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Phytochemical screening, proximate and vitamin composition of Jack fruit (*Artocarpus Heterophyllus*) pulp and seed

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Abstract

The potential health benefits of plant are determined by the level of phytochemicals, proximate, minerals and vitamin composition of the plant material. The study was carried out to determine the phytochemical composition, proximate and vitamin content of Artocarpus heterophyllus pulp and seeds. The results revealed that Artocarpus heterophyllus is rich in phytochemicals such as Saponins, Alkaloid, Cardiac Glycoside, Phlobatannins, Terpenes, Steroids and Deoxy-Sugar. Proximate composition analysis indicated that the pulp has higher moisture, protein and lipid content, while crude fibre and carbohydrate were higher in the seed. The fruit pulp contained a greater percentage of vitamins A and C compared to the seeds. These phytochemicals, proximate composition, and vitamins offer numerous health benefits, suggesting that the consumption of jack fruit pulp and seeds may help in alleviating various health challenges.

Keywords: Phytochemical; Proximate; Vitamin; Jack fruit

1. Introduction

Jack fruit (*Artocarpus heterophyllus*) is a species of tree in the *Moraceae*, originating in the region between the Western Ghats of southern India, Sri Lanka and the rainforests of Malaysia, Indonesia and the Philippines. Widely cultivated throughout tropical regions, it bears the largest fruit of all trees, reaching up to 55 kg in weight, 90 cm in length, and 50 cm in diameter (Berry, 1988).

A mature jack tree produces at least 200 fruits per year, with older trees bearing up to 500 fruits annually. The jackfruit is a multiple fruit composed of hundreds to thousands of individual flowers, and the fleshy petals of the unripe fruit are consumed. (Ong et al., 2006; Saxena *et al*., 2009). When ripe, the fruit is sweet (depending on the variety) and is often used for desserts. Canned green jackfruit has a mild taste, and the pulp has a meat-like texture, earning it the label of "vegetable meat" (Ong *et al*., 2006).

Phytochemicals, which is a bio-active chemicals components of plants, are considered as secondary metabolites, synthesized naturally in all parts of the plant body (Akpabio *et al*., 2012a; Akpakpan *et al*., 2017). Hence, any part of the plant body may contain these bioactive components. Phytochemicals are divided into two groups, primary and secondary constituents, based on their functions in plant metabolism. Primary constituents include common sugars, amino acids, proteins and chlorophyll while secondary constituents consist of alkaloids, terpenoids and phenolic compounds, flavonoids, tannins etc. (Aluko *et al*., 2012). The medicinal values of plants lie in these bioactive phytochemical constituents that produce definite physiological actions in the human body (Anderson, 2004). Phytochemicals accumulate in different part of the plants, such as in the roots, stems, leaves, flowers, fruits, nut and seeds (Costa *et al*, 1999 Akpabio *et al*., 2012b; Akpakpan *et al*., 2020).

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Plants possessing therapeutic properties or exerting beneficial pharmacological effects on the human body are generally termed "medicinal plant". It is now established that plants naturally synthesizing and accumulating secondary metabolites and vitamins possess medicinal properties (Sofowora, 1993). Medicinal plants have been used for therapeutic purposes by human beings since time immemorial to combat health challenges. Bioactive constituents have been reported from plant juice, this phyto juice can protect human beings against diseases (Doughari, 2012). It is pertinent to state that, as much as they help strengthen the body defense mechanism, moderate consumption is highly recommended to prevent them from serving as anti-nutrients to the body (Ifemeje, *et al*., 2014).

2. Material and methods

2.1. Sample Collection and Preparation

The Jack fruit sample was collected from Uyo, Akwa Ibom State, Nigeria, and was identified by a taxonomist in the Botany Department at the University of Uyo.

2.2. Extraction method

In the extraction process, the fruit pulp and seeds were ground using an electric blender. The phytochemicals in the pulp were extracted with ethanol.

