IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 13, Issue 9 Ver. I (Sep. 2014), PP 86-89
www.iosrjournals.org

The Effect of Processing Methods on Mineral (Iron, Zinc, Copper and Calcium) Composition of Fluted Pumpkin (Telferia Occidentalis) Leaves and Its Product, the Leaf Curd

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Abstract: *The study examined effect of processing methods on the mineral (iron, zinc, copper and calcium) composition of fluted pumpkin (Telferiaoccidentalis) leaf and the curd produced from the leaf. Fluted pumpkin leaf was divided into four (4) portions. One was shade-dried, another was sun-dried and the other was used to produce leaf curd. The last portion was not processed and served as the control. All the processed samples were milled to fine flour and analysed using standard assay methods. The results showed that the iron (Fe) levels of the samples ranged from 98.61-249.66 µg/g. The shade-dried sample had the least iron (98.61 µg/g) while the fresh pumpkin leaf had the highest (249.66 µg/g). Copper, zinc and calcium values followed the same trend as that of Fe. The fresh pumpkin leaves that had the highest iron also had the highest copper (200.28 µg/g), zinc (180.22 µg/g) and calcium (11.26 mg/100g) respectively. The copper content of dried leaf curd, shade-dried fluted pumpkin leaf and sun-dried fluted pumpkin leaves (38.68, 43.75 and 37.58 µg/g) were comparable ($p>0.05$). The fresh leaf curd had higher ($p<0.05$) zinc than the dried fluted pumpkin leaf (168.32 vs 56.64, 49.21 and 56.05 mg/g) respectively.These study have revealed the iron, zinc, copper and calciumcomposition of fluted pumpkin processed in different methods, hence, in this country and other developing countries where deficiency of these minerals are highly prevalent, it is advised that fresh Telferiaoccidentalisbe incorporated in their diet especially where it is readily available. Also government and agriculturist to make effort to increase the cultivation of this vegetable in other to improve the food security in the country.*
Keywords:*Processing Methods,* iron, zinc, copper, calcium*, Fluted Pumpkin,*

I. Introduction

Green leafy vegetables constitute an indispensable constituent of human diet in Africa generally and West Africa in particular [(1)]. Generally, they are consumed as cooked compliments to the major staples like cassava, cocoyam, guinea corn, maize, millet, rice and plantains. Most of the meals based on these staples are considered incomplete without a generous serving of cooked green leaves. The variety of green leafy vegetables utilized is as diverse as both the staples with which they are consumed. It has been estimated that perhaps over sixty species of green leafy vegetables are used in Nigeria alone [(2)]. These range from leaves of annuals and shrubs and of the families Amaranthaceae, compositae, protulacaceae and solanacea, to leaves of trees like the baobab. Many of these vegetables (e.g. Amaranth) are common in all areas of the country but some (e.g. baobab) are restricted in their natural distribution. Due to their wide adaptability, vegetables can fit into cropping systems under diverse agro ecological conditions. There is also seasonal variation in the availability of many of these vegetables.

Vegetables grow abundantly during the rainy season and are more available than in the dry season. This is particularly true of annuals. The seasonal variation in production and availability naturally leads to variation in quantities consumed by the local people. Despite this, however, relatively large quantities of these vegetables are still consumed. Earlier studies [(3)] estimated per capita daily consumption of fresh vegetables in Nigeria to be 65g while some more recent surveys [(4)] showed consumption to be as high as 360g per day. The importance of vegetables, which form a large constituent of the diet of populations in Nigeria, has long been ignored by Food scientists and Nutritionists. They tend to stress the role and contribution of other dietary component to the nutrition of Nigerians, without giving adequate attention to vegetables.

Among the factors influencing the mineral composition of leafy green vegetables, soil fertility (or type and quality of fertilizer used) is perhaps the most important [(5).] This could be the reason for the wide variation observed in some of the published data for leafy vegetables. In a study of twelve (12) Nigeria vegetables, Latunde-Dada [(6)] found that the total iron content differed significantly ranging from 29.4 to 92.6 mg/kg.Some earlier studies [(7 -8)] showed that Nigerian leafy vegetables contain appreciable amount of minerals and this was confirmed by more recent studies [(9 - 11).]

