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Phytochemical, Antinutrient and Mineral Compositions of Leaf Extracts of Some Cassava Varieties

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Abstract: *The Phytochemical, antinutrient and mineral compositions of four cassava leaf varieties (TME 419, TMS 92/0326, TMS 92B/0061 and NR8213) were investigated. The presence of alkaloids, flavonoids, tannins, cynogenic glycosides and saponin were determined. Antinutrients such as tannins, oxalate, phytate and trypsin inhibitor and some mineral elements such as Ca, Mg, K, Na, P, Hg, Mn, Zn were also present. The results of the phytochemical composition showed that alkaloid values ranged from 26.03 to 38.33 mg/100g, flavonoid content ranged from 48.07 to 58.94mg/100g, saponin content ranged from 1.58 to 1.65mg/100g,cynogenic glycosides content ranged from 0.49 to 0.57mg/100g, and tannin content ranged from 0.45 to 0.71mg/100g. In the antinutrient composition, the results revealed that oxalate ranged from 29.32 to 35.77mg/100g, phytate ranged from 1.95 to 2.17mg/100g, cyanide ranged from 31.48 to 35.77mg/100g, and typsin inhibitor ranged from 0.48 to 0.72mg/100g. The mineral composition determined showed the presence of Ca (1.87-2.25mg/100g), Mg (0.61-0.82mg/100g), K (0.31-0.40mg/100g), Na (0.24- 0.28mg/100g), P (0.36-0.49mg/100g), Mn (10.11-39.03mg/g), Zn (19.90 -38.90mg/100g, Fe (77.81-127mg/100g), Pb (0.01-0.6mg/g),Cu (0.43- 0.76mg/100g and trace amount of Hg. These results suggest that leaves from these cassava varieties can be regarded as safe and nutritious for human and animal nutrition especially in areas experiencing food security challenges.*

Keywords: *Antinutrient , cassava leaf, composition, mineral, phytochemical.*

I. Introduction

Cassava is among the major staple food crops in Nigeria and in most tropical countries. Cassava leaf is an indigenous edible vegetable leaf which is a significant source of potential alternate source of protein for both humans and animals [1].

Cassava leaves among other edible vegetables such as fluted pumpkin (*Telfairia occidentalis*), bitter leaf (*Venonia amygdalina*), sweet potato (*Ipomea batatas*) and *Moringa Oleifera* are inexpensive and abundant source of proteins, carbohydrate, minerals and vitamins [2][3],which are highly beneficial for the maintenance of health and prevention of diseases. They also maintain alkaline reserve of the body because of the high carbohydrate, vitamin and mineral content [3].

It has been reported [4] that in some countries of West African such as Sierra Leone and Liberia, pregnant women consume cassava leaves to increase breast milk production and control stomach worms. Also in Indonesia young cassava leaves compared to other vegetables are popular vegetables due to their high content of proteins, minerals and vitamins [5]. The amino acids in cassava leaf compare favourably with those of milk, cheese, Soya bean, fish and egg [6].

Different varieties of cassava leaf contain phytochemicals, minerals and antinutrients which play important roles in human development [7].

These phytochemicals act as antioxidants or nutrient protector, and intake of cassava leaf can reduce the risk of developing such diseases as cancer, diabetes, hypertension, obesity and heart diseases due to the high phytochemical contents [1][4]. Cassava leaves also contain some antinutrients which interfere with digestibility of nutrients [6], these antinutrients might present toxic effects depending on the amount consumed [7]. However, the toxicity problem which affects the nutritive value of the leaf can be reduced by traditional preparation method such as drying, pounding long periods of boiling [8]. Objectives of this work were to investigate the antinutrient, phytochemical and mineral compositions of leaves of some cassava varieties grown in Nigeria.

II. Materials and Methods

The fully matured cassava leaf varieties were obtained from a farm at Umuara Okpu Umuobo, Osisioma Ngwa L.G.A, Abia State, Nigeria.

2.1 Processing Methods

The leaves were washed and allowed to drain at room temperature and dried in the oven at 60^0C for six hours. They were pulverized using a grinding machine (Panasonic electric blender-model MX-GX1021), and were stored separately in air-tight containers, protected from sunlight until required for analysis

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2.2 Analyses

2.2.1 Phytochemical Analysis

The leaf samples were analyzed for phytochemical composition according to the methods described by [9][10] and were determined in triplicates. The phytochemical screening of the samples such as alkaloids, flavonoids, cynogenic glycoside, saponins and tannis were carried out as described by [11]

Determination of Antinutrient Composition

The tannin, oxalate, phytate, trypsin inhibitor, and cyanide were determined as described by the [9].

2.2.2 Determination of Mineral Composition

Mg, Zn, iron, Cu, Fe, Mn, Cu, and heavy metals were estimated using atomic absorption spectrophotometer [9] while phosphorus was determined spectrophotometrically using [9] Molybdate-Vanadate solution using the spectrophotometer. Na, Ca, and K were estimated using emission flame photometer [9].