2.3. Phytochemical Analysis

The phytochemical analysis of Jack fruit pulp and seed extract was conducted. This encompassing tests for alkaloids, saponins, glycosides, tannins, steroid, terpenes, flavonoids, deoxy-sugar, phlobatannins and Anthraquinones. Standard methods from the Association of Official Analytical Chemistry (A.O.A.C. 2009) was employed for analyzing the bioactive components in the fruit pulp and seed extract.

2.4. Test for Terpenes / terpenoids (Salkowski test)

About 5 ml of pulp or seed extract was mixed with 2 ml of chloroform. Concentrated H_2SO_4 (3 ml) was carefully added to form a layer. A reddish-brown colouration at the interface indicated positive results for the presence of terpenoids.

2.5. Test for cardiac glycoside

For the test for cardiac glycosides, 0.5 g of the pulp or seed extract was dissolved in 2 ml of chloroform. Concentrated sulphuric acid was then carefully added to form a lower layer. A reddish-brown colouration at the interface confirmed the presence of a steroidal ring of cardiac glycoside.

2.6. Test for anthraquinone

About 2.5 g of pulp or seed extract were boiled with 5 ml of 10% sulphuric acid and filtered. The filtrate was shaken with 2.5 mL benzene. The benzene layer separated, and 10 % ammonium hydroxide (NH_4OH) was added. A rose-pink colouration in ammonia phase (lower phase) indicated the presence of anthraquinone.

2.7. Test for alkaloids

About 0.5g of each sample was stirred with 5 ml (1%) HCl on a steam bath, then filtered. 1 ml of the filtrate was treated with a few drops of Dragendroff's reagent. Turbidity or precipitation was taken as evidence of the presence of alkaloids.

2.8. Test for saponins

The test for saponins involved shaking Jack fruit pulp and seed in aqueous solutions with water in a test tube. Frothing that persisted on warming served as evidence for the presence of saponins

2.9. Test for flavonoids

About 2 ml of 2 % NaOH was added to crude pulp or seed extract. When it turned intense yellow, a few drops of an acid were added and it turned colourless indicating the presence of flavonoids.

3. Results

The results of phytochemical composition of the Jack fruit pulp extract are presented in Table 1 while that of the seed extract are presented in Table 2.

Table 1 Phytochemical composition of Jack fruit pulp

Test	Observation	Inference	Intensity
Saponins			
(i) Frothing Test	Stable foam formed	Saponin present	++
(ii)Fehling Solution Test	Pink precipitate observed	Saponin present	+++
(iii)Fehling test + Na_2CO_3 test	Brownish precipitate observed	Saponin present	+++
Alkaloid			
Drangendoff's test	Red precipitate formed	Alkaloid present	+++
Flavonoids			
Magnesium metal test	No Effervescence occurs No formation of an orange, red or crimson colour	Flavonoids absent	+
Cardiac Glycoside			
Salkowski Test	No reddish brown at the interface rather greenish colour was observed	Cardiac glycoside absent	++
Phlobatannins			
Formaldehyde, HCl Test	A bulky precipitate formed	Phlobatannins present	+++
Antraquinones	No pink, red or violet colouration in the ammoniacal phase	Antraquinones absent	-
Terpenes and Steriods			
(i)Acetic Anhydride Test	Bluish-green interface observed	Terpenes absent Steriods present	- ++
Deoxy-Sugar			
(i) Glacial acetic acid Test	Violet ring observed at the interface	Deoxy–sugar present	+++

