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Effect Of Blanching and Drying On Some Micronutrients of Selected Green Leafy Vegetables Consumed In Tiv Community, Benue State Nigeria.

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Abstract
The study was aimed at evaluating the effect of blanching and other drying methods on some selected micronutrients (β –carotene Iron and Iodine) contents of Moringa oleifera, Bush fig and Black plum. The vegetables were bought from the major market in Markurdi, Benue State. Fresh healthy vegetables were selected for the study. β –carotene, Iron and Iodine contents of the sample were determined spectrophotometrically. All test were carried out in triplicate. Results showed that β –carotene and iondine content of Moringa oleifera ranged between 435 – 780mcg/100g and 5.03 – 9.75mg/100g respectively with the blanched shade dried (BSHD) having the highest β –carotene (780mcg/100g) and iodine values (9.75mg/100g). The iron content (0.86 vs 0.83mg/100g) of unprocessed and blanched sundried content were not significantly (P > 0.05) different from each other. Micronutrient composition of Bush fig showed blanched shade dried samples was significantly higher in β –carotene (723mcg/100g) and iodine (8.96mg/100g), while sundried sample had higher iron (0.74mg/100g) in Bush fig. The unprocessed sample of black plum appears to be significantly higher in all the nutrients analysed. Based on the outcome of the study blanched shade dried method of drying should be the best recommended for drying of vegetables
***Key words**: Moringa oleifera, Fixus sur, Vitex doniana, processing, micro nutrients*

Introduction

Green leafy vegetables (GLVs) as components of traditional foods are essential for rural subsistence livelihood and health. They occupy an important place among th food crops as they provide appreciable and the most affordable source of micronutrients and health promoting phytochemicals for humans (Chima and lgyor, 2007; Inyang 2016). Apart from variety which they add to the diets, green leafy vegetables are rich source of vitamins especially provitamin A carotenoid, beta carotene and many others and minerals such as calcium, potassium, iron and many others (Fasuyi, 2006 and Inyang, 2016). The consumption of a variety of vegetables by man is believed to contribute significantly to the improvement of human health, in terms of prevention and or cure of diseases because plants have long served as a useful and rational source of therapeutic agent (Igwe *et al.,* 2015).Vegetables are consumed in small quantities as side-dish or relish with the stable food. The vegetables are devised from different parts of plant and most of them are leaves, roots, stem of herbaceous plants, some are seeds and tubers (Rice *et al.,* 1993, Eboh, 2000). There is an increasing awareness of the value of vegetables for maintenance of health, particularly in areas where animal foods are scarce. GLVs are used not only for nutritional values but for flavour and texture (Eboh, 2000), Green leafy vegetables constitute an indispensable constituent of human diet in Africa generally and West Africa in particular (Oguntona and Oguntana, 1986). The variety of green leafy vegetables so utilized are as diverse as both the staples with which they are consumed and the localities. It has, for example been estimated that perhaps over sixty species of green leafy vegetables are used in Nigeria alone (Okoli *et al.,* 1988). In Nigeria generally and in Tiv community in particular, there is an immense number of GLVs both wild and cultivated which can be consumed raw, however, they are mostly cooked. These GLVs range from the leaves of annuals, perennials and shrubs to leaves of trees (Sobande, 2005). GLVs

are important sources of vitamin A *(β- carotene)* and C (ascorbate) and minerals in the diet. The loss of most nutrients in these vegetables depends on the processing conditions used and types of vegetable (Solanke and Awonorin, 2002). There are a lot of green leafy vegetables in Nigeria ecosystem. GLVs are good source of micronutrients and they could provide adequate quantities of micronutrients in the diet when properly processed and utilized (Rajyalakshmi *et al.,* 2001). Food processing transforms raw foods for better quality, shelf life, improved nutritive value, digestibility, enhancement of flavour and assurance of safety (Eboh, 2000). Processing techniques with various methods may have beneficial or harmful effects on different properties of food. The heat treatment at low or moderate temperature such as blanching improves nutrient digestibility (Enwere, 1998). The reasons for processing of foods are to ensure microflora and chemical safety, increase nutrient content, bioavailability and acceptability to the consumers (World Health Organization (WHO) 1998).

