THE EFFECTS OF DRYING ON SOME NUTRIENTS *MORINGA OLIEFERA* LEAVES

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Abstract
The Moringa Oleifera leaves contains a very high level of nutrients, some of which may be lost during drying. It is therefore necessary to determine the most appropriate drying method to minimize the loss of these nutrients. The main objectives of this work is to evaluate the effect of sun drying and drying at ambient conditions on the some mineral and vitamin content of Moringa Oleifera leaves powder with a view to determine the most suitable drying method for the production of Moringa Oleifera leaves powder. Fresh Moringa Oleifera leaves were harvested, defoliated, washed and drained. With the initial mineral and vitamin contents of the leaves determined, 120 g each was then sundried and dried at ambient conditions. The dried samples were milled and the mineral and vitamin contents determined using standard methods. The results shows that the sundried samples have higher content of vitamin C and E while the samples dried at the ambient conditions have the higher contents of phosphorus, potassium, magnesium and vitamin A. Drying however has no significant effects ($p \leq 0.05$) on the zinc and copper contents of Moringa Oleifera leaves. It can be concluded that drying generally resulted in the decrease in phosphorus, vitamins E and A contents of Moringa Oleifera leaves, while it increases the potassium, magnesium and vitamin C contents. It is therefore recommended that Moringa Oleifera leaves should be dried at ambient conditions due to the higher retention of some essential minerals and vitamins content of the dried samples.

Keywords: *Moringa Oleifera leaves, sun drying, ambient condition, mineral, vitamins*

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1 INTRODUCTION

Moringa (*Moringa oleifera* Lam.) is native to the Indian subcontinent and has become naturalized in the tropical and subtropical areas of the world. *Moringa Oleifera* trees are well naturalized in the northern parts of Nigeria where the leaves are popularly known as *Zogele* and widely consumed by populace. *Moringa Oleifera* is a deciduous tree or shrub, which grows to an average of 12 meters at maturity. It is a fast-growing plant, and drought resistant crop variety. It can survive in less fertile soil (Fahey, 2005, Anwar *et al*., 2007). *Moringa oleifera* tree has a wide-open typically umbrella- shaped crown, usually, a single stem which tends to be deeply rooted, the wood is soft and its bark is light (Anwar *et al*., 2007). *Moringa Oleifera* leaves are excellent, concentrated source of proteins, vitamins and minerals. Out of the 120 vegetable species tested for their nutrient content, antioxidant activity, gustatory qualities and the facility with which they are grown and processed, *Moringa Oleifera* leaves were top ranked by the World Vegetable Centre (AVRDC) (Moyo, *et al*., 2011). However, seasonal variation and varieties has been reported to have effects on the nutritional content, this is similar to the reports of Rodrigues, *et al*., 2011 on the effects of meteorological conditions on antioxidant flavonoids in Portuguese cultivar of white and red onions. The *Moringa Oleifera* leaves, fresh or processed into dried powder, can be used as an every-day food item in a multitude of ways: in ready-made meals, juices, breads, pasta, fritters, condiments, tea and instant soups. It can be used in households, school cafeterias, dispensaries, maternity wards, nutrition rehabilitation centers, as well as in restaurants and supermarkets (Armelle and Melanie, 2010). *Moringa Oleifera* leaves is an exceptional resource for developing countries. Processed or fresh, the *Moringa Oleifera* leaves is not only a new, promising source of income and employment, but also an outstanding, nutritionally rich vegetable for families and markets (Foidl, *et al*., 2001).The *Moringa Oleifera* plant leaves contains a very high level of nutrients. The *Moringa Oleifera* tree however, is a deciduous plants and its

sheds its leaves in the dry season. It is therefore imperative to develop a method to make the *Moringa Oleifera* leaves available in and out of season. Several attempts have been made to provide consumers with high quality fresh foods with minimal amount of effort and time to prepare, onions among others have been minimally processed to extend its shelf life and to retain its nutritional qualities (Perez-Gregorio, *et al*., 2011). Rodrigues, *et al*, 2010 carried out the assessment of the effect of different post-harvest treatment on the flavonoids content of red and white onion cultivars. Drying or dehydration is the oldest method of food preservations particularly successful in the hot, dry climates (Flores 2007). Certain qualities might be lost during drying, it is therefore imperative to determine the most appropriate method that will minimize loss in nutrients to the barest minimum. The main objectives of this work is to evaluate the effect of sun drying and drying at ambient conditions on some vitamin and mineral content of *Moringa Oleifera* leaves powder with a view to determine the most suitable drying method for the production of *Moringa Oleifera* leaves powder.

