

Effect of Drying Temperature on Nutritional Content of Moringa Oleifera Leave

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Abstract: *Moringa oleifera*, an edible tree found worldwide in the dry tropics, is increasingly being used as nutritional supplementation. Loss of nutrients can be induced by a number of factors. Obviously, losses of vitamins depend on cooking time, temperature, and cooking method. In this study the effect of temperature on vitamin A, vitamin C and protein content of moringa leave was investigated. Fresh samples of Moringa leaves were collected, sorted, dried using two different drying methods viz; oven drying and sun drying methods. The dried plant samples were ground using clean laboratory blender, the powdered plant samples were analysed separately for their protein, vitamin A and vitamin C constituents using appropriate methods. The nutritional content of the moringa oleifera leaves show variation with different drying condition. Drying temperature of 60°C gave the best drying temperature.

Keywords: Moringa, Oleifera, Nutritional-Supplement, Temperature

1. Introduction

Moringa oleifera is popularly known in many countries as a “miracle plant” because of its nutritional and medical properties. Moringa oleifera is the most cultivated plant from Moringaceae family. Primarily it grows in tropical, subtropical and semi-arid climate. It is used in traditional Indian medicine for centuries. Moringa Oleifera are grown largely in tropical and sub-tropical areas. It is increasingly being used for nutritional supplementation. Its nutrient-dense leaves are high in protein quality, leading to its widespread use by doctors, healers, nutritionists and community leaders, to treat under-nutrition and a variety of illnesses. Despite the fact that no rigorous clinical trial has tested its efficacy for treating under-nutrition, the adoption of *M. oleifera* continues to increase. Moringa can be described as miracle tree and its leaves are an abundant indigenous source of digestible proteins, vitamins, mineral and carbohydrates that are necessary for human beings of all ages [1]. Traditional medicine techniques used Moringa leaves to treat gastrointestinal problems, headache, inflammation, anemia, fever, eye infection, bronchitis, poor nutrition, inner ear

infection, skin infection (topical use). Fresh Moringa leaves could be cooked like spinach or any other green leaves, it could be used raw as a salad green mixture. Dry leaves could be sprinkled on any food to improve nutritional value. It was estimated that almost three hundred diseases can be cured by taking Moringa leaves along with hundreds of other health benefits. It also contains more than 90 nutrients, different antioxidants and all the eight essential amino acids [2]. Drying is the oldest and commonly used technique for preservation of fruits and vegetables.

Drying food preserves nutrients and protects it by removing the moisture that bacteria, yeasts, and molds need to live. Raw, fresh food at the moment it is harvested contains the highest content of nutrients, but begins to decline post-harvest as it is exposed to light and air during handling. Additional nutrient loss occurs when the food undergoes preparation (peeling, slicing, chopping), and declines further once exposed to heat for preservation and storage. Thus, maximum retention occurs when food is dried right after it is picked. The nutrient loss for commercially-dried foods varies between 30 – 80% for

vitamin C and 10 – 50% for vitamin A [3]. The variation is much greater for fresh food purchased from the store and preserved at home. Although drying destroys some nutrients like vitamin C, removing water concentrates what's left, along with other nutrients, jamming more calories, dietary fiber, and/or air-resistant vitamins and minerals into a smaller space. Drying cause changes in the food properties including discolouring, aroma loss, textural changes, nutritive value, and changes in physical appearance and shape. Higher drying temperature reduces the drying time but may result in poor product quality, heat damage to the surface and higher energy consumption. On the other hand, mild drying conditions with lower temperature may improve the product quality but decrease the drying rate thus drying period is lengthened. [4]. The colour measurements of food materials are used in an alternate way to determine the quality variations as they are faster than a complete physicochemical examination. Many researchers have conducted experimental studies on drying process and mathematical modeling of several fruits, leaves and vegetables mathematical modeling of several fruits, leaves and vegetables like eggplant, [5] red pepper, [6] black tea [7] etc. However, studies on the drying behavior of Moringa leaves are not present in literature except convective drying [8]. Moreover, the nutritional content varies slightly with location; there is no study on drying behavior at different temperatures of Moringa leaves from different localities. The goal of this work is to investigate the effect of drying temperature on nutritional content of moringa oleifera leaf obtained from Abuja, Nigeria.

2. Materials and Methods

2.1. Sample Collection and Processing

The sample was collected from the Moringa farm SHESTCO, Abuja. It was washed with tap water and the leaflets were stripped from the stem. It was then divided into four portions, each portion dried under the sun, at room temperature (under shade), at 60°C and 105°C respectively. The dried leafs were then made into powder by pounding.

