



Comparative assessment of phytochemical, proximate, mineral and vitamin compositions of brassica oleracea and musa paradisiaca fruit extracts

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Abstract

Musa paradisiaca and *Brassica oleracea* are medicinal plants cultivated in tropical and subtropical nations, and widely used as food and folklore medicine around the globe. But, the basis for its use in the prevention and treatment of diseases in the various parts of the world has not been properly elucidated. Samples of both plants were analyzed and the compositions of the phytochemistry, proximate, mineral and vitamin were revealed. The phytochemistry indicated that *M. paradisiaca* fruit extract contain flavonoids and alkaloids in large amount, tannin, oxalate, phytates in moderate amount and saponin, phenols and glycosides in small amount, also *B. oleracea* contain alkaloids and glycosides in large amount, tannin, oxalate, flavonoids and phytic acids in moderate amount and saponin in small amount. Both plants also contain moisture, ash, protein, carbohydrate, fiber, total and saturated fats in variable amounts, and also contain some useful vitamins and minerals. There was a significant amount of ascorbic acids (*M. paradisiaca* 9.33 ± 0.2 and *B. oleracea* 38.1 ± 0.2) and K (*M. paradisiaca* 401.1 ± 0.3 and *B. oleracea* 260.2 ± 0.2), the high K and low Na may be the reason behind its use in hypertension, stroke, arrhythmia and cancer prevention. These phytochemicals, proximates, minerals and vitamins embedded in these plants has justified its folkloric uses in many cultures.

Keywords: *brassica oleracea*, *musa paradisiaca*, phytochemistry, proximate, mineral, vitamin, fruit extracts

1. Introduction

The role of traditional medicine in solving health problems is gaining recognition the world over ^[1], and this is attributed to the great number of people in the developing countries who depends on traditional medicine for their health care needs ^[1-2]. Even individual countries have encouraged the use of plants and plant products for the prevention and cure of diabetes mellitus as alternative medicine ^[3], and therefore it calls for research into indigenous plant medicines to be encouraged to improve health care of the citizens of those communities.

Musa paradisiaca is a plant with height of 3-5M which grow in bunches with weight as much as 50 Kg. It is a major source of carbohydrate for more than 50 million people ^[4, 5], and In Nigeria, all stages of the fruit (from immature to overripe) are used as a source of food in one form or the other ^[4, 5]. The immature fruits are peeled, sliced, dried and made into powder and consumed as 'plantain fufu' ^[4, 5]. The mature fruits (ripe or unripe) are consumed boiled, steamed, baked, pounded, roasted, or sliced and fried into chips ^[4, 5] while, the overripe plantains are processed into beer or spiced with chili pepper, fried with palm oil and served as snacks ('dodo-ikire') ^[4, 5]. Industrially, plantain fruits serve as composite in the making of baby food ('Babena' and 'Soyamusa'), bread, biscuit and others ^[4, 5, 6]. Plantain bract has medicinal applications in bronchitis, dysentery and on ulcers; cooked plantain bracts are given to diabetics ^[4, 5, 7] and culinary uses (edible) in many Asian countries; from India to the Philippines ^[4, 5, 8]. The demand for plantain fruit within the country is high, with supply struggling to meet demand. This has hampered the status of this crop as a foreign exchange earner. It remains an

important staple food, source of revenue, as well as the raw material for industries producing value added products in many parts of Nigeria. Plantain occupies a strategic role in rapid food production, being a perennial ratoon crop with a short gestation period ^[4, 5].

Brassica oleracea var. *capitata* L. is a herbaceous green leafy vegetable that belongs to the Brassica genus and of Brassicaceae family with several other crop species including Brussels sprout, broccoli, cauliflower, kale and kohlrabi ^[9]. It has a defined taste and crunchy texture, with a characteristic compact head in which the leaves snug against each other ^[10], and colours ranging from pale or light green to dark green ^[11]. The vegetable is an excellent source of a variety of minerals, vitamins and dietary fibre ^[12], and has been ranked by the food and Agriculture Organization among the top twenty vegetable crops grown worldwide, establishing it as an important food source globally ^[13], and has been used in ancient times both as food and medicine ^[13]. The vegetable has been used in the management of several diseases like yeast infections, gout, rheumatism, relieving of gastric pain and hyper-acidity, short term rapid weight loss, reduction of painful breast engorgement in breast feeding women, hangover remedy, urine retention, menstrual pain or irregularities, scurvy, immune stimulant, constipation and as a poultice to clean infected wounds ^[14, 15].

