Proximate And Essential Nutrient Compositions Of *Momordica Charantia* Plant

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Abstract: The need to study the potential of medicinal plants cannot be over-emphasized *Momordica charantia* (bitter melon) plant is often used for some medicinal purposes in traditional medicine but the food value was investigated. The nutritional compositions of *momordica charantia* leaf and fruit were investigated using standard analytical methods. The proximate compositions showed the percentage of moisture content (11.38 ±0.29 and 10.74 ± 0.02), ash (14.39 ±0.02 and 7.40 ± 0.1), crude fat (2.65 ±0.10 and 6.11 ± 0.05), crude fibre (16.11 ±0.04 and 13.61 ± 0.04), crude protein (21.19 ±0.52 and 27.92 ± 0.06), carbohydrate (33.94 ±0.25 and 34.22 ± 0.11) and the calorific value (244.37 and 303.55) of samples on dry weight basis while the fresh *momordica charantia* fruit contains 82.83 ±0.21% and 90.84 ± 0.17% moisture content on wet weight basis for the leaf and the fruit respectively. The mineral analysis showed the concentration in mg/kg of Ca (53900 ±0.30 and 7000 ±0.23), Mg (1900 ± 0.01and 1600 ±0.02), Na (400.4 ±0.04 and 45.47 ±0.02), K (6700 ±0.02 and 31900 ±0.03), P (8800 ±0.01 and 3600 ±0.01), Fe (98.00 ± 0.02 and 139.1 ±0.04), Zn (105.5 ±0.40 and 72.40±0.56) and Cu (96.51 ±0.20 and 51.00 ±0.06) of samples on dry weight basis for the leaf and fruit respectively. The study indicated the presence of nutritional components that are beneficial in addition to the purported numerous medicinal values of the plant.

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Introduction

Food demands have been accelerated with the exponential human population growth resulting in marginal land resource availability for growing food crops especially vegetables. Among alternatives available to meet the food demands are cultivable and wild vegetables which are regarded as cheap source of food for the marginal communities (Hussain *et al*., 2010). According to the Food and Agricultural Organization (FAO), 2013, out of the 7.1 billion people of the world, there are about 870 million undernourished people in 2010–2012, of whom 852 million are in developing countries and 16 million in the industrialized countries. To apprehend the situation, interests have been centralized on the exploitation, quantification and utilization of food plants, especially the vegetables (Dini *et al*., 2005). Vegetable being the rich source of carbohydrates, fats and proteins, which form the major portion of the human diet, are the cheaper source of energy. Besides these biochemicals, the moisture, fiber, and ash contents and the energy values of individual vegetable and plant species have also been regarded important to the human health (Hussain *et al*., 2010). Over the years, medicinal plants have been recognised to be of great importance to the health of individuals and communities (Bakare et al., 2010). Herbs not only provide us chemicals of medicinal value but also provide us nutritional and trace elements needed for optimum functioning of the body and good health. Those elements that are required in our diets are also called "minerals." Minerals include compounds of the elements such as calcium, magnesium, phosphorus, sodium, potassium, sulphur, chlorine, iron, iodine, copper, manganese, zinc, molybdenum, selenium and chromium (Ali etal 2011). Despite extensive applications of this plant in traditional medicine, little information is available on its nutritional and proximate compositions. The prevailing situation is provoking us to analyze the bioactive plant with reference to a selected medicinal plant such as *momordica charantia leaf.*

Momordica charantia (bitter melon) is a tropical and subtropical vine of the family cucurbitaceae widely grown in India, south Asia, China, Africa and the Caribbean. Bitter melon as fondly called has been implicated experimentally to achieve a positive sugar regulatory effect by suppressing the neural response to sweet taste stimuli and also keep the body functions operating normally. Other use of the plant include to expel intestinal gas, for tumours, wound treatment, rheumatism, malaria, vaginal discharge and the seeds are used to induce abortion (Sofowora, 2006). A tea preparation from the leaf is used for diabetes. In Nigeria, Ghana and India peninsula, the root of the plant is used as an abortifacient together with the fruit as well as an ingredient in aphrodisiac preparation (Sofowora, 2006). The young fruits and shoots are reported to serve as supplementary or emergency food in some part of West Africa, and an effective emmenagogue to facilitate child birth in Ivory Coast (Burkil, 1985). Bitter melon is generally consumed cooked in the green or early yellowing stage. The young shoots and leaves of the bitter melon may also be eaten as greens. It is a popular food throughout southern Asia, India, China, Pakistan, Bangladesh, Vietnam, Philippines, Nepal, and Trinidad and Tobago (Bagchi, 2005).