2.2. Determination of Vitamin A Content

5g of the sample was soaked in 20ml of acetone overnight. It was then filtered into a separating funnel and 10ml of petroleum ether was added. The resulting solution was shook vigorously and then allowed to stand for some time. Two distinct layers were formed. The top layer was collected and its absorbance was taken at 452nm using the uv/visible spectrophotometer. The value of absorbance was then inserted into the formula below.

$$\text{Vitamin A} = \frac{3.85 * A * V * 100}{W * 1000} \quad (1)$$

Where

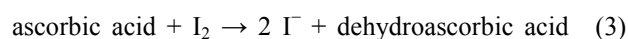
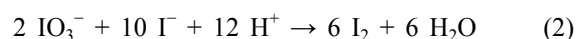
A= absorbance

V= volume of petroleum ether

W= weight of sample

2.3. Determination of Vitamin C Content

The vitamin C content of the moringa oleifera leaf was determined by redox titration using iodate solution. The concentration in mol L⁻¹, of ascorbic acid in the solution obtained from vegetable/juice was calculated using the equations (2) and (3)



2.4. Determination of Protein Content

The protein content was determined by using the micro Kjeddah method described by Association of Official Analytical Chemists AOAC [9]. The protein distillation was carried out and the titer value was inserted into the formula to determine the nitrogen content of the sample.

$$\text{N\%} = \frac{V_s - V_b * \text{Nacid} * 0.01401 * 100}{W} \quad (4)$$

where

Vs = titer value.

Vb = blank.

Nacid = normality of acid

W=weight of sample

% crude protein = %N x conversion factor (6.60)

3. Results and Discussion

The effect of temperature on the vitamin A, Protein and Vitamin C content of moringa oleifera leaf is shown in From table 1, 2 and 3 respectively.

Table 1. Effect of temperature of vitamin a content of moringa leaf.

Drying temperature (°C)	Drying time (hr)	Absorbance	Vitamin A (mg/100g)
105°C	4	0.716	0.5448
60°C	8	1.044	0.7945
Room temp. (average room temperature, 30°C)	96	0.973	0.7399
sundried	varies	0.842	0.6365

Vitamin A is a fat soluble vitamin that is also a powerful antioxidant. Vitamin A plays a critical role in maintaining healthy vision, neurological function, healthy skin, and more. The highest value of vitamin A was recorded at drying temperature of 60°C while the lowest value was recorded at 105°C. Vitamin A is unstable when exposed for length of time to light, air or heat [10].

Table 2. Effect of temperature of protein content of moringa leave.

Drying temperature (°C)	Drying time (hr)	%Nitrogen	%Protein
105°C	4	1.49	9.83
60°C	8	4.89	32.24
Room temp. (average room temperature, 30°C)	96	4.66	30.75
Sundried	varies	2.35	15.48

The melting temperature varies for different proteins, but temperatures above 41°C (105.8°F) will break the interactions in many proteins and denature them [11]. Heating process also results in nutritional loss by inducing biochemical and nutritional variation in food composition. Decrease in food protein and carbohydrate content probably occurs as a result of Maillard reaction; which results to complex changes in food

due to the reaction between protein and carbohydrate [12], [13] [14]. The effect of temperature on the protein content of moringa oleifera leave is shown in Table 2. The highest value of protein content was obtained at 60°C while the lowest values was obtained at 105°C. This value is more than the melting temperature of most protein

Table 3. Effect of temperature of vitamin C content of moringa leave.

Drying temperature (°C)	Drying time (hr)	Vitamin C
105°C	4	22.02
60°C	8	36.08
Room temp. (average room temperature, 30°C)	96	38.02
Sundried	varies	32.06

High temperature has effects on vitamin C content of fruits, blanching in hot water can cause an appreciable loss in vitamin C that is thermally labile. Ascorbic acid oxidase needs to be inactivated; this prevents enzyme-catalyzed reaction during processing [15]. The effect of temperature on the vitamin C content of moringa oleifera leave is shown in table 1. The highest value of vitamin C was recorded at drying temperature of 60°C while the lowest value was recorded at 105°C. [16] Reported that Vitamin C is easily destroyed by excessive heat and water, as well as exposure to air. For retention of vitamin C in cooked foods, it is recommended that vegetable be preserved under the temperature of 70 degree Celsius to avoid the damage caused by the heat [17].

4. Conclusion

The effect of drying temperature on the vitamin A, vitamin C and protein content of moringa oleifera leave was investigated. The results showed that the vitamin A, vitamin C and protein content of moringa oleifera leave vary with temperature. Moringa oleifera dried at room temperature and 60°C contain higher level of vitamin A, vitamin C and protein, compared to those dried under the sun and at 105°C. This is because vitamins and proteins are denatured at high temperature. It was also observed that moringa dried at room temperature took longer time dry (4 days), compared to those dried at 60°C (8 hrs). It can be concluded that moringa is better dried at 60°C. This is because it contains a higher amount of vitamin A, vitamin C and protein. Also it took a shorter time to dry compared to those dried at room temp.

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