2. MATERIALS AND METHODS

2.1 Materials

(i) Moringa *Oleifera* leaves

The *Moringa Oleifera* leaves used for this study were obtained from MAIZUBE farm located in the outskirt of Minna, Niger State Nigeria. The soil conditions present in this area favour the growth of *Moringa Oleifera* leaves and it is being grown in large quantity with a view to export. The *Moringa Oleifera* leaves were obtained in April 2012 and was transported from the farm to the Food Processing Laboratory in the Federal University of Technology Minna where it was processed into powder.

2.2 Methodology

The procedure for the processing of *Moringa oleifera* leaves into powder includes the followings steps:

i. Harvesting *Moringa Oleifera* leaves

Manual harvesting of leaves together with the shoots was carried out with a sharp knife. All shoots were cut at the desired height, i.e. 30 cm to 1 m above ground to prevent damaging the tree. This method also helps to prune the tree making the growth of the tree to be as vigorous as before (Armelle and Melanie, 2010, Kokou, *et al.*, 2001).

ii. Transporting *Moringa Oleifera* leaves

The leaves were transported together with the stems of the tree immediately to the laboratory to avoid deterioration. The leaves were well ventilated and care was taken not to put load on top of the leaves (Armelle and Melanie, 2010, Amaglo, *et al.*, 2007).

iii. Defoliating

Defoliation involves the process of detaching the leaves from the stock of the *Moringa Oleifera* tree stem. The transported leaves were then defoliated from the stems manually to prevent damaging the leaves. It is also imperative to defoliate the plant to ensure proper drying during the drying stage. Defoliation also prevents the leaves from returning nutrients back to the stock of the tree as this is peculiar to deciduous plant. Leaves were removed at the base of the petiole where it is tender and can be easily detached. At this stage diseased and damaged leaves were discarded (Armelle and Melanie, 2010, Farse, *et al*., 2006).

iv. Washing of *Moringa Oleifera* leaves

The defoliated leaflets were washed in troughs using clean portable water. This is to remove the dirt that maybe accumulated on the leaves. The leaves were washed again in 1% saline solution for about three to five minutes (3-5minutes), washing of the leaves in saline solution helps to remove microbes logged on the leaves. It is necessary to rinse again in clean portable water to remove the saline

content before proceeding to drain the water from the leaves. The troughs were drained after each batch and clean water was used for the washing of each successive batch (Armelle and Melanie, 2010, Amaglo, *et al.*, 2007).

v. Draining the leaves

Water was strained from the leaves using strains obtainable in the laboratory. The leaves were left to drain for about ten to fifteen minutes (10-15 minutes) before drying. It is important to drain the samples as the moisture content of the samples is to be determined before the drying takes place. Draining also prevents unnecessary introductions of moisture into the sample (Armelle and Melanie, 2010, Amaglo, *et al.*, 2007).

vi. Drying

The drying of the leaves was carried out by drying at ambient room condition and sun drying, The *Moringa Oleifera* leaves were dried when the weight of the samples remained constant at three consecutive readings.

a. Drying at ambient room temperature

The drying at the ambient room condition was done in the Food Processing Laboratory. The laboratory is conducive for the drying process; it is free of dust, rodents and insects. A hundred and twenty grams (120g) of the *Moringa Oleifera* leaflets were spread on a rack in the room. The leaflets were spread evenly on the rack and the loading density did not exceed 1 kg/m^2 (Armelle and Melanie, 2010, Flores 2007). Direct air blowing on the samples either from an artificial or natural source was avoided. This is because exposure to unnecessary air can increase contamination with germs in the air. The leaves were turned at a regular interval to enhance uniform drying.

b. Sun Drying

Drying in the sun was carried out with the aid of a rack covered with a muslin cloth. The muslin cloth was used to keep out the dust from the sample being dried. A hundred and twenty grams (120g) of the *Moringa Oleifera* leaflets were spread thinly and uniformly on the solar dryer rack at a loading density of about 2kg/m^2 (Armelle and Melanie, 2010, Flores 2007).

