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Nutritive compositions of locally available jackfruit seeds (*Artocarpus heterophyllus*) in Bangladesh

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Abstract

The nutritive value of jackfruit seeds was investigated using the following parameters-proximate composition and mineral composition. The aim of this study is to determine the physico-chemical properties of jackfruit seeds. Three types of jackfruits namely Khaja (green, hard and smooth, with juicy pulp and small seeds), Gala (rough, soft, with thin pulp, not very juicy, and large seeds) and Durosha (rough, soft, intermediate size of pulps and seeds) were taken under investigation. The fruits were cut, the seeds removed, sliced, dried at 60 °C for 24 hrs, packaged in polyethelyne bag and kept in a refrigerator (~20±2° C). The moisture content, dry matter and ash content was found around 21.10-42.25%, 57.75- 78.90% and 2.13- 4.07% respectively among the varieties. A good amount of protein content was found in all varieties of jackfruit seeds, it ranged from 13-18%. Crude fibre content of seed varied from 1.56-2.60%. Jackfruit is a good source of many mineral contents like N, P, K, Ca, Mg, S, Zn, Cu etc. Starch content in seed was found from 12.86- 17.90%. The information achieved from the study could be helpful for the students, teachers, scientists who has been engaged with the biochemical analysis of different types of jackfruits in Bangladesh.

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Introduction

Jackfruit (*Artocarpus heterophyllus* Lam) is popular fruit crop that is widely grown in Bangladesh and other tropical areas. The ripe fruit contains well flavored yellow sweet bulbs and seeds (embedded in the bulb). The edible bulbs of ripe jackfruit are consumed fresh or processed into canned products. Seeds make-up around 10 to 15% of the total fruit weight and have high carbohydrate and protein contents (Bobbio *et al* 1978 and Kumar *et al* 1988). Seeds are normally discarded or steamed and eaten as a snack or used in some local dishes. As fresh seeds cannot kept for a long time, seed flour can be an alternative product, which be used in some food products.

There have been few studies on jackfruit seeds. Bobbio *et al.* (1978) reported some physicochemical properties, such as pasting characteristics of jackfruit seed starch. Kumar *et al.* (1988) studied the proximate compositions of two varieties of jackfruit seeds and reported considerable biochemical difference between the two varieties. The starch content of the seed increases with maturity (Rahman *et al.,* 1999). Different locations give different seed contents. Some functional properties of jackfruit seed flour and its protein digestibility was reported by Singh *et al.* (1991). Jackfruit tree (*Artocapus heterophyllus*) belongs to the family Moraceae. Jackfruit has been reported to contain high levels of protein, starch, calcium and thiamine (Burkill, 1997). The seeds may be boiled, or roasted and eaten or boiled and preserved in syrup like chestnuts. Roasted, dried seeds are ground to make flour which is blended with wheat flour for baking (Morton, 1987). The composition of jackfruit perianth and seed has been reported (Selvaraj and Pal, 1989; Bobbio *et al*., 1978; Rahman *et al*., 1995; Hossain *et al*., 1990 and Morton, 1987). This project is therefore aimed at determining the physico-chemical and functional properties of jackfruit seed in order to explore its potentials in food systems. Three types of jackfruits namely Khaja (green, hard and smooth, with juicy pulp and small seeds), Gala (rough, soft, with thin pulp, not very juicy, and large seeds) and Durosha (rough, soft, intermediate size of pulps and seeds) were taken under investigation.