Blanching is a widely accepted practice of heat pretreatment of most vegetables prior to storage of other subsequent processing (Badifu and Okeke, 1992). The type of blanching stages affect the retention of their constituents (Onayemi and Badifu, 1991). Vegetables must be blanched before drying to prevent undesirable colour, odour changes and to avoid excessive vitamin losses blanching helps to deactivate enzymes which cause the undesirable changes (Badifu, 1991).
Drying increases the preservation period of a product, however, changes its quality aspect, texture and nutritive values (Rogis, 1997). Drying lowers the moisture and inhibits microflora growth. It is known that the lower the moisture content of a given product, the higher is the keeping quality (Dupriez and Leener, 1992).
Nahar *et al.,* (1992) articulated that different kind of vegetables are grown during the year in the tropics, however, little is known about their nutritive value and chemical composition. Among the Tiv in Benue State, many plants and shrubs are consumed as vegetables or used in food preparations. The knowledge of their use is usually transmitted by personal communication, they remain unknown to the general public. This study evaluated the effect of blanching and drying method and some micronutrients of selected green leafy vegetables consumed in Tiv community in Benue State of Nigeria.

Materials and Methods

The green leafy vegetables selected for this study were *Moringa oleifera Lam* leaves known as Neverdie in English and "Jegerde" in Tiv, *Fiscus sur Forssk* leaves known as Bush Fig in English and "Tugbu" in Tiv and *Vitex doniana* sweet leaves commonly known as black plum and "hulugh" in Tiv. These vegetables were purchased from local retailers in Markurdi, Benue State.

Sample preparation

The leaves were cleaned, destalked, washed thoroughly to remove dirt, sand and other extraneous materials. The black plum leaves was squeeze washed to remove bitterness. The leaves were then chopped with knife into small pieces of about 2 – 3mm width. They were then divided into six equal portions of 500g each. The first portion was unprocessed and served as control. The second portion was blanched in hot water (100^{o}C) in a ratio of 1:2 (w/v) and allowed to stand for 3 minutes. The third portion was sun dried and the fourth portion was shade dried. The fifth and sixth portions were blanched sun dried and blanched shade dried respectively.

Chemical analysis

The micronutrients (Vitamin A (β- carotene), Iron (Fe) and Iodine (I_2) composition of the blanched and dried of these green leafy vegetables were analyzed and the analyses were done in

triplicates.Vitamin A (β- carotene) was determined spectrophotometrically as described by Pearson (1991) in Kirk and Sawyer (1991). Iron was also determined spectrophotochemically (Phenanthroline Method) as described by Pearson (1991) in Kirk and Sawyer (1991). Iodine was determined according to the method of AOAC (1984).

Statistical analysis

The data obtained were analyzed using the mean, standard deviation and standard error of means procedures of steel and Torrie (1960).

Results and Discussion

The micronutrient content of *Moringa oleifera* leaves. The micronutrients (Vitamin A (β-carotene), iron and iodine) content of *Moringa oleifera* leaves are shown in Table 1. Table 1 Reveals the micronutrients (Vitamin A, (β- carotene) Iron (Fe) and Iodine (I_2) composition of *Moringa oleifera Lam* subjected to various domestic food processing techniques. Blanching alone decreased the vitamin A (β- carotene) content of this vegetable from 675.42 to 521.84mcg/100g and had a loss of 153.58mcg/100g. Sun drying alone decreased vitamin A (β- carotene) content from 675.42mcg/100g to 435.08 mcg/100g and had a loss of 240.34mcg/100g. Shade drying also reduced the vitamin A (β- carotene) content of the vegetable from 675.42 to 490.57mcg/100g and had a loss of 184.85mcg/100g, however, this is not as much as sun dried. Combination of blanching and shade drying increased the vitamin A (β- carotene) content of this vegetables from 675.42 to 780.66mcg/100g and had an increase of 105.24mcg/100g. All the food processing techniques employed on the vitamin A (β- carotene) content of *Moringa oleifera Lam* were significantly different at $P<0.05$. The decreased in vitamin A (β- carotene) content might be due to heat treatment because vitamin A (β- carotene) is volatile at high temperature. A similar loss in vitamin A (β- carotene) exist in literature (Rodriguez-Amayo, 2002; Wachap, 2005). The increased in vitamin A (beta-carotene) due to the combination of blanching and shade dried suggest that this food processing technique is good to preserve and retain this nutrient in green leafy vegetables.