Micronutrients are nutrients required by the body in small amount for proper body functions [12]. Micronutrients which include vitamins and minerals play vital roles in body growth and development, reproduction, brain functions and resistance to diseases among others. Vitamin A, iron, iodine and recently zinc are the major micronutrients of public health importance especially in developing country like Nigeria [13]. This is because of the magnitude and seriousness of their deficiencies and consequences on health, learning capacities and productivity of affected people. Micronutrient deficiencies increase morbidity and mortality rates not only in children under-five years, pregnant and lactating mothers, who are more vulnerable but also to the general populace including vibrant adolescents [14]. It is generally known that the prevalence of malnutrition and micronutrients deficiency increases rapidly in under-five children because of rapid growth and development, therefore deficiency of these nutrients jeopardizes the normal health, growth and development of the child. Children may look healthy and their diets may provide adequate energy and protein but are lacking in micronutrients. This is referred to as "hidden hunger".

The objective of this study is to evaluate the effect of different processing methods on the mineral (micronutrient) - iron, zinc, copper and calcium composition of one of the most widely consumed vegetable in Nigeria called Telferiaoccidentalis. The study is thus significant in that the result will help nutritionist and dietitians to provide informed nutrition education to the populace. The study will shed more light on processing methods that could be used to reduce bulk of locally available vegetables for use in infant feeding as well as the method of processing that is most suitable for conservation nutrient content of the vegetable.

II. Materials And Methods

Fluted pumpkin (Telfariaoccidentalis) used for the study were purchased from Nsukka main market in Enugu state.

Preparation of sample

Fluted pumpkin leaves were picked to remove stems, flowers, unwanted particles, washed in clean deionized water and divided into four equal portions. One portion was analysed fresh which served as control. The other two portions were dried, one under shade and the other under sunlight. The fourth portion was used to produce the leaf curd.

Preparation of fluted pumpkin leaf curd

One portion of fresh fluted pumpkin leaves was homogenized in a laboratory homogenizer (HOBART MIXER) to obtain vegetable puree. The puree were mixed with deionized water in a ratio of 1:3 (puree to water) to get a homoginized mixture. The mixture was filtered through a clean cloth to obtain a clean filtrate. The filtrates were simmered at $75^{O}C$ until the leaf curd was formed. The production of the fluted pumpkin leaf curd is shown in Fig 1.

Chemical analysis

Chemical analysis of the following samples were estimated in triplicate

(i) fresh fluted pumpkin leaves
(ii) sun- dried fluted pumpkin leaves
(iii) shade- dried fluted pumpkin leaves
(iv) dried leaf curd
(v) fresh leaf curd.

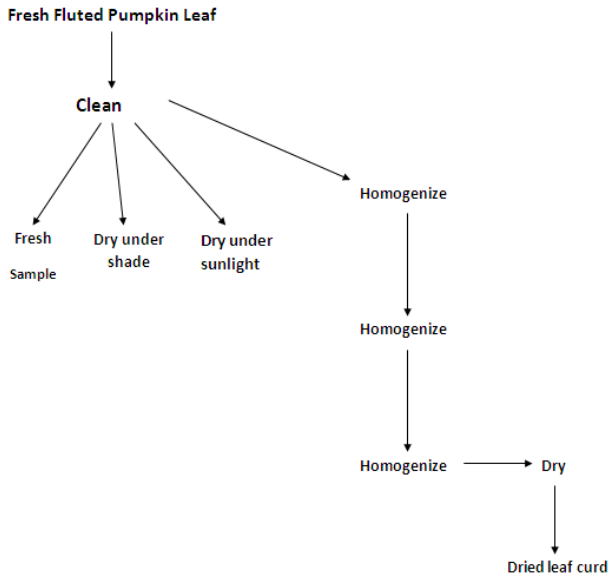

Fig.1: Flow diagram for leaf curd preparation

Minerals-iron (Fe), copper (Cu), zinc (Zn),and calcium (Ca)