Table 2 Phytochemical constituents of ethanol extract of Jack fruit seed

Test	Observation	Inference	Intensity
Saponins			
(i) Frothing test	Stable foam formed	Saponin present	++
(ii) Fehling Solution Test	Pink precipitate observed	Saponin present	+++
(iii) Fehling test +Na_2CO_3 test	Brownish precipitate observed	Saponin present	+++
Alkaloid			
Drangendoff"s test	Red precipitate formed	Alkaloid present	+++
Mayer test		Alkaloid present	++
Flavonoids			
Magnesium metal test	Effervescence occurs, and orange colour formed	Flavonoids present	++
Cardiac Glycoside			
Salkowski test	reddish brown observed at the interface	Cardiac glycoside present	+++
Terpenes and Steriods			
(i) Acetic anhydride test	Bluish green interface observed	Terpenes absent Steriods present	- ++
Deoxy-Sugar			
(i) Glacial acetic acid Test	Violet ring observed at the interface	Deoxy–sugar present	+++

Table 3 Proximate composition of Jack fruit pulp and seed

Proximate composition	Pulp (%)	Seed (%)
Moisture content	64.93	30.16
Crude fibre	3.00	3.90
Ash	1.00	0.16
Protein	10.03	7.16
Lipid	1.49	4.37
Carbohydrate	19.59	51.65

Table 4 Vitamins composition of Jack fruit pulp and seed

	Pulp (mg/L)	Seed (mg/L)
Vitamin C	122.00	0.150
Vitamin A	27.00	18.72

4. Discussion

The results indicated the presence of some phytochemicals such as alkaloids, saponins, phlobatannins, and Deoxy-sugar, in the fruit pulp. Alkaloids, have various pharmacological activities, included antihypertensive effects (many indole alkaloids), antimalarial activity (quinine), and anticancer actions (dimeric indoles, vincristine, vinblastine) (George, 2010). Some alkaloids like caffeine, nicotine and morphine were known for their stimulant properties and use as analgesics. The ethanol extract of Jack fruit pulp showed a high intensity of alkaloids suggesting potential therapeutic benefits for related illnesses.

The present of saponins in the pulp extract and seed indicated possible uses for treating hyperglycaemia, blood purification, hypertension (Fahey, 2005), and might also have cholesterol binding properties, haemolytic activities (Okwu, 2004), wound healing properties and treatment of bleeding (Okwu, 2004).

The presence of flavonoids suggested that the fruits can be used as an anti- inflammatory agent (Ekwueme *et al*., 2015) and for preventing damage caused by free radicals in the body (Dweck and Mitchell, 2002). Flavonoids also have some potential applications in treating diarrhoea (Schuier *et al.*, 2005), reducing fever (antipyretic), relieving pain (analgesic) inhibiting spasm (spasmolytic) and anticancer activities. Flavonoids exhibit dramatic effects on immune and inflammatory cells. The presence of Cardiac Glycoside implies that jack fruit can help to solve heart problems.

The results of proximate composition of Jack fruit pulp and seed presented in Table 2 revealed that the moisture content, ash content, and protein content were higher in the pulp compared to the seed. The seed, on the hand had a higher percentage of crude fibre, lipid and carbohydrate. Higher moisture content usually affects the shelf life of the plant materials. Plant material with higher moisture content spoil faster than those with lower moisture content (Ekpo *et al*.,2012).

The crude protein content of the pulp was similar to that of *cassia hirsute* seeds (10.50%) but lower than that of Almond seed. The Carbohydrate content of the seed (51.65 %) was higher than that of Almond seed but comparable to that of *cassia hirsute* seeds (52.80%) reported by Akpabio *et al*. (2012) and Akpakpan and Akpabio (2012). The crude fibre content was higher than those of common edible seeds such as peanut (2.9%) and *Vigna unquiculata* (1.9%) (Etokakpan, 1983). Diets with high fibre contents is undesirable as it can cause constipation (Akpabio *et al*., 2012). The lipid content of the pulp was lower than that of *Vigna unquiculate* 2.5%, while that of the seed was higher than that of *Vigna unquiculate* 2.5%, reported by Etokakpan, (1983).

