

Assessment of Physicochemical Properties of Jackfruits' (*Artocarpus heterophyllus* Lam) Pulp

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Abstract A study was undertaken to determine the physical properties and chemical composition of three types of jackfruit (*Khaja*, *Dorasha* and *Ghila*) pulps collected from different growing areas for a period of 6 months. In these circumstances, the pulps of *Khaja* (Both Modhupur and Valuka) were firm textured and those of *Ghila* were very soft to soft. Correspondingly, intermediate textures of pulps were observed in case of *Dorasha*. Furthermore, the pulps colour of *Khaja* fruits were whitish yellow whereas that of *Ghila* pulps were deep yellow. The colour of *Dorasha* pulps were light yellow. The *Khaja*, *Dorasha* and *Ghila* pulps were found less, medium and very juicy, respectively. However, highest moisture content was found in Valuka *Ghila* (84.44 %) and lowest in Modhupur *Ghila* (79.62 %) type of jackfruits. *Khaja* and *Ghila* collected from Valuka had greater ash content than *Khaja* and *Ghila* from Modhupur. Beside this, titrable acidity, Vitamin C and carotene content of *Khaja* type of jackfruits were lower than that of *Ghila* types. Highest carotene content was observed in Modhupur *Ghila* (520.46 µg/100g) while lowest in Valuka *Khaja* (334.06 µg/100g). TSS, starch, total sugar, non-reducing sugar and carotene content were higher in the jackfruit pulps from modhupur than that of Valuka. It was also found that *Khaja* types had higher starch content than *Ghila* types. The highest pH value was found in Modhupur *Khaja* (6.45) and lowest in Modhupur *Ghila* (5.61). There were slight variations in fibre content among the jackfruit pulps. Lowest reducing sugar content was found in *Dorasha* type of jackfruit (4.90%). From the study it is concluded that the proximate composition of jackfruit pulps is influenced by both type and place. Therefore, this information would be useful to select the best quality jackfruit to prepare different food products.

Key words

Artocarpus heterophyllus, physico-chemical, Proximate, pulps

Jackfruit (*Artocarpus heterophyllus* Lam) is a large fruit of a milky-juice tree, of Moraceae family. The edible, pulpy part represents the perianth. Jackfruit is the largest edible fruit in the world (Naik, 1949 and Sturrock, 1959). It originated in the forests of the Western Ghats (India), where it still grows in the wild, as well as in the evergreen forests of Assam and Myanmar. It is cultivated throughout Bangladesh, Burma, India, Indonesia, Malaysia, The Philippines, Sri Lanka, Thailand and to some extent in Brazil and Queensland (Australia). Jackfruit locally called kathal has gained the position of national fruit of Bangladesh due to its popularity and various other features. The poor people of jackfruit growing area, used to eat this fruit instead of rice, for one of their daily meals. It is

commonly referred to as "The Poor man's food" (Rahman *et al.*, 1995). At present Bangladesh produces 925965 tons of jackfruit annually from an area of 9977 hectares of land at the rate of 92.81 tons per hectare (BBS, 2007). It ranks next to mango and banana in total acreage but second in annual production among the fruits grown in Bangladesh. It is grown throughout the country. But it is grown more abundantly in Valuka and Modhupur regions of Mymensingh and Tangail districts. Jackfruit occurs naturally in two textural forms; *Ghila* with soft and pulpy perianth when ripe and *Khaja* with firm perianth (Rahman *et al.*, 1999). Additionally there is another type named "*Dorasha*" having both the characteristics of *Khaja* and *Ghila*. Jackfruit has been reported to contain high levels of

protein, starch, calcium, and thiamine (Brukill, 1997). The juicy pulp of the ripe fruit is eaten fresh as a dessert. The bulbs (excluding the seeds) are rich in sugar, fairly well in carotene and also contain vitamin C (Bhatia *et al.*, 1955). Jackfruit is also rich in nutrients such as sodium, potassium, iron, vitamin B₆, calcium, zinc, and many other nutrients. Jackfruit can lower blood pressure, cure fever and diarrhea. This fruit is also known to be beneficial to fighting asthma, ulcers, indigestion, tension, nervousness and constipation. It can slow down aging and cell degeneration. Jams, beverages, candies, conserves and dehydrated forms are other industrial uses for which the jackfruit can be utilized (Naik, 1949). The present study was designed to see the variation of physical characteristics and biochemical composition of pulp of the three types (*Khaja*, *Ghila* and *Dorasha*) of jackfruit grown in two localities (Valuka and Madhupur) of Bangladesh.