Materials and methods

Three varieties of Jackfruits were collected from Sher-e-Bangla Agricultural University Campus and from local areas of Sripur, Gazipur. Varieties are namely Khaja, Gala and Durosha. Mature jackfruits were harvested in the month of April and in July 2010, respectively. Freshly harvested jackfruits were stored in the laboratory of Biochemistry Department at room temperature. After it had ripened the fruit was opened and the required seeds of fruit were randomly collected and stored in deep fridge at -20±2° C temperature. For the determination of protein, starch and fibre the randomly collected seeds were cut in slices and dried in the sun and finally in the oven at 60° C. Dried pieces were finally ground by grinding machine and stored in polythene bag until required for analysis. Moisture, dry matter and ash contents of seeds were determined by the methods described in the Manual of Analysis of Fruit and Vegetable Products by Ranganna (1979). Fibre, Protein and Starch contents of seeds were estimated according to the procedure as described by Ranganna (1979). Nitrogen, Phosphorus, Potassium, Sulfur of seeds were determined by Micro-Kjeldahl method (Bremner, 1996), Molecular Absorption Spectrophotometry method (Iorio *et al.,* 1992), Flame Photometric method (Jones, 2001), Turbidimetric method (Tabatabai and Bremner, 1970) respectively. Zinc, Calcium, Magnesium of seeds were determined by Atomic Absorption Spectrophotometric method (Rowell, 1996).

Statistical analysis of data

The statistical analysis was done by following the method that described by Gomez and Gomez, 1984. The data generated by the procedure that analyzed by using computer package programme MSTAT-C, SPSS etc. The means were supported by LSD, CV% and by standard errors. The experiments considered 3

treatments with 3 replications. The data for the characters considered in the present experiments were statistically analyzed. The analysis of variance was conducted and means were compared following least significant difference (LSD) test at 1% and 5% level of probability for interpretation of results.

Results and discussion

Moisture content

Moisture contents were found 35.97%, 42.25% and 21.10% in Khaja, Gala and Durosha seeds respectively (Table-01). Gala jackfruit seeds contained highest amount of moisture content followed by Khaja, whereas the lowest moisture content was found in the seeds of Durosha jackfruit seeds. Purseglove (1968) reported moisture content as 51.6%. On the other hand Samadder (1990) reported moisture content 64.5% in jackfruit seeds. These values were found higher than the estimated values.

Dry matter

The data on dry matter content of three varieties of jackfruit seeds were derived from the percentage of moisture content. The difference in dry matter content was corresponding to the difference in percent moisture. Dry matter contents were found 64.03%, 57.75% and 78.90% in Khaja, Gala and Durosha seeds respectively (Table-01). Durosha seeds showed the highest average dry matter content followed by Khaja, whereas the lowest dry matter content was found in Gala jackfruit seeds. Popenoe (1974) and Samadder (1990) reported jackfruit seeds dry matter as 47.00% and 35.50% respectively. These values were found as less than the estimated values.

Ash

Ash amounts were found 4.073%, 2.127% and 3.300% in Khaja, Gala and Durosha seeds respectively (Table-01). The highest percentage of ash was observed in Khaja jackfruit seeds followed by Durosha and the lowest percentage of ash was in the Gala seeds. The results of the three treatments are comparable with the findings of Awal *et al.* (1991) and Purseglove (1968) who recorded ash as 1.8% and 1.5% respectively. These values were found as less than the estimated values.

Crude fibre

Crude fibre amounts were found 2.597%, 3.833% and 1.563% in Khaja, Gala and Durosha seeds respectively (Table-01). The highest fibre content was in Gala seeds followed by Khaja whereas the lowest fibre content was in Durosha seeds. The finding result ranged from 1.18% to 2.60% which were more or less similar with the result reported by Coronel (1983). These values were found as similar with the estimated values.

Protein

The determination of protein is highly related to the determination of nitrogen amount. In jackfruit seeds great amount of nitrogen was found. According to the above findings average content of protein varied from 13.13-18.13% among the three types of jackfruit seeds. Protein amounts were found 13.125%, 14.813% and 18.125% in Khaja, Gala and Durosha seeds respectively (Table-01). The highest content of protein was found in Durosha jackfruit seeds followed by Gala and the lowest protein were found in Khaja seeds. Awal *et al.* (1991) reported the seed protein content as 5.69% which was much lower than the findings of the present work. On the other hand Bobbio *et al.* (1978) reported the protein content of seed as 12.3% which agreed with the present findings.