2. Materials and methods

2.1 Plant materials

The fruit samples of the plants to be investigated were harvested from Ikot Nakanda village in Akpabuyo, Cross

River State, Nigeria during the months of January - February 2017. The plants fruits were authenticated by a Taxonomist in Botany Department of the University of Calabar, Calabar, Cross River State, Nigeria as *Brassica oleracea* and *Musa paradisiaca* and was deposited at the herbarium for reference with voucher specimen number 843-BB.

2.2 Chemicals and Drugs

All chemicals used were purchased from sigma chemical, Merch chemical supplies, SD fine and Himedia. All other chemicals used were obtained commercially and were of analytical grade.

2.3 Preparation of Extracts

The fruits were washed with tap water then rinsed in distilled water, and later chopped into pieces and shade dried at room temperature for two weeks. The dried samples were crushed into powder by the use of electric blender and the extraction of the active ingredient from the fruit powder was carried out using specific method [16, 17]. 25g of the powdered fruit were extracted by Soxhlet apparatus using 250 ml of ethanol and n-hexane in a separate flask. The extraction lasted for six hours. The extracts obtained was concentrated by evaporation using water bath at 100°C and then stored at 4°C in cold room.

2.4 Determination of mineral composition

The mineral composition was determined using Atomic Absorption Spectrophotometer. 10 g of each sample was weighed into a crucible and pre-ashed using a heater for about 10 minutes. The appearance of a black colour was used to indicate the end of the pre-ashing process. This was heated using muffle furnace (Carbolite model MA450) at 500 °C for about 20 hours. Nitric acid solution (1% v/v) was thereafter added to the ashed sample. The diluted sample was filtered using a Whatman filter paper. The filtrate was placed in a trace metal bottle for trace mineral analyses using a flame atomic absorption spectrophotometer (Schimadzu Model AA6800).

2.5 Determination of vitamin composition

The vitamin composition was determined using uv-visible spectrophotometer. To 10mls of methanol was added 0.5g of sample. It was filtered and poured into a cuvette for analysis using uv-visible spectrophotometer for various vitamins based on their standard calibration curves.

2.6 Determination of proximate composition

The moisture content, ash content, crude fibre content, crude lipid content, and total carbohydrate content, were determined by the method of Association of Official Analytical Chemists, [18], while crude protein content was by Kjeldahl method.

2.7 Determination of phytochemical composition

Quantitative phytochemical analysis to determine the presence of alkaloids, tannins, saponins, phytate, flavonoid and cardiac

glycosides using standard methods as described by [19, 20, 21] were carried out.

2.8 Statistical analysis

The results obtained were expressed as Mean \pm Standard Error of Mean (SEM). Significant difference between the control and experimental values were assessed using student's t-test and the results were considered significant at values less than 0.05 (P=0.05). Graphical representations were designed using Microsoft Excel (2007).

3. Results

Table 1: Phytochemical composition of *Musa paradisiaca* fruit extracts.

Phytoconstituents	Inference
Flavonoids	+++
Alkaloids	+++
Tannins	++
Saponins	+
Phenols	+
Glycosides	+
Oxalates	++
Phytates	++

Table 2: Phytochemical composition of *Brassica oleracea* fruit extracts.

Phytoconstituents	Inference
Tannins	++
Alkaloids	+++
Glycosides	+++
Saponins	+
Oxalates	++
Flavonoids	++
Phytic acid	++

Table 3: Proximate composition of *Musa paradisiaca* fruit extracts

Components	Values (%)
Moisture	5.20 \pm 0.2
Ash	0.48 \pm 0.3
Protein	1.11 \pm 0.1
Carbohydrate	23.3 \pm 0.2
Fiber	2.61 \pm 0.3
Total fat	0.63 \pm 0.1
Saturated fat	0.22 \pm 0.3

Table 4: Proximate composition of *Brassica oleracea* of fruit extracts.