Thus, this work is aimed to exploit the nutritional composition and chemical profile of the herb as a mean to create awareness that these herbs can serve the purpose of food.

Collection of Plant Materials

Fresh leaf and fruit of the herbs were harvested between June and July, 2014, in Auchi, Edo State, Nigeria. They were identified and authenticated by Department of Botany, Ambrose Alli University Ekpoma, Nigeria. The plant materials were sorted out to eliminate all extraneous materials. The samples were washed with the deionised water to remove dust particles. The leaves were dried in a hot air oven (SD 93114624, Gallenkamp, United Kingdom) for five days at 40°C (Odetola and Akojenu, 2000). After drying, the plant materials were pulverised to powder using an electric blender. 100 g of the powdered sample each were stored in airtight containers and kept under normal room temperature until required.

Proximate Analysis

The proximate analysis was carried out according to the procedure of Association of Official Analytical Chemist (AOAC, 2000) and carbohydrate by difference. The calorific values of the samples were estimated

(1). Determination of Moisture Content (AOAC 934.01): Evaporation by heat using dry oven at 100^0C (gravimetric method). The sample was dried in the moisture oven at 105^oC for 4 hours or until weight was constant.

Hence, $\%\text{moisture} = \frac{W_2 - W_3 \text{ X } 100}{W_2 - W_1}$

Where: W_1 = initial weight of empty crucible

W_2 = initial weight of crucible + food sample before drying

W_3 = final weight of crucible + food sample after drying,

(2). Determination of Crude Fat Content (AOAC 920.39) : Solvent extraction (Soxhlet) method was used:

Hence,

$\%\text{fat on dry weight bases} = \frac{W_2 - W_1 \text{ x } 100}{W_3}$

Where: W_1 = weight of empty flask

W_2 = weight of flask + fat

W_3 = weight of food sample

(3). Determination of Crude Protein Content (AOAC 955.04): Kjeldahl method was used by and using a conversion factor based on the percentage of nitrogen in the food protein to be 6.25.

Calculation: $\%\text{ Nitrogen} = \frac{\text{Vs} - \text{Vb X Nacid X } 0.01401 \text{ X } 100}{W}$

Where Vs = volume (ml) of acid required to titrate the sample

Vb = volume (ml) of acid required to titrate the blank

Nacid = normality of acid (0.1N)

W = weight of sample in grams

% crude protein = N X conversion factor)

(4). Determination of Total Ash Content (AOAC 942.05) : Dry ashing method was used by heating the sample in a furnace for 12 – 18 hours at about 500^0C to ash. The ash content is calculated as follows:

$\%\text{ash (dry basis)} = \frac{W_2 - W_3 \text{ x } 100}{W_2 - W_1}$

Where: W_1 = initial weight of empty crucible

W_2 = initial weight of crucible + food sample before ashing

W_3 = final weight of crucible + ash.

(5). Determination of Crude Fibre Content (AOAC 962.09): Gravimetric method was used by boiling the sample under reflux for 30 minutes with 200ml of a solution containing 1.25g H_2SO_4 per 100ml of solution and NaOH per 100ml solution. The final residue was filtered and incinerated.

Hence:

$\%\text{ crude fibre (dry basis)} = \frac{W_2 - W_1 \text{ x } 100}{W_3}$

Where: W_1 = weight after incineration

W_2 = weight after dying

W_3 = weight of sample.

(6). Determination of Crude Carbohydrate Content: Carbohydrate content of each sample was calculated using the difference method as follows: Carbohydrate (%) = 100 - (moisture (%) + protein percentage (%) + lipid (%) + ash contents (%)) (Hussain et al., 2010).

(7). Estimation of the Calorific Values by calculation: The energy value of each sample was determined using the following formula: K calories/100 g = 9 (crude fats (%)) + 4 (carbohydrates (%)) + 4(proteins (%)). (Asibey-Berko & Tayie, 1999).

Elemental Analysis:

The elements were analysed using AAS and AES spectrometers: A weighed portion of the ground sample of sample was placed in a pre-cleaned silica crucible to heat on flame for about 10 min to remove moisture and volatile matter. The crucible was heated in a muffle furnace at 600°C for about 4 h to convert the sample into ash. The ashed sample was dissolved in conc. HNO_3 (12 ml). Then the total volume was made to 100 ml with deionised water. The content was then be filtered, and the filtrate was used for the mineral analysis. Standard solutions of the minerals to be analyzed were prepared. The atomic absorption spectrophotometer (S series AA)/Flame Photometer (Sherwood 410) were set with power on for 10min to stabilize. The standard metal solutions were injected to calibrate the AAS using acetylene as the carrier gas. An aliquot of the mineral solution obtained from the plant digest were injected and the concentration were obtained from the AAS (Cu, Fe and Zn) / AES (Na, P, K, Ca and Mg) for each mineral element with their appropriate hollow cathode lamp. The experiments were done in triplicate and the results were averaged (Bakare, *et al*., 2010).