Vitamins are essential for bodily functions such as helping to fight infection, wound healing, making our bones strong and regulating hormones (Taraj, *et al*., 2021) Vitamins and minerals can cause toxicity if consumed in large amounts (Martirosyan, 2015). Vitamin C, also known as ascorbic acid, is necessary for the growth, development and repair of all body tissues. It's involved in many body functions, including formation of collagen, absorption of iron, the proper functioning of the immune system, wound healing, and the maintenance of cartilage, bones, and teeth. Vitamin C has an important role in the maintenance of a healthy immune system and its deficiency causes immune insufficiency and multiple infections (Kalokerinos *et al*., 2005; Martirosyan, 2015). Jack fruit pulp contain greater amount of vitamin C, and A, hence it can serve as a good source of these vitamins.

5. Conclusion

This research evaluates the phytochemical composition, proximate and vitamin contents in Jack fruit seed and pulp. The proximate composition analysis revealed that the fruit contains appreciable amount of crude protein, fibres, carbohydrate and lipid. The pulp sample has higher percentage of vitamin A and C, and both pulp and seed have varying intensity of some phytochemicals. Hence Jack fruit seed and pulp should be eaten as a supplement for these nutrients and its can also be eaten to harness some sickness in rural communities since it contains good percentage of vitamin and some phytochemicals.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors have declared that no competing interest exist.

References

[1] A.O.A.C.(2009). Official Methods of Analysis, 15th edition. Association of Official Analytical Chemists

[2] Akpabio, U. D. Akpakpan, A. E. and Enin Godwin N. (2012). Evaluation of Proximate Compositions and Mineral Elements in the Star Apple Peel, Pulp and Seed. Journal of Basic and Applied Scientific research 2(5) 4839-4843.

[3] Akpabio, U. D., Udo, U. E. and Akpakpan, A. E. (2012). Evaluation of Phytochemical, proximate and mineral element composition of stem of costus after (Bush cane). Asian Journal of Plant Science and Research, 2(5): 607-612.

[4] Akpabio, U. D., Wilson, L. A., Akpakpan, A. E and I. B. Obot (2012). Phytochemical Screening and proximate composition of Cassia hirsute seeds. Elixir Journal of Applied Chemistry 8704-8707.

[5] Akpabio, U. D., Wilson, L. A., Akpakpan, A. E and I. B. Obot (2012). Phytochemical Screening and proximate composition of Cassia hirsute seeds. Elixir Journal of Applied Chemistry 8704-8707.

[6] Akpakpan, A. E. Uwanta, Emaime J. Akpan, Patrick E. and. Owen, Aniekan E (2020). Phytochemical screening and analytical assessment of acid-base indicator properties of red and white kola nuts extracts. Asian Journal of Advances in Research 3(1): 1-7

[7] Akpakpan, A. E., Ukpong, E. J., Odiongenyi, A. O. and I. E. Willie (2017) Phytochemical Screening of the Ethanol and Aqueous Extracts of Dicliptera verticillata Leaves. Archives of Current Research International, 11(2): 1-5.

[8] Aluko, B. T., Oloyede, O. I. and Afolayan, A. J. (2012). Phytochemical and nutrient compositions of the leaves of ocimum canum sims. African Journal of Biotechnology 11(63):12697-12701.

[9] Anderson, G. D. (2004). Phytochemical. Dynamic Chiropractic, in K. T., Chungs I. Weichang and M. G. Johnson, Are tannins a double edge sword in biology and health? Trends in food Science Technology, 4, 168-175.

[10] Berry, S. K, and Kalra, C. L. (1988). Chemistry and technology of jackfruit (Artocarpus heterophyllus) – A review. Ind Food Pack 42 (3), 62 – 76

[11] Costa, M. A, Zia, Z.Q, Davin, L. B., Lewis, N. G. (1999). Phytochemicals in Human Health Protection, Nutrition, and Plant Defense. Recent Advances in Phytochemistry 33: 67-87

[12] Dweck AC, Mitchell D (2002). Emblica officinalis [Syn: Phyllanthus Emblica] or Amla: The Ayurvedic wonder. Chesham Chemicals Ltd. London.