2.3 Determination of Some Mineral and Vitamin Content of Dried *Moringa Leaves* Powder

The phosphorus, potassium, magnesium, zinc and copper (mineral content) and vitamin A, C and E (vitamin content) were determined using the methods of AOAC (1990) as follows: The mineral content was determined by adding 0.5g of dried ground samples into a 75ml digestion tube, 5ml of the digestion mixture was added and placed in a fume hood. It was then digested for 2 hrs at 150^{0}C and then cooled for 10 minutes. Three milliliters (3 ml) of 6N HCL was added and the mixture digested for another one and half hours before it was cooled. Thirty milliliters (30ml) of distilled water was then added and the mixture stirred. After cooling the volume was made up to 75 ml mark and the tube shaken. The mixture was then transferred to analyses cups for total mineral analysis. The vitamin C content was determined by weighing five grams (5g) of each sample into a volumetric flask and 10ml of extracting solution was added. Ten milliliter (10ml) of the solution was pipette into a small flask and titrated with 2, 6 dichlorphenol solution. The vitamin C content was then calculated from the titer value.

3. RESULTS AND DISCUSSION

The results shows that there was a decrease in the phosphorus content in the dried *Moringa Oleifera* powder compared to the fresh leaves (Fig 1), it decreased from 23.6 % to 18.6 % and 18.3 % for the leaves dried at ambient conditions and sun respectively. The potassium content in the dried powder increased compared to the fresh leaves of *Moringa Oleifera*, it increased from 0.78 % to 1.6 %.

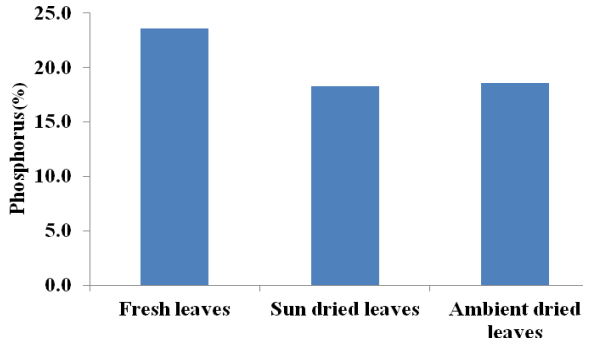

Fig. 1: The effect of drying on the phosphorus content of *moringa oleifera* leaves

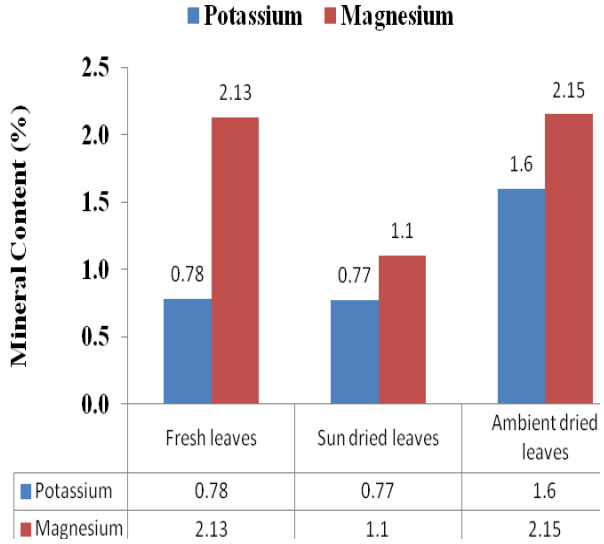

Fig. 2 The effect of drying on the potassium and magnesium content on *moringa oleifera* leave

The result shows that drying methods used does not affect the increase in potassium content as there was no significant difference ($p \leq 0.05$) in the potassium content of powder after drying for all the samples (Fig 2).