Minerals were determined using a Perkin Elmer Model 303 Atomic absorption spectrophotometer after wet or dry ashing of samples and extracting with 0.2M HCl solution [15]. A quantity of 2 g of sample was weighed in a crucible. The samples were be ignited in a muffle furnace for 6-8 hours or overnight at a temperature of 500^{O}C. The samples were cooled and added 5ml 1NHNO_3 solution. It was evaporated to dryness. The samples were returned to the furnace and heated at 400^{O}C for 10-15 minutes until a perfectly white or greyish white colour was obtained. It was cooled and added 10 ml 1N HCl and was filtered into a 50 ml volumetric flask. The crucible and filter paper were washed with additional 10 ml portion of 0.1N HCl solution. The filtrate was stored for mineral determination.

The minerals iron, zinc, copper, iodine, and calcium were determined spectro-photometrically using Perkin Elmer Model 303 Atomic absorption spectrophotometer [16] and compared with the absorption of standards of these minerals.

III. Result

Table 1: Mineral composition of differently processed fluted pumpkin (Telifariaoccidentalis) leaf on dry matter basis

Nutrients	FLC	DLC	SHDPL	SDPL	FPL	LSD
Iron (Fe) (µg/g)	179.09^{b}	111.99^{c}	98.61^{d}	129.56^{c}	249.66^{a}	14.55
Copper (Cu) (µg/g)	186.42^{b}	38.68^{c}	43.75^{c}	37.56^{c}	200.28^{a}	11.92
Zinc (Zn) (µg/g)	168.32^{b}	56.64^{c}	49.21^{c}	56.05^{c}	180.22^{a}	11.71
Calcium (Ca) (mg/100g)	8.80^{b}	3.75^{c}	2.95^{c}	2.99^{c}	11.27^{a}	0.81

n= 3

*a-d: Values with the same letters are statistically similar ($p>0.05$) and those with different letters are different ($p<0.05$)

FLC - Fresh leaf curd
DLC - Dried leaf curd
SHDPL - Shade-dried fluted pumpkin leaf
SDPL - Sun-dried fluted pumpkin leaf
FPL - Fresh fluted pumpkin leaf

Table 1 presents the mineral composition of the five samples on dry matter basis. The iron (Fe) levels of the samples ranged from 98.61-249.66 µg/g. The shade-dried sample had the least iron (98.61 µg/g) while the fresh pumpkin leaf had the highest (249.66 µg/g). Copper, zinc and calcium values followed the same trend as that of Fe. The fresh pumpkin leaves that had the highest iron also had the highest copper (200.28 µg/g), zinc (180.22 µg/g) and calcium (11.26 mg/100g) respectively. The copper content of dried leaf curd, shade-dried fluted pumpkin leaf and sun-dried fluted pumpkin leaves (38.68, 43.75 and 37.58 µg/g) were comparable ($p>0.05$). The fresh leaf curd had higher ($p<0.05$) zinc than the dried fluted pumpkin leaf (168.32 vs 56.64, 49.21 and 56.05 mg/g) respectively.

IV. Discussion

The iron (Fe) content (249.7µg/g) of the fresh pumpkin leaf was lower than the level observed by Oguntona[17] {300µg/g}. The high Fe content of dried leaf curd is an attribute of leaf concentrate because it is known to be high in Fe [18]. The lower copper (Cu) content (38.7µg/g) of the processed leaves than the fresh leaves (200µg/g) could be due to processing, which further reduced the amount present. The zinc levels of the processed fluted pumpkin leaf (49.21-56.02 µg) differed from reports on frequently consumed leafy vegetable like Vernoniaamyadalina (bitter leaf) {0.01 mg} [11]. This might be due to the type of processing done and soil type. The higher calcium (Ca) level of the fresh leaf sample and fresh leaf curd than their processed sample could be as a result of processing.

V. Conclusion

The results of this study showed that sun and shade-dried fluted pumpkin leaf and the leaf curd have promising nutrient potentials. The fresh leaf curd and fresh curd and fresh fluted pumpkin leaf are good sources of iron, copper, zinc and calcium.

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