Starch

Starch contents were found 15.61%, 17.90% and 12.86% in Khaja, Gala and Durosha seeds respectively (Table-01). The highest starch content was found in Gala seeds followed by Khaja and the lowest was found in Durosha jackfruit seeds. Bhatia *et al.* (1955) found 57.09% starch which was higher than the present findings.

Table 1. Chemical composition of three varieties of jackfruit seeds.

Varieties	Moisture (%)	Dry Matter (%)	Ash (%)	Crude Fibre (%)	Protein (%)	Starch (%)
Khaja	35.97b	64.03b	4.073a	2.60b	13.125c	15.61b
Gala	42.25a	57.75c	2.127b	3.83a	14.813b	17.90a
Durosha	21.10c	78.90a	3.300a	1.56a	18.125a	12.86c
CV (%)	8.66	4.29	14.69	16.36	1.78	5.45
$LSD_{(0.05)}$	5.399	5.399	0.8751	0.8207	0.5156	1.587

Means followed by same letter significantly different at 5% level of significance.

Table 2. Mineral contents of three varieties of jackfruit seeds.

Varieties	N (%)	P (mg/100g)	K (%)	Ca (mg/100g)	Mg (mg/100g)	S (mg/100g)	Cu (mg/100g)	Zn (mg/100g)
Khaja	2.10c	139.0b	1.30b	0.02c	150.7c	30.00c	3.167b	1.500c
Gala	2.37b	170.7a	1.34ab	0.11b	168.7b	41.00b	1.467c	2.333b
Durosha	2.90a	119.3c	1.42a	0.38a	210.0a	81.00a	4.133a	3.100a
CV (%)	1.77	1.51	3.53	17.71	3.26	4.97	10.79	13.18
$LSD_{(0.05)}$	0.8420	4.068	0.0842	0.05954	10.83	4.74	0.5924	0.5742

Means followed by same letter significantly different at 5% level of significance.

Nitrogen

Nitrogen amounts were found 2.10%, 2.37% and 2.90% in Khaja, Gala and Durosha seeds respectively (Table-02). The highest percentage of nitrogen was counted under Durosha seeds followed by Gala and the lowest nitrogen percentage was counted under Khaja seeds.

Phosphorus (P)

Phosphorus contents were found 139.0 mg/100g, 170.7 mg/100g and 119.3 mg/100g in Khaja, Gala and Durosha seeds respectively (Table-02). The highest percentage of phosphorus was counted under Gala seeds followed by Khaja seeds and the lowest phosphorus percentage was counted under Durosha seeds. Aykroyd *et al.* (1966); Narasimham (1990); Soepadmo (1992); Gunasena *et al.* (1996); Azad (2000) reported that phosphorus content of seeds were 38-97 mg/ 100g. These values were found as less than the estimated values.

Potassium (K)

Potassium contents were found 1.30 %, 1.343 % and 1.423 % in Khaja, Gala and Durosha seeds respectively (Table-02). The highest percentage of potassium was

counted under Durosha seeds followed by Gala seeds and the lowest potassium percentage was counted under Khaja seeds. Aykroyd *et al.* (1966); Narasimham (1990); Soepadmo (1992); Gunasena *et al.* (1996); Azad (1999) reported magnesium content of jackfruit seeds as 247 mg/ 100g. These values were found as much higher than the estimated values.

Calcium (Ca)

Calcium amounts were found 0.02 mg/100g, 0.11 mg/100g and 0.38 mg/100g in Khaja, Gala and Durosha seeds respectively (Table-02). The highest percentage of calcium was counted under Durosha seeds followed by Gala seeds and the lowest calcium percentage was counted under Khaja jackfruit seeds. Aykroyd *et al.* (1966); Narasimham (1990); Soepadmo (1992); Gunasena *et al.* (1996); Azad (1999) reported calcium content of jackfruit seeds as 50 mg/ 100g. These values were found as much higher than the estimated values.

