

Table 5. Amount of calcium, iron and zinc present in the pulp of mature litchi cultivars.

Name of cultivar	Calcium (mg%)	Iron (mg%)	Zinc (mg%)
Bombai-1	13.42±0.4	1.37±0.03	1.64±0.04
Bombai-2	14.12±0.3	1.59±0.04	1.33±0.02
Green	16.93±0.4	1.76±0.02	1.27±0.01
Madrajee	12.41±0.2	1.13±0.03	1.60±0.05
China-3	21.61±0.5	4.72±0.03	1.57±0.02
Bedana	21.08±0.3	2.63±0.04	1.75±0.03
Local-1	19.47±0.4	3.74±0.05	3.49±00.03
Local-2	15.37±0.2	1.74±0.02	2.29±0.01
Local-3	11.84±0.3	1.72±0.03	2.59±0.04
Local-4	9.95±0.2	1.91±0.02	2.64±0.03

The moisture, ash and vitamin C contents of litchi-pulp were found to be varied between 81.14-85.63 gm%, 0.36-0.53 gm% and 13.84-25.7 mg% in premature stage, and 80.07-82.58 gm%, 0.51-0.74 gm% and 0.74-21.4 mg% in mature stage, respectively (Table 2). Further, the results also indicated that local cultivars contained remarkably higher amount of vitamin C than the other good quality cultivars in mature stage.

The protein and lipid contents of different litchi-cultivars were presented in Table 3. It was found that the litchi-pulp contained low amount of protein and lipid, and the ranges for protein and lipid were 1.24-2.02 gm% and 0.38-0.65 gm% in mature stage, respectively.

The analytical data of free sugar, polysaccharide and TSS contents in the

pulp of different litchi cultivars were given in Table 4. The free sugar, polysaccharide and TSS contents were found to be varied between 3.43-5.67 gm%, 3.5-4.15 gm% and 10.7-15.2 gm% in premature stage, and 6.0-10.2 gm%, 4.53-6.65 gm% and 15.5-18.6 gm% in mature stage, respectively. At mature stage, Bombai-2 cultivar contained the highest amount of TSS (18.6 gm%), followed in decreasing order by Bombai-1 (18.2 gm%), China-3 (18.0 gm%) and so forth. The amount of iron, calcium and zinc present in the litchi-pulp were found to be varied in between 1.13-4.72 mg%, 9.95-21.61 mg% and 1.27-3.49 mg%, respectively (Table 5)

Discussion

As shown in Table 1, the pH of litchi-pulp was in acidic ranges at different

stages, and decreased with the changes of maturity. Significantly the pulp of local litchi cultivars were more acidic than the good quality cultivars. It might be suggested from the results that the pH value of 3.55 or above is an indication of maturation of litchi.

The moisture content of litchi -pulp decreased slightly while ash content increased remarkably with the changes of maturity. The moisture content of matured litchi cultivars may be decreased due to increase in nutrient contents of litchi-pulp with maturation . The results clearly indicated that vitamin C content of good quality litchi cultivars decreased remarkably in comparison to that of local litchi cultivars with the changes of maturity.

Protein and lipid contents of litchi cultivars were also increased with the changes of maturity. The increased in ash, protein and lipid contents of litchi cultivars with maturation might be due to increased metabolic activities.

It was found in present study that the litchi fruits contained 12.58-14.86 gm% sugar. These values were very similar to that reported for indian mango by Singh and Singh¹, who reported that Indian litchi fruits contained 6.94-13.86 gm% sugar. Free sugar content of litchi-pulp was found to be increased remarkably with the changes of maturity. From the present data it might be suggested that the free sugar content of litchi-pulp may be considered as an important index to determine the quality of fruit, since good quality litchi cultivars contained remarkably higher amount of free sugar