The iron content of the fresh *Moringa oleifera* ranged from 0.86 to 0.75mg/100g. Sun dried alone had the least iron content of 0.65mg/100g. The result showed that vegetables are poor sources of iron. In this case, not only that this vegetable is a poor source of iron but the little it contained was lost during processing. Oguntona, (1998) and Wachap (2005) had similar phenomenon.

All the food processing techniques employed, decreased the iodine, content of this vegetable drastically except blanched sun dried that increased it from 8.82 to 8.92mg/100g and blanched shade dried from 8.82 to 9.75mg/100g respectively. The above higher iodine content in blanched sun dried and blanched shade dried demonstrated the advantages of snergestic effect of these processing techniques as against a single process. The fact that blanched shade dried contained more iodine than others techniques, showed that it is a better technique to increase and conserve iodine in this vegetable. All the processing techniques applied on the iodine content of *Moringa oleifera Lam* were significantly different at $P<0.05$.This observation confirms those of many researchers (Latunde-Dada, 1990; Aletor and Adeogun, 1995; Bako *et al*., 2002) in green leafy vegetables.

The micronutrient content of *Fiscus sur leaves.* The micronutrients (Vitamin A (β- carotene), iron and iodine) content of *Moringa oleifera* leaves are shown in Table 2. Table 2 Presents the micronutrients (vitamin A (β- carotene), iron and iodine) composition of *Fiscus sur Forssk* subjected to various processing techniques, Blanching alone decreased the vitamin A (β- carotene)

content of this vegetable from 687.86 to 582.17mcg/100g. Sun dried had the least vitamin A (β-carotene) content of this vegetable from 687.86 to 366.87mcg/100g and had a loss of 320.99mcg/100g.

Other processing technique like shade dried and blanched sun dried decreased it from 687.86 to 454.59 and 687.86 to 431.37mcg/100g respectively. But blanched shade dried had the increase of 45.87mcg/100g (687.86 to 723.73mcg/100g) in vitamin A (β- carotene) content of this vegetable. The decrease in vitamin A (β- carotene) in all food processing techniques employed except in blanched shade dried, might be due to heat treatment because vitamin A (β- carotene) is volatile at high temperature. The increase in vitamin A (β- carotene) due to blanching and shade dried suggest that this food processing technique is good to preserve and retain nutrient in this green leafy vegetable *Fiscus sur Forssk* (Bush fig).

Table 1: The micronutrient (Vitamin A (β- carotene) **iron and iodine composition of *Moringa Oleifera Lam* subjected to various processing techniques**

Parameters	Vitamin A (β–carotene)mcg/100g	Iron (mg/100g)	Iodine (mg/100g)
UPS	$675.42^{b} \pm 0.64$	$0.86^{a} \pm 0.00$	$8.82^{b} \pm 0.00$
BD	$521.84^{c} \pm 0.61$	$0.73^{b} \pm 0.00$	$5.03^{d} \pm 0.00$
SD	$435.08^{d} \pm 0.73$	$0.65^{c} \pm 0.00$	$6.61^{c} \pm 0.00$
SHD	$490.57^{d} \pm 0.24$	$0.76^{b} \pm 0.00$	$6.42^{c} \pm 0.00$
BSD	$429.05^{d} \pm 0.46$	$0.83^{a} \pm 0.00$	$8.92^{b} \pm 0.00$
BSHD	$780.66^{a} \pm 0.19$	$0.75^{b} \pm 0.00$	$9.75^{a} \pm 0.00$

Mean ± SD (standard deviation) of triplicate determinations. Mean on the same row with different superscript are significantly different at P<0.05

UPS – Unprocessed BD – Blanched SD – Sun dried SHD – Shade dried BSD – Blanched sun dried BSHD – blanched shade dried

Table 2: The micronutrients (Vitamin A {β – carotene} iron and Iodine) composition of *Fiscus sur Forssk* subjected to various processing techniques

