



Mineral Composition and Antioxidant Profile of Jackfruit (*Artocarpus heterophyllus* Lam.) Seed Flour

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ABSTRACT

Jackfruit is a tropical and highly seasonal fruit. It is largest tree borne fruit in the world. Jackfruit consists about 29 per cent pulp, 54 per cent rind and 12 per cent seeds by weight. Seeds of jackfruit are edible and known to possess nutritional property. Jackfruit seed flour is utilized for value addition of food products and also as a source of starch. The present study was undertaken to investigate mineral composition and antioxidant profile of jackfruit seed flour. Hard variety of jackfruits were procured from a single tree situated at University of Agricultural Sciences, Dharwad campus. Ripe fruits were cut, seeds separated, dried and milled to flour. Jackfruit seed flour was analyzed for macro-minerals such as calcium, phosphorous, magnesium; micro-minerals such as iron, copper, zinc, manganese and antioxidants like phenols and tannins. Results indicated that calcium content of jackfruit seed flour was 234.24 ± 0.02 mg/100 g. Phosphorous and magnesium content was 105.93 ± 0.03 mg/100 g and 162.51 ± 0.02 mg/100 g respectively. Iron content in jackfruit seed flour was 12.55 ± 0.03 mg/100 g. Copper, zinc and manganese content was 4.25 ± 0.03 mg/100 g, 2.03 ± 0.02 mg/100 g and 2.02 ± 0.03 mg/100 g respectively. Phenolic content in jackfruit seed flour was 4.52 ± 0.01 mg gallic acid equivalent/g and tannin content was 2.12 ± 0.01 mg tannic acid equivalent/g. The study revealed that jackfruit seed flour is a good source of minerals and antioxidants. Hence consumption of jackfruit seeds and utilization of its flour needs to be enhanced.

KEY WORDS: Jackfruit seed, flour, micromineral, micromineral, antioxidants.

INTRODUCTION

Jackfruit (*Artocarpus heterophyllus* Lam.) is a largest tree-borne and highly seasonal fruit consisting about 29 per cent pulp and 54 per cent rind. Seeds make up to 12 per cent (Berry and Kalra, 1988) of total fruit weight. Jackfruit seeds are edible and are boiled or roasted for direct consumption or used in culinary preparation namely; *curry*, *bhaji*, *cutlet* etc. Though seeds are consumed and utilized but most of the time they are discarded/wasted or spoiled rapidly due to high moisture content. However, seeds are nutritious and can be converted to flour for better utilization and storage stability. Jackfruit seed flour contain moisture (11 - 14 %),

carbohydrates (60 - 70 %), crude protein (9 - 12 %), fat (1 %), crude fiber (2 - 3 %), total mineral matter (2 - 3 %) and calorific value of 320 - 360 kcal/100 g (Airani, 2007; Gupta *et al.*, 2011; Islam *et al.*, 2015). Seed flour is also used for value addition in traditional and novel products.

Nutrition plays an important role in maintaining good health. Micro nutrients like vitamins and minerals are protective nutrients essential in growth, development and maintaining good health. Antioxidants are non-nutritive substances that prevent oxidative damage by free radicals and reactive oxygen species. Dietary phenolic compounds, tannins and flavonoids exhibit



antioxidant activity (Araceli *et al.*, 2003). Hence, the present study was undertaken with the objective to analyze mineral composition and antioxidant profile of jackfruit seed flour.

MATERIALS AND METHODS

Hard variety of jackfruits were procured from a single tree situated at University of Agricultural Sciences, Dharwad campus. Ripe fruits were cut and seeds were separated. Jackfruit seeds were chopped uniformly, dried in a hot air oven at 45 °C until consecutive weights were constant. Dried seeds were milled to flour (Airani, 2007). Jackfruit seed flour analyzed for minerals and antioxidants.

Calcium estimation was carried out by titrimetric method (Oser, 1965), phosphorous was estimated colorimetrically (Ranganna, 1986), magnesium was estimated by ethylenediaminetetraacetic acid (EDTA) titrimetric method (Derderian, 1961). Microminerals (iron, zinc, copper and manganese) were estimated by wet digestion using triacid mixture (Anon., 2000). Total phenol estimation was carried out with the Folin - Ciocalteu reagent (FCR). Gallic acid was used as the standard and results were expressed as gallic acid equivalent (Anon., 2000). Tannins were estimated calorimetrically using Folin - Denis reagent (FDR). Tannic acid was used as the standard and results were expressed as tannic acid equivalent (Schander, 1970). All the analyses were carried out in triplicates and results were expressed as Mean \pm Standard Deviation (S.D.).

