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Proximate and Mineral Evaluation of Dried Composites of selected Leafy Vegetables

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***Abstract*— This study aimed at determining the chemical qualities of six selected green leafy vegetables (pumpkin, moringa, chaya, A. spinach, scent leaf and cocoyam). Proximate result showed that the composite sample was significantly higher in all parameters except for carbohydrate where it was significantly least. Mineral analysis result ranged between 8.24-1315.8; 243.7-536.3; 23.61-35.92; 1.21-29.91 for Ca, Mg, Fe and Zn respectively. The quantity recorded for the composite sample is adequate enough to furnish for the daily requirement.**

***Keywords*— Leafy vegetable, proximate, mineral**

INTRODUCTION

Vegetables generally play important part in the diets of many people in the tropics. They provide essential minerals, vitamins and add flavour, variety, taste, colour and aesthetic appeal to what will "otherwise be a monotonous diet {6}. Vegetables are edible portions of plants usually used in making soup or served as integral part of the main meal. The edible parts of plant could either be from seeds, nuts, fruits, roots, tubers, bulbs, buds, flowers, leaves or stem. They include those useful wild and cultivated leaves that are cholesterol and fat free. They could be low income sources of nutrient. Organolepticially, vegetables are also valued for their supreme flavour, aroma, texture and others {11}.

Vegetables are cultivated or wildly produced. Despite the fact that there are over 60 species of green leafy plants which are used as food in Nigeria {4}, micronutrient malnutrition is still a problem, Nigeria Health Demographic Survey {10}. There are to an extent, information on nutrient composition of tropical green leafy vegetables and other groups of tropical foods. There are also excellent compilations of foods commonly consumed, however, little is known of green leafy vegetables in Nigeria {16}.

Nigeria is a country with multi-cultural diversities where indigenous vegetables especially leafy vegetables have been used as indispensable ingredients in diets. In most tropical countries of Africa, vegetables have served as important components in traditional sauces and soups that accompany carbohydrate staples. They are the cheapest sources of essential nutrients and hence provide nutritional balance and food security which are naturally important for humans both in rural and urban setups. However, due to inadequate scientific knowledge of the nutritional potentials of many local vegetables, they are under-utilized in Africa. Many reports abound in literatures documenting the nutritional composition of various edible plant materials but much still needs to be done.

In Nigeria, generally there is an immense number of Green leafy vegetables both wild and cultivated vegetables which can be consumed raw, however, they are mostly cooked. These green leafy vegetables range from the leaves of annuals, perennials and shrubs to leaves of trees {11}. Many of these Green leafy vegetables are common in all areas of the country (e.g. amaranthus). There are seasonal variations in the availability of many of these vegetables. In general, these vegetables grow abundantly during the rainy season and more readily available than in the dry season. This seasonal variation in production and availability naturally leads to variation in quantities consumed by the local people {16}.

{7}, Observed that the prevalence of degenerative disease such as cancer, cataracts and heart disease is lower in Asian families due to their dominant vegetarian habits with the use of vegetables. However, there have been growing deductions in the consumption of vegetables with each passing decade {2}. This affluence in recent decades has made humans to focus on relatively fewer vegetables, thereby placing humans at risk.

Deficiencies of iron, iodine, vitamin A and other micro-nutrients are gaining increasing attention in developing countries, with the recognition of their adverse health effects and subsequent costs to human and economic development {15}. These nutritional problems call for the study of these

known vegetables. This will increase food security. {9}, noted that the traditional leafy vegetables are important in ensuring food security, since most of them are drought and pest-resistant.

{5} noted that, green leafy vegetables are excellent sources of dietary fibre, vitamin A & C, folate and minerals. Vegetables also contain roughages and minerals. Also, majority of people tend to consume one or few vegetables in a diet instead of consuming many of them together. This is because the quantity of each in a diet is important and the quantity available for cellular utilization is equally important so, combining different vegetables in a diet will be of optimum value.