Materials and Methods

The research work was conducted in the laboratory of Department of Biochemistry, Bangladesh Agricultural

University, Mymensingh-2202. For this, mature ripened jackfruits (*Khaja*, *Ghila* and *Dhorasha*) were collected from Valuka and, *Khaja* and *Ghila* from Modhupur. Physical parameters were recorded from the comments of 10 correspondents. Freshly collected jackfruits were stored in the laboratory of Biochemistry department at room temperature. The fruits were opened and the required pulps of fruits were randomly collected and stored in deepfreeze at -20 ± 2 °C temperature. Fresh pulps were used to estimate vitamin C, carotene, pH and titrable acidity. Then the other estimations were done from the stored pulps. Moisture, dry matter, ash contents, titrable acidity, fibre and TSS of pulps of jackfruits were determined by the methods described in the Manual of Analysis of Fruit and Vegetable Products by Ranganna (1979). In addition, pH of pulp was determined by Fischer pH meter. Vitamin C and carotene content of pulps were determined in according to AOAC method (1965). Total sugar and reducing sugar were determined by the anthrone method (Jayaraman, 1981) and dinitrosalicylic acid method (Miller, 1972), respectively.

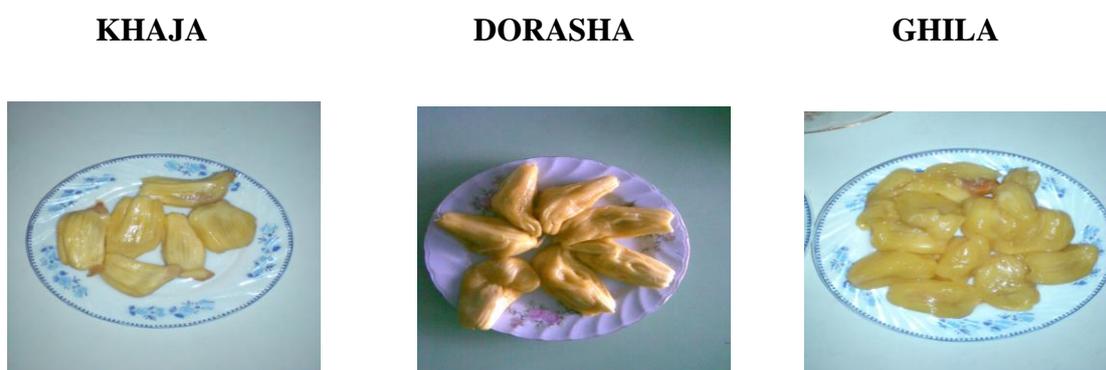


Fig1. Different types of Jackfruits pulps

Results and Discussions

Pulp characteristics

There were differences in colour and texture among the pulps of jackfruits from different locations.

Table 1

Physical parameters of pulps				
Pulp	Texture	colour	Juicyness	Sweetness
Valuka Khaja	firm	Whitish yellow	juicy	Less sweet
Valuka Ghila	very soft	deep yellow	Very juicy	Sweet
Valuka Dorosha	intermediate	light yellow	medium juicy	Medium sweet
Modhupur Khaja	firm	Whitish yellow	juicy	Less sweet
Modhupur Ghila	very soft	deep yellow	Very juicy	sweet

The pulps of *Khaja* (Both Modhupur and Valuka) were firm textured and those of *Ghila* were very soft to soft. Intermediate textures of pulps were observed in case of *Dorasha*. The colour of pulps of *Khaja* fruits were whitish yellow whereas that of *Ghila* pulps were deep yellow. The colour of *Dorasha* pulps were light yellow. The *Khaja*, *Dorasha* and *Ghila* pulps were found less juicy, medium juicy and very juicy, respectively. These observations are close to the statement given by Haque (2001) who studied on 45 germplasms established at Bangladesh Agricultural University, Mymensingh.

Moisture

There was a difference in moisture content of pulp of jackfruits of five types- Valuka *khaja*, Valuka *Ghila*, Valuka *Dorasha*, Modhupur *khaja* and Modhupur *Ghila*. In this regard, highest moisture content was found in Valuka *Ghila* (84.44 %) and lowest in Modhupur *Ghila* (79.62 %) type of jackfruits. The Valuka *Khaja*, Valuka *Dorasha*, Modhupur *Khaja* contains 82.88, 80.04 and 80.95 % respectively. These variations may be due to difference in types and locations. On the other hand, *Dorasha* types of jackfruit had intermediate moisture content (80.04 %). It may be due to the texture of pulp which was intermediate of soft (*Ghila*) and firm (*Khaja*) pulps. These results were found to be closer to findings of Haque (1993) who reported the moisture content of soft, intermediate and firm pericarp were 81.89, 80.02 and 79.65 %, respectively.