RESULTS AND DISCUSSION

Mineral composition of jackfruit seed flour

Minerals are inorganic substances, present in all body tissues and fluids. Although they yield no energy, they play important roles in many activities in the body (Soetan *et al.*, 2010). Calcium, phosphorous and magnesium are essential for carbohydrate metabolism, bone and teeth formation, enzyme activity and regulating the acid-alkaline balance in the body (Scarlbet, 1991 and Brody, 1994). Iron is essential nutrient for blood formation (Kittiphoom, 2012). Copper is involved in iron

metabolism. Manganese is a cofactor in several enzymes whereas zinc is essential part in more than 100 enzymes involved in energy metabolism (Huskisson *et al.*, 2007).

Mineral composition of jackfruit seed flour is presented in Table 1. Calcium content of jackfruit seed flour was 234.24 ± 0.02 mg/100 g. Phosphorous and magnesium content was 105.93 ± 0.03 mg/100 g and 162.51 ± 0.02 mg/100 g respectively. Iron content in jackfruit seed flour was 12.55 ± 0.03 mg/100 g. Copper, zinc and manganese content was 4.25 ± 0.03 mg/100 g, 2.03 ± 0.02 mg/100 g and 2.02 ± 0.03 mg/100 g respectively. Similar values for phosphorous (139.00 mg/100 g), magnesium (150.70 mg/100 g), copper (3.16 mg/100 g) and zinc (1.50 mg/100 g) in jackfruit seed was reported by Abedin *et al.* (2012). Ocloo *et al.* (2010) reported that jackfruit seed flour was rich in calcium (308.7 mg/100 g), magnesium (338.0 mg/100 g) and copper (1.04 mg/100 g). Banerjee and Datta (2015) recorded 13.07 mg iron and 1.45 mg copper per 100 g of jackfruit seed flour. Calcium, magnesium, iron, copper and manganese content in jackfruit seed flour was 166.10, 295.10, 1.30, 2.50 and 4.20 mg/100 g respectively (Okafor *et al.*, 2015). The difference observed may be attributed to the analytical methods used for estimation, the variety of jackfruit and the geographical location of the plant. Jackfruit seed flour is good source of minerals and hence has better nutritional value.

**Table 1 Mineral composition of jackfruit seed flour**

Minerals		(mg/100 g)
Macro minerals	Calcium	234.24 ± 0.02
	Phosphorous	105.93 ± 0.03
	Magnesium	162.51 ± 0.02
Micro minerals	Iron	12.55 ± 0.03
	Copper	4.25 ± 0.03
	Zinc	2.03 ± 0.02
	Manganese	2.02 ± 0.03

Mean ± S.D.

Phenols and tannins content of jackfruit seed flour

Phenols and tannins are the phytochemicals present in plant. They provide protection against cancer, cardiovascular disease, dementia, cataract, muscular degeneration, ageing and various other disorders associated with increased oxidative stress (Sirisha *et al.*, 2014). These phytochemicals act antioxidants which intercept free radicals and protect the cells from the oxidative stress (Nuttall *et al.*, 1999).

Phenols and tannins content of jackfruit seed flour are presented in table 2. Phenolic content in jackfruit seed flour was 4.52 ± 0.01 mg GAE/g and

tannin content was 2.12 ± 0.01 mg TAE/g. Similar result for phenolic content of 4.42 mg GAE/g in jackfruit seed flour was reported by Gat and Ananthanarayan (2015). Nair *et al.* (2012) reported that total phenolic and tannin content of jackfruit seed extract was 4.06 mg GAE/g and 1.98 mg GAE/g respectively. A strong relationship between phenolic content and antioxidant activity in fruits and vegetables has been reported (Odukoya *et al.*, 2005). Thus, the presence of phenols and tannins in jackfruit seeds add to its nutritional value and health benefits.

Table 2 Phenols and tannins in jackfruit seed flour

Phenols (mg GAE/g)	Tannins (mg TAE/g)
4.52 ± 0.01	2.12 ± 0.01

Mean ± S.D.

GAE – Gallic acid equivalent, TAE – Tannic acid equivalent

CONCLUSION

Jackfruit seed flour is a good source of nutrients like minerals and non-nutritive substances like antioxidants. Minerals and antioxidants play a vital role for growth, development and in maintaining good health. Even though jackfruit seeds are nutritious, most of the times they are wasted/discarded or spoiled rapidly. Therefore, consumption of jackfruit seeds and utilization of its flour at household and commercial level needs to be enhanced to improve nutritional security and gain better health benefits.

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