MATERIAL AND METHODS

Material

Six leafy vegetables were selected for this study scent leaf (*Occimum gratissimum*), Moringa leaf (*Moringa oleifera*), A. spinach (*Amaranthus spp*), Cocoyam leaf (*Colocasia esculenta*), fluted pumpkin (*Telferia occidentalis*) and Chaya leaf (*Cnidoscolus aconifolia*). All were purchased from Anyigba Central market in Dekina local Government Area, Kogi State, Nigeria. Chemical analysis was carried out using equipments from the Biochemistry, Soil and Environmental Management laboratory of Prince Abubakar Audu University, Anyigba, Kogi State.

Methods

Samples Preparation

The vegetables were individually washed to remove extraneous materials and oven dried at 45°c for 1hour and then pulverized into fine powder using laboratory hammer mill. The samples were packaged in a well labeled plastic container. The processing method is as shown in **fig 1** below.

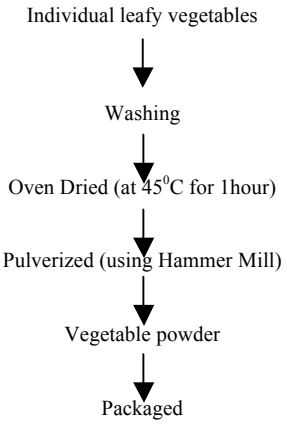

Fig 1: Flow diagram for the production of leafy vegetable powder

Analysis of Samples

The Proximate and Mineral composition of the samples was determined according to standard methods as prescribed by the Association of Official Analytical Chemist {1}.

Using Analysis of variance (ANOVA), all the data collected were subjected to statistical analysis and the means separated using Duncan Multiple range test at 5% probability level (SPSS version 23 computer software was used).

RESULT AND DISCUSSION

TABLE 1: Result of Proximate Analysis of Leafy Vegetable Powder Samples

	Samples						
(%)	A	B	C	D	E	F	G
Moisture	8.2^c	6.83^e	10.2^b	7.26^d	6.75^e	6.41^f	12.31^a
Ash	3.76^e	5.85^b	4.33^d	4.75^c	3.15^g	3.57^f	6.15^a
Crude Fiber	11.35^b	8.21^d	9.72^c	7.25^g	8.15^e	7.55^f	12.76^a
Protein	21.64^c	5.43^f	22.73^b	3.20^g	8.40^e	15.68^d	25.73^a
Fat	4.71^b	1.25^g	2.48^c	2.15^d	1.14^f	1.96^e	6.36^a
Carbohydrate	50.36^f	72.43^b	50.55^e	75.39^a	72.19^c	64.83^d	36.72^g

Values are the means of replicated measurements. Values in the same row with different superscripts were substantially different ($p \leq 0.05$)

Where; Sample A = Moringa leaf powder
Sample B = Cocoyam leaf powder
Sample C = Pumpkin leaf powder
Sample D = A. spinach leaf powder
Sample E = chaya leaf powder
Sample F = Scent leaf leaf powder
Sample G = mixed sample leaf powder (15%A: 15%B: 15%C: 15%D: 15%E: 10%F)

Table 1 presents the proximate composition of the six leafy vegetables. The value for the moisture content shows that the mixed sample was significantly higher in moisture (12.31%) followed by pumpkin (10.2%), moringa (8.2%), A. spinach (7.26%), cocoyam leaf (6.83%), chaya (6.75%) and scent leaf (6.41%) respectively. Low moisture content after drying provides concentrated nutrients while high moisture content enhances water activities that can increase spoilage. {14} suggests that high content of moisture in samples allows for high perishability.

All samples were significantly different ($p \leq 0.05$) in ash. The amount of ash present can be translated to the quantity of minerals present in the sample {8}.