Magnesium (Mg)

Magnesium contents were found 150.7 mg/100g, 168.7 mg/100g and 210.0 mg/100g in Khaja, Gala and Durosha seeds respectively (Table-02). The highest percentage of magnesium was counted under Durosha followed by Gala seeds and the lowest was found in Khaja seeds. Aykroyd *et al.* (1966); Narasimham (1990); Soepadmo (1992); Gunasena *et al.* (1996); Azad (1999) reported magnesium content of jackfruit seeds as 54 mg/ 100g. These values were found as less than the estimated values.

Sulfur (S)

Sulfur amounts were found 30.00 mg/100g, 41.00 mg/100g and 81.00 mg/100g in Khaja, Gala and Durosha seeds respectively (Table-02). The highest percentage of sulfur was counted under Durosha seeds followed by Gala jackfruit seeds. The lowest sulfur percentage was counted under Khaja seeds.

Copper (Cu)

Copper contents were found 3.167 mg/100g, 1.467 mg/100g and 4.133 mg/100g in Khaja, Gala and Durosha seeds respectively (Table-02). The highest percentage of copper was found under Durosha seeds followed by Khaja jackfruit seeds and the lowest copper percentage was counted under Gala seeds.

Zinc (Zn)

Zinc contents were found 1.50 mg/100g, 2.333 mg/100g and 3.100 mg/100g in Khaja, Gala and Durosha seeds respectively (Table-02). The highest percentage of zinc was found in Durosha followed by Gala and the lowest was in Khaja seeds.

Conclusion

The average moisture and dry matter content of jackfruit seeds of different varieties ranged from 21.10% to 42.25% and 57.75% to 78.90% respectively. Average ash and crude fibre content of different varieties of jackfruit seeds were found as 3.17% and 2.66% respectively. It was found jackfruit seeds as a good source of protein content. The protein content varied from 13.125% to 18.125% among the three jackfruit seed varieties. According to the findings, average starch content in seeds of Khaja, Gala and Durosha were 15.61%, 17.90% and 12.86% respectively. Average nitrogen content in seeds ranged from 2.10% to 2.90% among the Khaja, Gala and Durosha jackfruits. From the findings, it was seen that seed of all the three types of varieties contained very minor amount of copper and zinc content. The copper content in seeds ranged from 1.47- 4.13 mg/100g among the three varieties. Zinc content in seeds ranged from 1.5-3.1 mg/100g among the three varieties. A good amount of potassium was found in seeds varied from 1.30% to 1.42% on average. Good amount of phosphorous content was found in the seeds. Phosphorus content ranged from 119.3-139.0 mg/100g among the seeds. The percentage of calcium, magnesium and sulfur content of three varieties of jackfruit seeds ranged from 0.02-0.4 mg/100g, 150.7- 210.0 mg/100g and

30.0- 81.0 mg/100g respectively. Mineral contents were found higher in amount most of the time in Durosha seeds. So, according the findings we can declare Durosha as the most nutritive one, whereas it has the highest nutritive value.

References

Awal HMA, Gheyasuddin S. 1991. Biochemical parameters of jackfruit seed meal. Bangladesh J. Agril. Res. **16(1),** 17-22.

Aykroyd WR, Gopalan, Balasubramanayan S. 1966. The nutritive value of Indian Food and the planning of satisfactory diet. Spec. Rep. Ser. 42. Indian Council of Medical Research, New Delhi.

Azad AK. 1999. Genetic diversity of jackfruit in Bangladesh and development of propagation methods. Ph.D. Thesis, Faulty of Engineering and Applied Sciences, Departmental Civil and Environmental Engineering, University of Southampton, UK. p. 15-188.

Bhatia BS, Siddappa GS, Lal G. 1955. Composition and nutritive value of jackfruit. Indian J.Agri. Sci. **25(4),** 30-36.

Bobbio FO, El-Dash AA, Bobbio PA, Rodrigues LR. 1978. Isolation and characterization of the physicochemical properties of starch of jackfruit seeds (*Artocarpus heterophyllus*). Cereal Chem. **55,** 505-511.