2.2.3 Statistical Analysis

Replicate readings of measurements were subjected to Analysis of variance (ANOVA), while the means were separated using Duncan's multiple Range Test [12]

III. Results and Discussion

3.1 Phytochemical Analysis

The phytochemical composition of the cassava leaf varieties are presented in Table 1. The lowest alkaloid content was recorded in TME 419 (26.03 mg/100g) and highest in TMS 92/0326 (38.33mg/100g), while flavonoid was found to be highest in TMS 92B/0061 (58.37mg/100g) compared to TMS 92/0326 which was lowest (48.07mg/100g). TMS 92B/0061 had the highest flavonoids and have been reported to exert multiple biological effects including antibacterial, antiviral, antitoxic and anti-inflammatory activities [13]. Saponin content of 1.66mg/100g was found in TMS 92B/0061, while TME 419 recorded the lowest level of saponin content (1.58mg/100g). The result revealed that TMS 92B/0061 recorded the highest cyanogenic glycoside content (0.57mg/100g) compared to other varieties. This compares with the values reported by [14] that saponins have anti-carcinogenic properties, immune modulation activities and regulation of cell proliferation as well as health benefits such as inhibition of the growth of cancer cells and cholesterol lowering activity. Cynogenic glycoside content in TMS 92B/0061 (0.57mg/100g) was highest and NR8213 recorded lowest (0.49mg/100g).Tannin content in NR8213 was highest (0.71mg/100g) compared to all other varieties.

Table 1: Mean value of phytochemical composition of cassava leaf varieties (mg/100g)

Cassava leaf varieties	Alkaloids	Flavonoid	Cynogenic glycoside	Saponin	Tanin
TME419	26.03±0.09	54.94±1.51	0.51± 0.05	1.58±0.020	0.45 ±0.04
TMS 92/0326	38.33±0.18	48.07±1.09	0.52± 0.05	1.65± 0.25	0.58± 0.06
TMS 92B/0061	38.07± 0.16	58.37±1.61	0.57± 0.05	1.66± 0.25	0.64± 0.06
NR8213	32.63± 0.10	50.92±1.30	0.49± 0.04	1.64± 0.24	0.71± 0.06

Values are means of three independent determination ±SEM

3.2 Antinutrient Analysis

Oxalate content is significantly ($p<0.05$) lower in NR8213 (29.32mg/100g) compared to TME419 (35.77mg/100g) and TME92B/0061 (34.60mg/100g). Oxalates affect calcium and magnesium metabolism and react with proteins to form complexes which have inhibitory effect on peptin digestion [15]. The result revealed that the phytate content was highest in TME 419 (2.17mg/100g) and lowest in TMS 92/0326 (1.95mg/100g).

The values obtained for cyanide content was lowest in NR8213 (31.48mg/100g) and highest in TMS 92/0326 (35.77mg/100g).

The tannin and trypsin inhibitor contents were lowest in NR8213 (0.71 and 0.72 respectively).

Table 2 :Mean value of Antinutrient composition of cassava leaf varieties (mg/100g)

Cassava leaf varieties	Tannin	Oxalate	Phytate	Trypsin inhibitor	Cyanide
TME419	0.45±0.04	35.77±0.14	2.17±0.03	0.48± 0.04	32.32±0.11
TMS 92/0326	0.58±0.05	31.48±0.11	1.95± 0.08	0.61± 0.06	35.77±0.14
TMS 92B/0061	0.64±0.06	34.60±0.13	2.08± 0.02	0.58± 0.05	34.60±0.13
NR8213	0.71±0.06	29.32±0.10	2.01± 0.01	0.72± 0.06	31.48±0.11

Values are means of three independent determinations ± SEM

3.3 Mineral Analysis

Table 3 showed the result of the mineral composition. The calcium content is highest in TMS 92B/0061(2.25mg/100g) compared to all other varieties. Calcium is good for growth and maintenance of bones, teeth and muscles [16][17], therefore these varieties could provide veritable source of calcium. The potassium content recorded TME 419 (0.49mg/100g), TMS 92/0326 (0.38mg/100g), TMS 92B/0061 (0.36mg/g) and NR8213 (0.48mg/g). The result revealed the presence of Fe, Zn and Mn in higher quantities than other mineral elements, these elements are antioxidant micronutrient [18] and their presence could therefore, boost the immune system. Fe is an important constituent of haemoglobin. The presence of heavy metals (Hg, Pb) could be due to bioaccumulation [19], the presence of Cu was also dictated.

