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Determination of total antioxidant capacity, phenols and flavonoids in jack fruit seed flour

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Abstract

Introduction: Plant products are considered to be the most important components of diet for a good health. (Deepika Gupta *et al.*, 2011). Jackfruit seeds are eaten as boiled or roasted but less popular as vegetable. The main objective of the study was to assess total antioxidant, phenols and flavonoid content of jack fruit seeds (germinated and non-germinated).

Materials and methods: Jack fruit are seasonal fruits which provide health and nutritional benefits. Ripen fresh jackfruits were bought from the local markets of Coimbatore. The seeds were separated from the pulp. Germination was carried out by soaking the seeds in water for 24 hours and hanging them to develop sprouts. Both germinated and non-germinated seeds were dried in sunlight, powdered and stored. Water extract of the seed flours (germinated and non-germinated) were prepared for analysis of total antioxidant capacity (Phospho molybdate method), Total phenols (Folin – Ciocalteu assay), Total Flavonoids (Aluminium chloride method)

Results: The quality analysis of the germinated and non-germinated jack fruit seeds showed that the antioxidant, phenol and flavonoids content of seeds increased significantly due to germination. The total antioxidant content of the non-germinated seeds was 14 mg/g and germinated seeds was 41 mg/g. The phenolic content of non-germinated and germinated seeds were 104 mg/g and 148 mg/g respectively. Regarding flavonoids in non-germinated seeds it was found to be 102 mg/g and in germinated seeds as 403 mg/g.

Conclusion: On comparing the non-germinated and germinated jack fruit seeds, maximum potency of the functional components was observed with germinated seeds. This signifies that the germination process improves the functional properties of the seeds.

Keywords: *Artocarpus heterophyllus* LAM, germination, seed flour, antioxidant capacity, phenols, total flavonoids.

1. Introduction

Fruits and vegetables have been shown to exert a protective effect. Jackfruit (*Artocarpus heterophyllus* LAM.) belongs to the family Moraceae, is a fairly large sized tree and bears the largest fruit among the edible fruits. (Shadab Butool *et al.*, 2013) ^[1]. The seeds are also rich source of carbohydrates and proteins and good source of fibre and vitamins. (Albi Abraham, 2014) ^[2]. Jackfruit seeds have considerable antioxidant capacity and high phenol content. (Soong YY, 2004) ^[3]. The study was conducted with the objective to analyze Total antioxidant capacity, phenols and flavonoids of germinated and non-germinated jack fruit seed flour.

2. Methodology

2.1. Selection and procurement of fruit

Jackfruit is an ancient fruit that is widely consumed as a fresh fruit. Fully ripened, fresh jackfruit was purchased from a local market in Coimbatore district, Tamil Nadu, India.

2.2. Processing of seed flour

After collection of fresh jackfruit, the seeds were separated from pulp and skin. Seed coat and thin brown layer was peeled and washed thoroughly. For germination, seeds were soaked in water for 24 hours and tied in a muslin cloth and sprinkled with water frequently for two weeks. Both germinated and non-germinated seeds were sliced and dried under sunlight. The dried pieces were powdered and stored in polyethylene pouches for further analysis.

2.3. Preparation of extract

Extract was prepared by dissolving the germinated and non-germinated jackfruit seed powders in 20 ml distilled water respectively. The mixture was kept in shaker for 24 hours, filtered and stored in freezer (-4C)

2.4. Determination of total antioxidant capacity

Antioxidants are naturally occurring or synthetic chemicals in food that help to counter the detrimental effects of reaction oxygen species (ROS) and free radicals which causes degenerative human diseases such as cancer, heart diseases and cardiovascular diseases (Wresburger, 2002) [4]. The Phosphomolybdate method is quantitative, since the total antioxidant capacity is expressed as α -tocopherol equivalents. 2ml of the extract was added to reaction mixture (0.6M sulphuric acid, 28 mMol sodium phosphate, 4 mMol ammonium molybdate) and incubated at 95°C and cooled. The absorbance of the aqueous solution is measured at 695nm against blank using UV spectrophotometer.

2.5. Estimation of Total Phenolic content

Phenolics or polyphenols have received considerable attention because of their physiological functions, including antioxidant, antimutagenic and antitumor activities. (Nagai *et al.*, 2003) [5]. 1ml of extract was added to 1ml of freshly prepared Folin's ciocalteau reagent. Exactly after 4 mins 20% sodium carbonate was added. The prepared seed extracts react with phosphomolybdic acid in Folin-ciocalteau reagent and sodium carbonate, produces blue coloured complex (molybdenum blue) which are determined spectroscopically at approximately 725 nm (Swain, 1959; Thaipong, 2006) [6, 7].