Burkill HM. 1997. The Useful Plants of West Tropical Africa. Royal Botanic Gardens, Kew **4(2),** 160-161.

Coronel RE. 1983. Jack. In. Promising fruits of the Philippines. College of Agriculture. University of Philippines at Los Banos. Languna, Philippines p. 267.

Gomez KA, Gomez AA. 1984. Statistical procedures for agricultural research. John Wiley & Sons, Inc. New York.

Gunasena HPM, Ariyadasa KP, Wikramasinghe A, Herath HMW, Wikramasinghe P, Rajakaruna SB. 1996. *Manual of jack cultivation in Srilanka*. bForest Information Service, Forest Department. p. 48.

Hossain MK, Azizur R, Matior R, Jabbar M. 1990. Some low molecular weight compounds isolated and characterized from jackfruit (*Artocarpus heterophyllus*). J. Bang. Acad. Sci. **14,** 49 – 56.

Iorio A, Rendina A, Garcia A, Schor A. 1992. Efecto de la temperatura, matriz vegetal y tiempo sobre la reduccion del acido fosfomolibdico. Rev. Fac. Agron. **13,** 261-265.

Jones JB. 2001. Laboratory Guide for Conducting soil tests and plant analysis. CRC Press: Boca Raton, FL. **141,** 27-160

Kumar S, Singh AB, Abidi AB, Upadhyay RG, Singh A. 1988. Proximate composition of jack fruit seeds. J Food Sci Techno **25,** 308-309.

Morton J. 1987. Jackfruit (*Artocarpus heterophyllus*). p. 58 – 64. In: Fruits of warm climates. Julia, F., Morton, Miami, F.L.

Narashimham P. 1990. Breadfruit and jackfruit. In: Nagy S, Shaw PE, Wardowski WF. (eds.). Fruits of Tropical and Subtropical Origin Composition, Properties and Uses. Florida: Florida Science Source, Inc. p. 216-259.

Popenoe, W. 1974. Manual of Tropical and Subtropical Fruits. Hafner press. Div. of Macmillan Publishing Co. Inc. p. 413-414.

Purseglovc JW. 1968. Tropical Crops. Dicotyledons 2. Longmans. Green and Co. Ltd. London and Harlow. p. 377-390.

Rahman AKMM, Huq E, Mian AJ, Chesson A. 1995. Microscopic and chemical Changes occurring during the ripening of two forms of Jackfruit (*Artocarpus heterophyllus*). Food Chem. **52,** 405 – 410.

Rahman MA, Nahar N, Mian AJ, Mosihuzzaman M. 1999. Variation of carbohydrate composition of two forms of fruit from jack tree (Artocarpus heterophyllus L.) with maturity and climatic conditions. Food Chem. **65,** 91-97.

Ranganna S. 1979. Manual of Analysis of fruits and Vegetable Products. Tata McGraw Hill Publishing Co. Lid. New Delhi, p. 1-20.

Rowell DL. 1996. Soil Science Methods and Applications. (3rd Ed) Longman, UK.

Samaddar HN. 1990. Jackfruit. In. Fruits, Tropical and Subtropical (lst edn). Naya Prakash. 206 Bidhan Sarani. Calcutta. India, p. 637-639.

Selvaraj Y, Pal DK. 1989. Biochemical changes during ripening of jackfruit (*Artocarpus heterophyllus* L.). J.Food Sci. Tec. **26,** 304 – 307.

Singh A, Kumar S, Singh IS. 1991. Functional properties of jack fruit seed flour. *Lebensm* - Will u Technol **24,** 373-4.

Soepadmo E. 1991. *Artocarpus heterophyllus* Lam In: Verheij, E.W.M. and Coronel R.E. (eds). Plant Resources in South East Asia, No. 2. Edible fruits and Nuts. Netherlands: Wageningen. p. 86-91.

Tabatabai MA, Bremner JM. 1970. A simple turbidimetric method of determining total sulfur in plant material. Agron J. **62,** 805–806.