Dry Matter

From the Table 2, it was observed that the pulps of Modhupur Jackfruits had greater dry matter content than that of valuka jackfruits. This might be due to the influence of locality and various environmental factors. The highest and lowest dry matter contents were observed in Modhupur *Ghila* (20.38 %) and Valuka *Ghila* (15.56 %), respectively. Valuka *Dorasha* contained 19.96 % dry matter which indicates its intermediate texture of pulp. These results were more or less comparable with the findings of Karim et al. (2008) who reported that the dry matter content ranges from 19.16 to 21.73 %.

Ash

Ash content was highest in Valuka *Dorasha* (1.11%). The ash content of Valuka *Khaja* and *Ghila*, Modhupur *Khaja* and *Ghila* were 0.98 and 1.04, 0.88, and 0.70%, respectively. So those *Khaja* and *Ghila* collected from

Valuka had greater ash content than *Khaja* and *Ghila* from Modhupur and some variation among the different types. These were may be due to difference in texture of pulps and fibre content. The values were closely agreed with those reported by Karim et al. (2008) and Hossain et al. (1979) who mentioned the ash content of the pulp was 1.1 %.

Vitamin C

The Vitamin C content was found to be highest in Valuka *Dorasha* which contained 8.18 mg% Vitamin C. Besides this, Valuka and Modhupur *Khaja* contained 5.20 and 4.57 mg% Vitamin C whereas Valuka and Modhupur *Ghila* contained 7.26 and 7.13 mg% Vitamin C, respectively.

On this context, Vitamin C content of *Khaja* type of jackfruits was lower than that of *Ghila* types of jackfruits. This statement was also found in the findings of Haque (1993) who reported the higher Vitamin C content in Soft pericarp (*Ghila*) than firm pericarp (*Khaja*).

Carotene

Variation in carotene content was also observed. Valuka *Khaja*, Valuka *Ghila*, Valuka *Dorasha*, Modhupur *Khaja*, and Modhupur *Ghila* contained 334.06, 470.91, 380.45, 346.03 and 520.46 µg carotene/100g sample, respectively. It can be stated from the above values that *khaja* types had lower carotene content than *Ghila* types whereas pulps of jackfruit from Modhupur had higher carotene content than that of Valuka types. Highest carotene content was observed in Modhupur *Ghila* (520.46 µg/100g) while lowest in Valuka *Khaja* (334.06 µg/100g). The present results were found to be closer to the findings of Hasan (2002).

Starch

Variation in starch content was observed in both place to place and type to type. Valuka *Khaja*, *Ghila* and *Dorasha*, Modhupur *Khaja* and *Ghila* contained 7.37, 6.11, 7.07, 8.34 and 7.27 % starch, respectively. It was also found that *Khaja* types had higher starch content than *Ghila* types and pulps of jackfruit from Modhupur had higher starch content than that of Valuka types. However, the highest starch content was observed in Modhupur *Khaja* (8.34 %) and lowest in Valuka *Ghila* (6.11 %). The starch content in the pulps was low as the carbohydrates were present in the forms of free sugars. These results were in agreement with that of reported by Coronel (1988).

Table 2

Biochemical parameters of pulp of Jackfruit collected from different growing areas

Sample	Moisture (%)	Dry Matter (%)	Ash (%)	Vit C (mg %)	Carotene (µg/100g)	Starch (%)	pH	Protein (%)	Titrate Acidity (%)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)	TSS (%)	Fibre (%)
Valuka Khaja	82.88	17.12	0.98	5.20	334.06	7.37	6.29	0.57	0.79	13.80	4.92	8.88	20.1	0.55
Valuka Ghila	84.44	15.56	1.04	7.26	470.91	6.11	5.93	0.67	0.91	15.27	7.10	8.17	19.3	0.60
Valuka Dorosha	80.04	19.96	1.11	8.18	380.45	7.07	5.82	0.91	0.64	11.29	4.90	6.39	27.0	0.61
Modhupur Khaja	80.95	19.05	0.88	4.57	346.03	8.34	6.45	0.83	0.46	16.50	7.04	9.46	23.8	0.90
Modhupur Ghila	79.62	20.38	0.70	7.13	520.46	7.27	5.61	0.97	0.61	17.89	8.19	9.70	26.4	0.51

pH

The pH content of Valuka *Khaja*, *Ghila*, *Dorasha*; and Modhupur *Khaja* and *Ghila* were 6.29, 5.93, 5.82; and 6.45, and 5.61 respectively. *Khaja* types contained higher pH values than *Ghila* types. The highest pH value was found in Modhupur *Khaja* (6.45) and lowest in Modhupur *Ghila* (5.61). *Dorasha* type contained intermediate pH value (5.82). The pH of *Khaja* and *Ghila* types varied might be for their difference in chemicals content. Present results showed that the pH of pulp ranged from 5.61 to 6.29. These findings were similar to the reputation by Hossain and Haque (1979).