2.6. Determination of total flavonoids

Flavonoids have health-promoting properties due to their high antioxidant capacity in both in vivo and in vitro systems (Yao *et al.*, 2004) [9]. 1ml of extract was added to 0.1ml of 10% ALCL3 and 1ml of Potassium acetate. Aluminium chloride forms acid labile complexes with the ortho-dihydroxyl groups in the A-or B-ring of flavonoids. The total content was diluted with 2.8ml of distilled water. The mixture was then incubated at room temperature for 30 minutes. Absorbance of the mixture was measured using spectrophotometer at 415nm (Douglas, 2012) [8]

3. Results

3.1. Determination of Total antioxidant capacity

Antioxidants in the diet play an important role in maintaining endogenous antioxidants for the neutralization of oxidative stress. (Pham-Huy *et al.*, 2008) [10]. Total antioxidant capacity of the germinated and non-germinated jack fruit seeds was estimated through phosphomolybdate method. The results pertaining to the analysis were presented in the table – 1.

Table 1: Determination of Total Antioxidant Capacity

| S. No. | Seed | Total Antioxidant Capacity (mg/g) |
|--------|----------------|-----------------------------------|
| 1 | Non-germinated | 14 |
| 2. | Germinated | 41 |

The Total antioxidant capacity of germinated and non-germinated jack fruit seed was 41mg/g and 14mg/g respectively. Overall, the antioxidant capacity of Jack fruit seed increased after germination.

Total antioxidant content of jack fruit seeds as estimated by Kamath *et al.*, [12] revealed that the acetone extract of the seeds had 9.84 mg/g activity. Another study conducted by Shrikanta *et al.* in hydroethanolic extract of jack fruit seeds resulted that the seeds had 0.19 mM GAE/g of extract. The difference in the reported study and present study may be due to the usage of variant extracts. The present study also provides additional data on germinated variation.

3.2. Estimation of Total phenolic content:

Phenols have been reported to be a potential source to combat free radicals, which are harmful to our body and foods systems (Nagai *et al.*, 2003) [5]. Folin Ciocalteau method was used to estimate the amount of phenols in germinated and non-germinated seeds of jack fruit. The results of the analysis was tabulated in table – 2.

Table 2: Estimation of Total Phenolic content

| S. No. | Seed | Total Phenols (mg/g) |
|--------|----------------|----------------------|
| 1 | Non-germinated | 104 |
| 2. | Germinated | 148 |

The Total phenolic content of non-germinated and germinated jack fruit seeds was found to be 104mg/g and 148mg/g respectively.

Estimation Phenolic content in acetone and dichloromethane: methanolic extracts of jack fruit seeds was conducted. The results are 1.45 μ g GAE/ mg extract and 2.12 μ g GAE/ mg extract. (Gupta, 2011) [13]. Similar study evaluating the phenolic content of jack fruit seeds in acetone extract provided the result as 1.26 mg/g (Kamath, 2015) [12]. The difference in the phenolic content can be attributed to the usage of different solvents in the extract preparation. This signifies that the jack fruit seeds has high potency in aqueous solvent.

3.3. Determination of total flavonoids

Flavonoids comprise a large group of polyphenolic compounds that are characterized by a benzo-y-pyrone structure, which is ubiquitous in vegetables and fruits (Yao *et al.*, 2004) [9]. Flavonoid content of the jack fruit seeds was estimated using aluminium chloride method and the results were presented in table – 3.

Table 3: Determination of Total Flavonoids

| S. No. | Seed | Total Flavonoids (mg/g) |
|--------|----------------|-------------------------|
| 1 | Non-germinated | 102 |
| 2. | Germinated | 403 |

The Total Flavonoid content of jack fruit seed increased tremendously after germination being 403mg/g. Flavonoid content was found to be lesser in non-germinated jack seed (102mg/g).

Acetone and dichloromethane: methanolic extract of jack fruit seeds were estimated for total flavonoid content. The flavonoids content was 290 μ g / mg extract and 457 μ g / mg extract respectively (Gupta, 2011) [13]. Additionally, total flavonoid content in acetone extract of jack fruit was estimated and it was 0.61 mg CE / g. (Shrikanta, 2013). The difference in the values may be due to the adaption of different methods for estimation and different solvents for extraction.

4. Conclusion

Jack fruit is an ancient fruit that is widely consumed as a fresh fruit. Jack seed is used as a natural ingredient because of low cost and comprised of other health promoting properties. Germination of the seed improved its functional components significantly. Jack fruit seeds is reported to poses medicinal properties such as antifungal capacity, immunomodulatory effect and antibacterial effect. Thus, the germinated seeds can be utilized in the formulation of pharmaceutical products which may improve the potency of the drug.

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