The crude fiber content reveals that the value of A .spinach (7.25%) was low, scent leaf (7.55%), chaya (8.15%), cocoyam (8.21%), pumpkin (9.72%), moringa (11.35%) and the mixed sample (12.76%) respectively. Higher fibre content in food enables easy digestion and prevention of colon cancer {3}. Also non starchy vegetables are the richest sources of dietary

fibre and are employed in the treatment of diseases such as obesity, diabetes and gastrointestinal disorders {3}.
The fat content was highest in the mixed sample (6.36%), moringa (4.71%), pumpkin (2.48%), A.spinach (2.15%), scent leaf (1.96%), chaya (1.41), cocoyam leaf (1.25%) respectively. This shows that the mixed sample is more palatable than the rest of the sample because dietary fat function to increase food palatability by absorbing and retaining flavours {13}. A diet of 1to 2 % of its caloric energy as fat is said to be sufficient to human beings as excess fat consumption yield certain cardiovascular diseases such as atherosclerosis. Fat is known to supply most of the energy needed by man, although vegetables generally contain low lipid content making them valuable sources in avoiding obesity.

This study also revealed that the mixed sample significantly contain the least carbohydrate content (36.72%), moringa (50.36%), pumpkin (50.55%), scent leaf (64.83%), chaya leaf (72.19%), cocoyam (72.43%) and A. spinach (75.39%) respectively. With these it can be said that the mixed sample contains higher nutritional value in relation to protein, fat and fiber.

TABLE 2: Minerals Analysis of Leafy Vegetable Powder Samples

	Samples						
Mg/Kg	A	B	C	D	E	F	G
Ca	8.24^{g}	1019.25^{c}	828.5^{e}	585.3^{f}	1278^{b}	863.8^{d}	1315.8^{a}
Mg	312.5^{f}	445.2^{c}	362.6^{e}	243.70^{g}	523.3^{b}	536.3^{a}	387.9^{d}
Fe	28.36^{f}	39.65^{c}	35.92^{e}	23.61^{g}	45.36^{b}	37.81^{d}	52.11^{a}
Zn	1.45^{f}	2.31^{c}	1.89^{e}	1.21^{g}	29.91^{a}	2.05^{d}	4.53^{b}

Values are the means of replicated measurements. Values in the same row with different superscripts were substantially different ($p \leq 0.05$)
Sample A = Moringa leaf powder
Sample B = Cocoyam leaf powder
Sample C = Pumpkin leaf powder
Sample D = A. spinach leaf powder
Sample E = chaya leaf powder
Sample F = Scent leaf powder
Sample G = mixed sample leaf powder (15%A: 15%B: 15%C: 15%D: 15%E: 10%F)

The highest calcium content was observed in the mixed sample (1315.8mg/kg), cocoyam (1278 mg/kg), chaya (1019.25 mg/kg), scent leaf (863.80 mg/kg), A.spinach (828.5 mg/kg), moringa (824 mg/kg) and pumpkin (585.3 mg/kg) respectively. Studies have shown significantly that dried vegetables contain higher calcium content than fresh vegetables {12}.

All samples were significantly different ($p \leq 0.05$) in magnesium content. Values recorded ranged from pumpkin 243.70 mg/kg to mixed sample (536.60 mg/kg). All samples had appreciable quantity of magnesium adequate for the day to day functioning of the body.

The highest value for iron was observed in the mixed sample (52.11 mg/kg), cocoyam leaf (45.36 mg/kg), chaya leaf (39.65 mg/kg), scent leaf (37.81 mg/kg), A. spinach (35.92 mg/kg), moringa (28.36 mg/kg) and pumpkin (23.67 mg/kg) respectively. Iron is essential for the formation of red blood cell. The mixed sample was significantly higher in Zinc and would be a better source of zinc compared to the other samples.

CONCLUSION

This study showed that mixed sample has a good potential in terms of food value and can serve as an easily accessible food resources. Differences in the chemical compositions may be attributed to different vegetables. The study further revealed that the leaves of plants contains appreciable amount of crude fiber, crude protein, fats as well as minerals, some of which helps in the formation of bones teeth and required in the activation of different enzymes.

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