Protein

Valuka *Khaja*, *Ghila* and *Dorasha*, Modhupur *Khaja* and *Ghila* contained 0.57, 0.67, 0.91, 0.83 and 0.97 % protein, respectively. It was also found that *Khaja* types had higher protein content than *Ghila* types and pulps of jackfruit from Modhupur had higher protein content than that of Valuka types. However, the highest protein content was observed in Modhupur *Ghila* (0.97 %) and lowest in Valuka *Khaja* (0.57 %). Watt *et al.* (1963) conducted an experiment and observed protein content in the edible portion is 1.3 %.

Titration Acidity

Greater titration acidity of pulp was observed in Valuka *Ghila* (0.91 %) whereas the lowest was in Modhupur *Khaja* (0.46%). From the Table-2 it was found that *Khaja* types contained lower titration acidity than *Ghila* types. These were may be due to the difference in texture and chemical contents. It was also found that jackfruit pulps from Modhupur had lower titration acidity than that of Valuka. It was also may be due to change in location and influence of environmental factors. Intermediate value was found in *Dorasha* which was 0.64%. The present results were found to be closer to the findings of Bhatia *et al.* (1955) and Hasan (2002).

Total sugar

Location and type influenced the total sugar content of the pulps. Valuka *khaja* and *Ghila* contained 13.80 and 15.27 % total sugar respectively while Modhupur *Khaja* and *Ghila* contained 16.50 and 17.89 % respectively. Higher total sugar content was observed in jackfruit pulps from Modhupur than those of Valuka types. Higher total sugar content was found in *Ghila* types than *Khaja* types. Lowest total sugar content was found in Valuka *Dorasha* (17.89%) which was might be due to variation in types. The values were in agreement with those reported by Haque (1993) for soft, intermediate and firm types of jackfruit pulps (16.25 %, 15.05 % and 13.23 %, respectively).

Reducing sugar

The percent reducing sugar content was also influenced by types and locations. Higher reducing sugar content was found in *Ghila* types than *Khaja* types. The same

difference was observed in case of the fruits from Modhupur than that of Valuka type. On the contrary, Lowest reducing sugar content was found in *Dorasha* type of jackfruit (4.90%). The reducing sugar content of Valuka *Khaja* and *Ghila*, Modhupur *Khaja* and *Ghila* were 4.92 and 7.10, 7.04 and 8.19 %, respectively. These results were in agreement with the values reported by Haque (1993) who had made an investigation on very soft, intermediate and firm types of jackfruit pulps and found 7.44, 8.03 and 7.04 % reducing sugar, respectively.

Non-reducing sugar

Highest non-reducing sugar content was found in the Modhupur *Ghila* (9.7 %) while the lowest in Valuka *Dorasha* (6.39%). The non-reducing sugar content of Valuka *Khaja*, Valuka *Ghila*, and Modhupur *Khaja* were 8.88, 8.17 and 9.46%, respectively. The jackfruit pulps of Modhupur had higher non-reducing sugar content than that of Valuka types. These results were more or less close to the values obtained by Haque (1993) who had reported the non-reducing sugar content in very soft, intermediate and firm were 8.81, 6.81 and 6.28 % respectively.

Total Soluble Solids

There were variations in total soluble solids of pulp of different types and of its locations. A highest total soluble solid was found in Valuka *Dorasha* (27.0 %) whereas the lowest was in Valuka *Ghila* (19.3 %). Jackfruit pulps from Modhupur contain greater total soluble solids than that of Valuka. It might be due to place difference. Haque (1991) studied with 32 selected jackfruits and reported that total soluble solids in pulps in the range of 14 to 21.5% which agreed with the present findings for most of the values. The values beyond the range might either due to harvesting time or place.

Fibre

There were slight variations in fibre content among the jackfruit pulps. The fibre content was more or less in the range of 0.50 to 0.65 % but exception one was observed in Modhupur *khaja* which contained 0.90 % fibre. The fibre content of Valuka *khaja*, *Ghila* and *Dorasha* and Modhupur *Ghila* pulps were 0.55, 0.60, 0.61 and 0.51 % respectively. These were may be due to the differences in composition of pulps. The results were more or less close to the findings reported by Coronel (1988).

Conclusion

The present investigation was carried out to analyze the physical characteristics and biochemical composition of pulp of jackfruits (*Khaja*, *Dorasha* and *Ghila*) collected from different locations. From the study it was concluded that the proximate composition of jackfruit pulps is influenced by both type and place.

Finally, this information would be helpful for selecting the best quality jackfruit in food preparation and preservation.

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