Parameters	Vitamin A (β–carotene)mcg/100g	Iron (mg/100g)	Iodine (mg/100g)
UPS	$687.86^{b} \pm 0.82$	$0.68^{b} \pm 0.00$	$7.83^{b} \pm 0.03$
BD	$582.17^{c} \pm 0.80$	$0.55^{c} \pm 0.01$	$4.63^{d} \pm 0.00$
SD	$366.87^{e} \pm 0.64$	$0.49^{d} \pm 0.00$	$5.04^{d} \pm 0.00$
SHD	$454.59^{d} \pm 0.66$	$0.56^{c} \pm 0.01$	$6.53^{c} \pm 0.00$
BSD	$431.37^{d} \pm 0.28$	$0.74^{a} \pm 0.00$	$8.01^{b} \pm 0.00$
BSHD	$723.73^{a} \pm 0.60$	$0.77^{a} \pm 0.00$	$8.96^{a} \pm 0.00$

Mean ± SD (standard deviation) of triplicate determinations. Mean on the same row with different superscript are significantly different at P<0.05

UPS – Uprocessed BD – Blanched SD – Sun dried SHD – Shade dried BSD – Blanched sun dried BSHD – blanched shade dried

The iron content of this vegetables was very low ranging from 0.68 to 0.49mg/100g in all the food processing techniques employed except in blanched sun dried and blanched shade dried that ranged from 0.68 to 0.74 and 0.68 to 0.77mg/100g respectively. Generally the iron content of this vegetable is poor. The lower iron values for this vegetable showed that vegetables are poor sources of iron. In this case, not only that this vegetable is a poor source of iron but the little it contained was lost during processing. Wachap (2005) reported a similar phenomenon.

The iodine content of this vegetable (*Fiscus sur Forssk*) ranged from 7.83 to 8.96mg/100g. There were decreased in all the food processing techniques applied and they ranged from 7.83 to 4.63mg/100g except in blanched sun dried and blanched shade dried that increased from 7.83 to 8.01mg/100g and 7.83 to 8.96mg/100g respectively. The higher iodine content 8.01 and 8.96mg/100g due to the combination of blanched sun and shade dried of this vegetable demonstrated the advantages of synergistic effect of these processing techniques as against a single process. This observation confirms the findings of Aletor and Adeogun (1995); Bako *et al.,* (2002) in green leafy vegetables. The high iodine content for the blanched shade dried of this vegetables showed that this food processing technique was very specific to increase and conserve iodine in this vegetable. This result agrees with the report of WHO (1996) that food processing improves food values.

The micronutrient content of *Vitex domiana leaves*. The micronutrients (Vitamin A (β- carotene), iron and iodine) content of *Moringa oleifera* leaves are shown in table Table 3. Table 3 Reveals the micronutrients (Vitamin A (β- carotene), Iron and Iodine) content of *Vitex doniana* Sweet subjected to various processing techniques. The vitamin A (β- carotene) content of this vegetable was drastically decreased by all the food processing techniques ranging from 878.06 to 601.82mcg/100g. Blanching alone decreased the vitamin A (β-carotene) content from 878.06 to 801.55mcg/100g and had a loss of 76.51mcg/100g. Other techniques as sundried, shade dried, blanched sun dried and blanched shade dried decreased the vitamin A (β- carotene) content is *Vitex doniana* leaves from 878.06 to 653.63; 878.06 to 687.94, 878.06 to 601.82 and 878.06 to 746mcg/100g respectively. The vitamin A (β- carotene) content of this vegetable was significantly different at $P<0.05$. Vitamin A (β- carotene) is volatile at high temperature and this may be the cause of its decreased in this vegetable. This agreed with the result of Rodriguez-Amaya (2002) on the effects of processing and storage on carotenoids.

The iron content of this vegetables is very low and ranged from 0.77 to 0.64mg/100g. The lower value of iron in this vegetables and generally in all vegetables proved that vegetables are poor sources of iron and the little they contained might even leached out during processing.

The iodine content of *Vitex doniana* Sweet ranged from 8.90 to 5.35mg/100g. Blanched shade dried increased higher than all other processing techniques but not as high as the unprocessed and from 8.90 to 8.14mg/100g.

Conclusion

Based on the results, if these green leafy vegetables would be available fresh all year round, they are better sources of vitamin A (β- carotene), iron and iodine than when processed. Combination of blanching and shade drying was a better food processing technique to preserve and retain appreciable nutrients than combination of blanching and sun drying. More popular and lesser known seasonal or underutilized green leafy vegetables need to be investigated to diversify their food uses and production to increase food security. There should be awareness campaign to promote the use of these green leafy vegetables in other communities in Benue State and in Nigeria as a whole.

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