The magnesium content decreased from 2.13 % to 1.10 % in the sundried sample, while there was no significant difference ($p \leq 0.05$) in the magnesium content between the fresh leaves and sample dried at ambient conditions (Fig 2). Drying has no significant effects ($p \leq 0.05$) on the zinc and copper content of *Moringa Oleifera* leave. Drying however decreased the vitamin A of *Moringa Oleifera* leaves, it decreased from 12.25 mg/100g to 11.4 mg/100g and 11.60 mg/100g for the sundried and samples dried at ambient condition respectively (Fig.3).

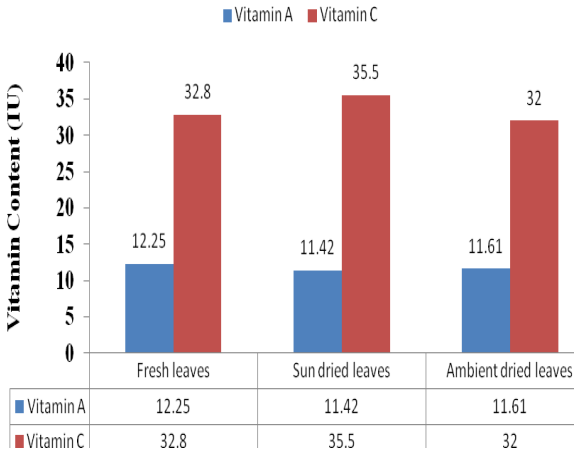

Fig. 3 The effect of drying on the *vitamin A and C content of *moringa oleifera*

The vitamin C content of the dried samples increased from 32.8 mg/100g to 35.5 mg/100g in the sundried sample but the decrease was not significant in the sample dried at the ambient conditions and the fresh leaves (Fig.3). The vitamin E content decreased from 2.3 mg/100g to 2.0 mg/100g and 1.2 mg/100g respectively for the sundried samples and samples dried at ambient conditions (Fig 4).

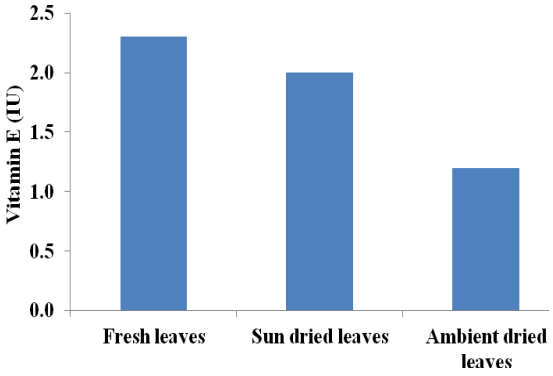

Fig. 4 The effect of drying on the *vitamin E content of *moringa oleifera* leave

*1 milligram is equivalent to 1 International Units (IU)

Vitamins are needed to regulate the maintenance and growth of the body and to control metabolic reactions in cells. These minerals and vitamins are important because they are required for the proper functioning of body cells, muscles and nerves (Tull, 1996) and therefore processing should result in minimal loss of these nutrients. This results shows that drying has slight effect on the loss

of minerals and vitamins in *Moringa Oleifera* leaves. Hence drying at ambient condition is a suitable method for the processing and preservation of *Moringa Oleifera* leaves.

3. CONCLUSIONS

It can be concluded that drying generally resulted in the decrease in phosphorus, vitamins E and A contents of *Moringa Oleifera* leaves, while it increased the potassium, magnesium and vitamin C contents. It however has no significant effects ($p \leq 0.05$) on the zinc and copper contents of *Moringa Oleifera* leaves. The sundried samples have higher content of vitamin C and E while the samples dried at the ambient conditions have the higher content of phosphorus, potassium, magnesium and vitamin A. It is therefore recommended that *Moringa Oleifera* leaves should be dried at ambient conditions due to the higher retention of some essential minerals and vitamins in the dried samples.

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