Results

The results are shown in Tables 1, 2.

Table 1: Proximate composition of Momordica Charantia leaf and fruit

Parameter	% composition	Leaf	Fruit
	Moisture (WW)	82.83 ±0.21	90.84 ± 0.17
	Moisture (DW)	11.38 ±0.29	10.74 ± 0.02
	Total ash (DW)	14.39 ±0.02	7.40 ± 0.10
	Crude fat (DW)	2.65 ±0.10	6.11 ± 0.05
	Crude fibre (DW)	16.11 ±0.04	13.61 ± 0.04
	Crude protein (DW)	21.19 ±0.52	27.92 ± 0.06
	Carbohydrate (DW)	33.94 ±0.25	34.22 ± 0.11
	Caloric value (kcal/100 g)	244.37	303.55

Results are mean of 3 determinations ± SD; DW = Dry weight & WW = Wet weight

Table 2: Mineral composition of Momordica Charantia leaf and fruit

Minerals	Concentration (mg/kg)	Leaf	Fruit
	Calcium	53900 ±0.30	7000 ±0.23
	Magnesium	1900 ± 0.01	1600 ±0.02
	Sodium	400.4 ±0.04	45.47 ±0.02
	Potassium	6700 ±0.02	31900 ±0.03
	Phosphorus	8800 ±0.01	3600 ±0.01
	Iron	98.00 ± 0.02	139.1 ±0.04
	Zinc	105.5 ±0.40	72.40±0.56
	Copper	96.51 ±0.20	51.00 ±0.06

Results are mean of 3 determinations ± SD

Discussion

The dry weight basis of the leaf and fruit compositions that are 11.38% and 10.74% respectively expressed the optimal function of all the nutrients because they are all present in adequate amount.

Nutrients are necessary for life and good health; these may be found in a number of different foods. The general functions of nutrients include fuel (energy) expressed in kcal, building materials for body structures and regulation and control of body processes. The proximate analysis shows that both the leaf and the fruit are good source of carbohydrate and protein; these may serve as source of energy and nutrients for the body metabolic activities in addition to its medicinal properties. However, the fruit of *mormordica charantia* has the highest percentage of protein and carbohydrate content of 27.92% and 34.22% when compare to the leaf of 21.19% and 2 33.94% respectively. The result obtained can also be compared favourably to protein rich foods like soybeans, cowpeas, melon and pumpkin (23.10% - 33.00%). This is beneficial since carbohydrate constitutes a major class of naturally occurring organic compounds that are essential for the maintenance of plant and animal life and also provide raw materials for many industries.

The crude fat content in *Momordica charantia* fruit (6.11%) was higher than that of the leaf (2.65%) as in the case of carbohydrate and protein. The crude fat may add to the caloric value extractable from the fruit for metabolic activities. This why the calorific value is reasonably higher which shows that the fruit has a higher energy value to the leaf.

Though the crude fibre, total ash and the moisture content is higher in the leaf sample (16.11%, 14.39% and 11.38%) as compare to the fruit sample (13.61%, 7.40 % and 10.74%) respectively. The study also shows that the plant contain reasonable amount of fibre which could be beneficial when consumed. Dietary fibre is important for lowering blood cholesterol and blood sugar. It is known to reduce the risk of diseases such as obesity, diabetes, breast cancer, hypertension and gastrointestinal disorder. (Bakare et al, 2010).

The ash content represents all the elements present in the sample. The study shows that the minerals are more concentrated in the leaf than in the fruit. The elements such as calcium, magnesium, potassium, zinc, iron, copper, phosphorus and sodium which were found in reasonable amount in the leaf and the fruit as expressed in mg/kg in table 2.They are nutritionally and biochemically important for proper body function. For instance, calcium is known to play a significant role in muscle contraction, bone and teeth formation and blood clotting. Some of these minerals such as magnesium and zinc are needed as cofactor in enzyme catalysis in the body. Sodium and potassium which are present in the intracellular and extracellular fluid helps to maintain electrolyte balance and membrane fluidity. Iron is known to be a component of some metalloenzymes, myoglobin and heamoglobin, which is needed in the transport of oxygen and carbon dioxide during respiration or cellular metabolism. This heamoglobin (containing iron) also serve as buffer to regulate changes in blood pH. It is known that inorganic mineral elements such as potassium, calcium and zinc play important roles in the maintenance of normal glucose-tolerance and in the release of insulin from beta cells of *islets of Langerhans*. Zinc present in the plant is beneficial to prevention and treatment of diarrhoeal episode, it is also involves in normal functioning of immune system (Adeyeye and Otokiti, 1999). According to FAO’s food balance data, it has been calculated that about 20% of the world’s population could be at risk of zinc deficiency. Phosphorus is essential in bone and teeth formation while copper is a components of a number of enzymes that are involved in metabolizing substances such as histamine, serotonin, binding of iron to trasferrin, etc. All of the above elements were found to meet the Recommended Dietary Allowance (RDA).