Table 3: **Mean value of Mineral composition of cassava leaf varieties (mg/100g)**

Cassava varieties	Ca	Mg	K	Na	P	Hg	Mn	Zn	Fe	Cu	Pb
TME 419	2.15 ± 0.06	0.61 ± 0.09	0.40 ±0.02	0.24 ± 0.02	0.49 ± 0.01	TRACE	31.53 ± 0.18	38.90 ± 3.39	112.0 ± 4.95	0.52 ± 0.06	0.60 ± 0.02
TMS 92/0326	2.05 ± 0.07	0.64± 0.04	0.36 ± 0.02	0.25 ±0.01	0.38 ± 0.03	0.01 ±0.001	10.11 ± 0.72	19.90 ± 0.42	127.60 ± 11.6	0.76 ±0.15	0.01 ± 0.01
TMS 92B/0061	2.25 ± 0.07	0.82 ± 0.12	0.33 ± 0.06	0.28 0.±04	0.36 ± 0.02	0.06 ± 0.005	39.03 ± 1.51	34.10 ± 1.13	77.81 ± 13.71	0.52 ± 0.09	0.03 ±0.005
NR8213	1.87 ± 0.07	0.55 ± 0.09	0.31 ± 0.03	0.025 ± 0.01	0.48 ± 0.04	TRACE	16.38 ±2.65	26.58 ± 2.65	86.2 ± 12.87	0.43 ± 0.11	0.02 ±0.01

Values are means of three independent determinations ±SEM

IV. Conclusion

The analyses carried out on cassava leaf varieties showed that cassava leaves contain mineral elements and phytochemicals that are of nutritional and biochemical importance to humans and animals. Moreover, cassava leaves contain anti nutrients which reduces nutrient absorption and may lead to other adverse effects, therefore, the use of appropriate processing techniques could help reduce or eliminate the adverse effects of these antinutrients and will improve their nutritive value of cassava leaves. The antinutrient content vary with leaf varieties, the major antinutrients in the four varieties of cassava investigated are oxalates and cyanide (Table 2). It is suggestive therefore, to develop new varieties of cassava, whose leaves can be safely used as green leafy vegetables.

Reference

[1] A.O. Fasuyi, Nutrient Composition and Processing Effects on cassava leaf (Manihot esculenta, Crantz) antinutrient, Pakistan Journal of Nutriton 4 , 2005, 37-42.(1)

[2] J.C. Okafor, Horticultural Promising indigenous wild plant species of the Nigerian Forest Zone, Acta Horticulturae, 123 ,1983,165-176.

[3] J.K. Mensah, R.I Okoli, J.O. Ohaju-Obodo, K. Eifediyi, Phytochemical, nutritional and medicinal properties of some leafy vegetables consumed by Edo people of Nigeria, Africa Journal of Biotechnology, 7, 2008, 2304-2309.(14)

[4] M. Bokanga ,Processing of cassava leaves for Human consumption, Acta Hort, 375, 1994, 203-207.

[5] N. Wargiono, N. Richana and A. Hidajat , Contribution of cassava leaves used as a vegetable to improve human nutrition in Indonesia, International center for Tropical Agriculture, 2002, 466-471

[6]. G. Ravindran and V. Ravindran, Changes in the Nutritional composition of cassava (Manihot esculenta Crantz) leaves during maturity, Food Chemistry. 27, 1988, 299-309.

[7]. H. M. Alessio, A.E. Hagerman, M. Romanello, Consumption of green tea protects rats from exercise – induced oxidative stress in kidney and liver, Nutr. Res., 22, 2002, 1177-1188.

[8]. P.A. Lancaster and J.E. Brooks, Cassava leaves as human food, Economic Botany, 37,(3) 1983, 331-348.

[9]. AOAC, Official methods of analysis Association of official Analytical chemist, (Washington DC.1990).(14)
[10]. O.I. Oloyede, Chemical Profile of unripe pulp of carica papaya Pakistan Journal of Nutrition, 4 , 2005, 379-381.(6)
[11]. J.B. Harbone, Phytochemical methods, a guide to modern technique of plant analysis (Chapman & Hall, New York, NY. 1973).(2)
[12]. R.S.D. steel and J.H. Torrie, Principles and procedures of statistics, a biometric approach (Mc-Graw Hill, New York, 1980).(2)
[13]. N.S. Cook and S. Samman , Flavonoid-Chemistry, metabolism, cardioprotective effect and dietary sources, Journal of Nutritional Biochemistry, 7, 1996, 66-76.
[14]. D.S. Seigler ,Plants with saporins and cardiac glycosides, www.lifwe.vinc.edu/plantbio/363/saponinslides, 1998
[15]. K.E. Akande, U.D Doma, H.O. Agu and H.M. Adamu, Major anti-nutrients found in plant protein sources: their effect on nutrition. Pakistan Journal of Nutrition 9, 2010, 827-832.(8)
[16]. M.I. Dosunmu , Chemical composition of the fruit of Tetrapleura tetreptra and the physiolochemical properties of its oil, Global Journal of Pure Applied Science 3,1997, 61-67.(1)
[17]. M. Turan, S. Kordali , H. Zengin, A. Dursun, Y. Sezen ,Macro and micro mineral content of some wild edible leaves consumed in Eastern Anatolia, Acta Agric. Scand. Sect. B, Plant Soil Sci. 53, 2003,129-137
[18]. G.P. Talwaret, L.M. Srivastava, K.D. Mudgil, Textbook of biochemistry and human biology 2nd ed. (Prentice-Hall of India Private Ltd,1989).(2)
[19]. A.O. Adesuyi, O.A. Awosanya, F.B. Adaramola, A.I. Omeonu, Nutritional and phytochemical screening of Aloe barbadensis, Current Research of Journal Biological Science 4 , 2012, 4-9, (1)