Components	Values (%)
Moisture	9.30 \pm 0.2
Ash	0.49 \pm 0.1
Protein	1.62 \pm 0.2
Carbohydrate	4.11 \pm 0.3
Fiber	2.33 \pm 0.2
Total fat	0.33 \pm 0.3
Saturated fat	0.03 \pm 0.1

Table 5: Vitamin content of *Musa paradisiacal* fruit extracts (Mg/100g)

Constituents	Concentration
Retinol (Vit. A)	9 μ g \pm 0.1
Thiamine (Vit.B ₁)	0.0051 \pm 0.1
Riboflavin (Vit.B ₂)	0.13 \pm 0.1
Pyridoxine (Vit.B ₆)	0.63 \pm 0.1
Ascorbic Acid (Vit.C)	9.33 \pm 0.2
Tocopherol (Vit.E)	0.32 \pm 0.1
Nicotinic Acid (Niacin)	0.81 \pm 0.1
Folate	20.1 μ g \pm 0.1

Table 6: Vitamin content of *Brassica oleracea* fruit extract (Mg/100g)

Constituents	Concentration
Retinol (Vit.A)	15 μ g \pm 0.1
Thiamine (Vit.B ₁)	0.06 \pm 0.1
Riboflavin (Vit.B ₂)	0.05 \pm 0.1
Pyridoxine (Vit.B ₆)	0.11 \pm 0.1
Ascorbic Acid (Vit.C)	38.1 \pm 0.2
Tocopherol (Vit.E)	0.2 \pm 0.1
Nicotinic Acid (Niacin)	0.06 \pm 0.1
Folate	48 μ g \pm 0.1

Table 7: Mineral content of *Musa paradisiacal* fruit extracts.

Components	Values (Mg)
Calcium	7.1 \pm 0.2
Phosphorous	23.1 \pm 0.2
Magnesium	31.2 \pm 0.2
Potassium	401.1 \pm 0.3
Zinc	0.22 \pm 0.1
Sodium	1.21 \pm 0.1
Iron	8.1 \pm 0.1

Table 8: Mineral contents of *Brassica oleracea* fruit extract.

Components	Values (Mg)
Calcium	50 μ g \pm 0.1
Phosphorous	25.0 \pm 0.2
Magnesium	17.1 \pm 0.2
Potassium	260.2 \pm 0.3
Zinc	0.32 \pm 0.1
Sodium	9.1 \pm 0.1
Iron	0.71 \pm 0.1

4. Discussion

M.paradisiaca and *B.oleracea* extracts have been found to contain many phytochemical components, proximate, minerals and vitamins. The presence of this components has supported its use in the prevention and treatment of many illnesses including chronic constipation, GIT inflammation, dyspepsia, stomach pain, cancer, scurvy, diabetes, dysentery, gout, diarrhea, eczema. These plants has high K and low Na and this demonstrates why it was utilized in the treatment and prevention of arterial hypertension, arrhythmia, stroke and cancer. Mg inhibits the progression of arteriosclerosis and prevents heart attack.

The abundance of vegetable fiber help to lower cholesterol level. The presence of vitamins A, C and E has demonstrated it use in ulcer management as they help to regenerate arterial walls. They also acts as vermifuge to expel intestinal parasits. The presence of high K and low Na has demonstrated its use

in the treatment of cardiovascular diseases. These findings was in per with [22, 23, 24, 25, 26], and was ascribed to a high tryptophan and carbohydrate content which increases the serotonin levels and gives serotonin mediated natrorexic effect.

This high potentiative nature of *M. paradisiaca* and *B. oleracea* may be as a result of the phytochemicals – Alkaloids, saponins, tannins, oxalates, phenols, minerals, vitamins and proximates embedded in this plants. The Phytochemicals found in these plants can be exploited in the production of cheap and readily available herbal drugs which will aid in the treatment and prevention of numerous illnesses ascribed to them considering the cost implication involved in the management these diseases.

5. Conclusion

The isolations and characterization of the active ingredients in these plants fractions followed by further pharmacological and clinical studies would aid in the production of novel herbal drugs for the treatment and prevention of hypertension and other cardiovascular diseases which will be affordable and readily available as an alternative therapies to the conventional medications.

6. Consent

Not applicable

7. Ethical Approval

All the authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 declaration of Helsinki.

8. Acknowledgements

The authors are grateful to all the staff of the Department of Pharmacology for their technical assistance.

9. Competing Interests

All authors have declared that no competing interests exist.