[13] Ekpo, F. E., Asuquo, M. E., and Uwanta, E. J. (2012). Comparative study of nutrient and anti-nutrient content of Gnetum africanum (Afang) and Heinsia crinita (Atama). Global Journal of Pure and Applied Sciences, 18(1/2), 37-41.

[14] Ekwueme, F.N., Nwodo O. F. C., Joshua, P.E. Nkwocha, C., Eluka, P.E. (2015) Qualitative and Quantitative Phytochemical Screening of the Aqueous Leaf Extract of Senna mimosoides : Its Effect in in vivo Leukocyte mobilization induced by inflammatory stimulus. International Journal of Current Microbiology and Applied Sciences 4 (5):1176-118

[15] Etokakpan, O. U. (1983). Chemical Evaluation of effect of past infection on the Nutritive value of vigna unguiculata (cowpea). Food Chemistry Journal, 12: 146-149.

[16] Fahey, J.W. (2005). Moringaoleifera: A review of the medical evidence for its nutritional, therapeutic, and prophylactic properties. Trees Life Journal, 15(1):1-15.

[17] George, N. J., Obot, I. B, Ikot, A. N, Akpan, ,A. E., Obi-Egbedino, N. O.(2010). Phytochemical and Antimicrobial Properties of Leaves of Alchonea Cordifolia. E-Journal of Chemistry 7(3), 1071-1079

[18] Ifemeje, J.C. Egbuna, C. Eziokwudiaso, J.O. and Ezebuo, F.C. (2014). Determination of the Anti-nutrient Composition of Ocimum gratissimum, Corchorus olitorius, Murraya koenigii Spreng and Cucurbita maxima. International Journal of Innovation and Scientific Research 3 (2): 127-133

[19] Kalokerinos, A., Dettman, I., Meakin, M. (2005). Endotoxin and vitamin C part 1 Sepsis, endotoxin and vitamin C. Journal of Australasian College Nutritional and Environmental Medicine, 24(1):17-21

[20] Martirosyan, D. (2015). Vitamin C: optimal dosages, supplementation and use in disease prevention Callen Pacier and Danik M. Martirosyan. Functional Foods in Health and Disease, 5(3): 89-107

[21] Okwu, D.E. and Josiah, C. (2006). Evaluation of the chemical composition of two Nigerian medicinal plants. African Journal of Biotechnology, 5(4):357-361.

[22] Ong B T , Nazimah S A H , Osman A , Que S Y , Voon Y Y . (2006). Chemical and fl avour changes in jackfruit (Artocarpus heterophyllus Lam.) cultivar J3 during ripening . Postharv Biol Technol 25 , 279 – 286 .

[23] oughari, J. H. (2012). Phytochemicals: Extraction methods, basic structures and mode of action as potential chemotherapeutic agents. In Phytochemicals-A global perspective of their role in nutrition and health. In Tech.

[24] Saxena, A. Bawa, A. S. and Raju, P. S. (2009a). Phytochemical changes in fresh-cut jackfruit (Artocarpus heterophyllus L.) bulbs during modifi ed atmosphere storage. Food Chem 25: 1443 – 1449

[25] Schuier M, Sies H, Billek B, Fischer H (2005). Cocoa-Related Flavonoids Inhibit CFTR-Mediated Chloride Transport across T84 Human Colon Epithelia. J. Nutrit. 135 (10): 2320-2325.

[26] Sofowora, A. (1993) Phytochemical Screening of Medicinal Plants and Traditional Medicine in Africa Edition. Spectrum Books Ltd., Nigeria, 150-156.

[27] Taraj, K., Hasa, A., Muca, A. (2021). Sources and Benefits of Vitamin C. Technium BioChemMed, 2, (1): 23-31