than local cultivars. The results also revealed that polysaccharide content of local litchi cultivars increased sharply while that of good quality litchi cultivars increased moderately with the changes of maturity. From the Table 4 it is seen that the TSS content of mature litchi-pulp was varied between 15.5-18.6 gm.%. This values show good correlation with those reported for Indian Litchi. Jawanda and Singh³ reported that TSS content of Indian litchi fruits was varied between 16.5-21.0 gm%³² while Kanwar and Nijjar¹⁶ found TSS in litchi fruit ranged from 18.0-18.7 gm%. The present results also revealed that TSS content increased remarkably with the changes of maturity. The increase in TSS content of litchi-pulp at mature stage might be due to the increase in free sugar content. Again, TSS content of litchi -pulp might be used to determine its quality since good quality litchi cultivars contained higher amount of TSS as compared to that of low quality litchi cultivars.

Summary

The physico-chemical compositions of six good quality and four local litchi cultivars, produced in Rajshahi region were analyzed at pre-mature and mature stages. The pH of litchi-pulp was in acidic region, and acidity decreased gradually with the changes of maturity. In mature stage the moisture and ash contents were in the ranges of 80.07-82.58 gm% and 0.51-0.74 gm, respectively. With the changes of maturity vitamin C content was decreased remarkably in good quality litchi cultivars while that decreased moderately in local cultivars.

The protein, lipid, carbohydrate and TSS contents of litchi-pulp were increased with the changes of maturity, and in mature stage the ranges for protein, lipid, carbohydrate and TSS

were 1.24-2.02, 0.38-0.65, 12.58-14.84 and 15.5-18.6 gm%, respectively. Minerals such as Ca, Fe and Zn were found to be present in very low amounts in all the litchi cultivars.

References

1. Sing LB. and Sing UP. The litchi supplement, printing and stationary, Uttar Pradesh, India, 1954, 122-125.
2. Battacharyya R.K. Mohan N.K. South Indian Horticulture Journal, 1977, 25:51-94.
3. Jawanda J.S, Singh S. The Punjab Horticulture Journal, 1977; XVII (3&4) : 123-124.
4. Nijjar, G.S. Litchi Cultivation, Punjab Agricultural University, Ludihana 1972.
5. Sharfuddin, A.F.M. and Hussain A., Use of the growth regulators and effect of pruning of the detouched rooted shoot on the success of air layering in litchi, M.Ag. Tesis, Bangladesh Agriculture University, Mymensingh, 1972.
6. Mannan, M.A. and Faruque, A.H.M., Effect of Naphthalene acetic acid in rooting performances of stem cuttings of some fruits of East Pakistan, M. Ag. Thesis, Bangladesh Agriculture University, Mymensingh, 1969.
7. Alam, M.Z. and Wadud, M.A. On the biology of litchi in East Pakistan, Pak. Jour. Sci., 15 (5) : 232-240, 1963.
8. Ahmed, K. and Rahman, M.S., Edible portions and non-edible wastes of some fruits of Bangladesh, Bang. Hort. 2 (1), 39-40, 1974.
9. Bernard, S. and Oser, L., Hawk's Physiological Chemistry (14th edition), McGraw-Hill Book Co., USA, P. 1210 & 1264-1265, 1965.
10. Kalimuddin, M., A text book of practical physics (4th edition), P. 84, 1976.
11. Bessey, O.A. and King, C.G., The distribution of vitamin C in plant and animal tissues and its determination. J. Biol. Chem., 103. 687-693, 1933.
12. Wong, T. : J. Biol. Chem., 55 : 427-432, 1923.
13. Bligh, E.G. and Dyer, W.J., Total lipid extraction and purification. Can. J. Biochem. Physiol. 37 : 911-915, 1959.
14. Morse, E.E., Anthrone in estimating low concentration of sucrose. Anal. Chem., 19 : 1012-1013, 1947.
15. Davies, N.T. and Hilary, R., The British J. Nutr., 41 : 579-580, 1979.
16. Kanwar, J.S. and Nijjar, G.S. Litchi cultivation in the Punjab problems and prospects. The Punjab Hort. Jour., 15 (1&2), : 9-15, 1975.