Conclusion

The result obtained in this study showed that *Momordica Charantia* plant contains appreciable amount of nutrients, and these can contribute to the health and energy requirement of man when the plant is taken for curative purposes in certain disease conditions. However, this study has shown that *Momordica Charantia* has food value which is beneficial to man nutritionally and health wise.

Recommendation

❖ In view of recent food demands in the world, it is recommended that *M. Charantia* fruit should be exploited for this purpose. *Momordica Charantia* is not just a food but a food that will contribute to the health of the consumer which will reduce the consumer risk of ill-health.

❖ It is also recommended that more research should be carried out on this plant so that the possible ways to process this plant into food will be known. However, it has been known that this plant is used in other part of the world as food for diet-rich meal and healthy life. This will help to reduce cost of expenses on food and drugs and increase the social economic well-being of the populace.

References

1. Adeyeye, E., Otokiti, M. K. O. (1999). *Proximate composition and some nutritional valuable minerals of two varieties of Capsicum annum (Bell and cherry peppers).* Discov. Innov., 11: 75-81.
2. Ali B., Zubeda C. 1., Gul, J. 1., Mohammad, D.1., Atta ur, R. 1., Rafiq, A.1., Aman, k. 1., Shah, K., and Farman, A.(2011) *Nutritional and elemental analyses of some selected fodder species used in traditional medicine, African Journal of Pharm & Pharmacology*. 5(8), 1157-1161.
3. AOAC, (2000). *Official methods of analysis.* 13th Ed. Washington D.C.
4. Ayoola, P.B. and Adeyeye, A. (2010) *Phytochemical And Nutrient Evaluation of Carica Papaya (Pawpaw) Leaves.* IJRRAS 5 (3).
5. Bagchi, I. (2005). *"Food for thought: Green 'karela' for Red China".* Times of India (adapted from Wikipedia) http://en.wikipedia.org/w/index.php?title=Momordica_charantia&oldid=63952434.
6. Bakare, R. I, Magbagbeola, O. A., Akinwande, A. I. and Okunowo O. W. (2010). *Nutritional and chemical evaluation of Momordica Charantia, Journal of Medicinal Plants Resources*. 4(21), 2189-2193.
7. Burkill, H. M. (1985). *The Flora of West Tropical Africa*. Second edn. Royal Botanic Gardens: Kew.
8. Dini, I., Tenore, G. C. and Dini, A. (2005). *Nutritional and antinutritional composition of Kancolla seeds: an interesting and*

underexploited food plant. *Food Chem.*, 92: 125-132.
9. Diouf, J. (2002). *The State of Food Insecurity in the World*. Published by the Food and Agriculture Organization of the United Nations Viale delle Terme di Caracalla, 00100 Rome, Italy. pp 51-53.
10. Food and Agriculture Organization (FAO) for the United Nations Statistics online (2013) *http://faostat.fao.org*.
11. Hussain, J., Khan, A.L. Rehman, N. Z., Hussain, S.T., Khan, F. An Shinwari, Z.K. (2010). *Proximate and nutrient analysis of selected medicinal plant species of Pakistan. Pakistan Journal of Nutrition*. 8(1): 620 -624.
12. Odetola, A. A., Akojenu, S. M. (2000). *Anti-diarrhoeal and gastrointestinal potentials of the aqueous extract of Phyllanthus amarus (Euphorabiaceae*). *African Journal of Medical Sci*. 29: 119-122.
13. Sofowora, A. (2006). *Medicinal Plants and Traditional Medicine in Africa*.
14. Ibadan, 2nd Ed., Spectrum Books Ltd., Nigeria. pp. 151-153, 209-214.
15. Sharma, S., Shruti, T., Semwal, B. and Komal S. (2011) *Momordica charantia Linn.: A Comprehensive Review on Bitter Remedy, Journal of Pharm. Resources and Opinion.* pp42-47.

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