10. References

- 1 Udia PM, Ogbonna OJ, Antai AB, Mbatutung IF, Eyo SE. Oral glucose tolerance test and some haematological effects of aqueous leaf extract of *Rothmannia hispida* K Schunn fargel on normoglycaemic albino rats. *Research J Pharmacognosy and Phytochemistry*. 2013; 5(6):300-305.
- 2 World Health Organization WHO. Prevention of diabetes mellitus. Technical report series, 1994; 844:3-16).
- 3 Ampofo O. The practice of Phytotherapy in Ghana, In A. Sofowora Ed, African medicinal plants. University of Ife Press, Nigeria, 1979.
- 4 Adeolu AT, Enesi DO. Assessment of proximate, mineral, vitamin and phytochemical compositions of plantain *Musa paradisia* bract- and Agricultural waste. *International Research Journal of plant science*. 2013; 4(7):192-197.
- 5 Ayoola PG. Determination of proximate composition, vitamins, phytochemical and mineral contents of *Musa*

- paradisiacal plantain root. PA Sci. Tech. 2011; 1(2):16-29.
- 6 Ogazi PO. Plantain: production, processing and utilisation. Paman and Associates publishers, Okigwe, Nigeria, 1996, 1-29.
- 7 Morton J. Banana, in: fruits of warm climates, 1987, 29-46.
- 8 Peter B. Banana flower or Banana blossom: Culinary uses and nutritional value, Accessed on 8th July, 2013 from www.foodnutrition.knoji.com, 2011.
- 9 Katz SH, Weaver WW. Encyclopedia of Food and Culture, 2003; 2:279-285.
- 10 Dixon GR. Vegetable Brassicas and Related Crucifers. Crop Production Science in Horticulture. 2007; 14, 19.
- 11 Ingram C. The Cook's Guide to Vegetables. Hermes House, USA, 2000, 64-66.
- 12 Adeniji OT, Swai I, Oluoch MO, Tanyongana R, Aloyce A. Evaluation of head yield and participatory selection of horticultural characters in cabbage *Brassica oleracea* var. *Capitata* L. Journal of Plant Breeding and Crop Science. 2010; 2(8):243-250.
- 13 Food and Agricultural Organization, Traditional Food Plants. Food and Agricultural Organisation of the United Nations, Rome, Italy, 1988, 8.
- 14 Dalby A, Grainger S. The Classical Cook book. Getty Publications, 1996, 52.
- 15 Hatfield G. Encyclopedia of Folk Medicine: Old World and New World Traditions. ABC-CLIO, 2004, 59-60.
- 16 Harbon JB. Phytochemical methods: A guide to modern techniques of plant analysis 3rd edition. Chapman and Hill Publishers, London, 1998, 279.
- 17 Shanmugapriya K, Saravana PS, Harsha P, Peer MS, Williams B. Antioxidant activity, total phenolic and flavonoid content of *Artocarpus heterophyllus* and *Manilkara zapota* seeds and its reduction potential. International Journal of Pharmacy and Pharmacological Sciences. 2011; 3(5):256-260.
- 18 AOAC. Official Methods of Analytical Chemist, Washington DC, USA, 2006, 42.
- 19 Trease GE, Evans WC. Pharmacognosy. 11th Edition, Tindal LTD, London, 1985, 60-75.
- 20 Sofowora EA. Medicinal plant and traditional medicine in Africa. John Wiley and sons LTD, 2008, 1-10.
- 21 Ogbonna OJ, Udia PM, Onyekpe PI, Ogbeihe GO. Comparative studies of the Phytochemistry and Proximate analysis, mineral and vitamin compositions of the root and leaf extracts of *Tetracarpidium conophorum*. Archives of Applied Science Research. 2013; 5(4):55-59.
- 22 Ghani A. Medicinal Plants of Bangladesh: Chemical Constituents and Uses. 2nd Ed. The Asiatic Society of Bangladesh, Dhaka, Bangladesh, 2003, 315.
- 23 Okoli RI, Aigbe O, Ohaju-Obodo JO, Mensah JK. Medicinal Herbs Used for Managing Some Common Ailments among Esan People of Edo State, Nigeria. Pakistan J. Nutr. 2007; 6(5):490-496.
- 24 Osim EE, Orie NN, Bose S, Etra KM. The effect of plantain and banana extracts on blood pressure and heart rate in albino rats. Nigerian J. Physiol. Sci., 1990; 6:114-119.
- 25 Khare CP Ed. Indian Medicinal Plants, Springer Science+Business Media, New York, USA, 2007, 426.
- 26 Perfumi M, Massi M, De Caro G. Effects of Banana Feeding on Deoxycorticosterone-Induced Hypertension and Salt Consumption in Rats. Pharm. Biol, 1994; 32(2):115-125.