

The effect of different drying temperatures on the nutritional composition and phytochemical constituents of *Jatropha Multifida* leaves

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ABSTRACT

Jatropha multifida is very useful in herbal applications; the young leaves are cooked for food in Guinea. *Jatropha M.* leaves is called different names in different Nigerian language, “lapalapa” in Yoruba, “Wuluidu” in Igbo, and “Zingu binda” in Hausa language . In West Africa especially in Nigeria, they are used in the treatment of constipation, hypertension, fever and a few other applications. It is therefore very crucial to consider the best method of drying suitable for preservation. About One (1) kg of fresh leaves was collected from the College of Forestry in Jos North Local Government Area in Plateau State Nigeria, and it was identified and authenticated. The cleaned leaves were then divided into three groups and subjected to different drying temperatures; for shade drying (30 – 32°C) JMLSD, oven drying at 40°C, JML40°C, and at 80 °C, JML 80°C. The mineral composition, proximate food analysis, and phytochemical screening of the different dried samples were determined. The result showed that for nutritional consumption, the shade drying method produced the best result with reduced phytochemical contents and more retained nutritional constituents. But for the medicinal application the 40°C is the optimum temperature for drying, because of its average nutritional and phytochemical constituents.

Keywords: different temperatures, mineral composition, proximate food composition, phytochemical constituents, *Jatropha multifida* leaves

INTRODUCTION

Medicinal plants have been the mainstay of traditional herbal medicine amongst rural dwellers worldwide since antiquity to date. The therapeutic use of plants certainly goes back to the Sumerian and the Akkadian civilizations in about the third millennium BC. Hippocrates (ca. 460–377 BC), one of the ancient authors who described medicinal natural products of plant and animal origins, listed approximately 400 different plant species for medicinal purposes [1]. Over the years they have assumed a very central stage in modern civilization as natural source of chemotherapy as well as amongst scientist in search for alternative sources of drugs. Medicinal plant is employed in the control or treatment of a disease condition and therefore contains chemical components that are medically active. The commonly used method for drying in Africa especially is either sun-drying or shade drying. But with a welcoming development of technology, most of the modern day’s Herbal practitioners prefer to use closed gas oven. Thus, ensuring quicker production and consequently increase in cash rewards, without taking into consideration the harmful side effects. These non-nutrient plant chemical compounds or bioactive components are often referred to as phytochemicals (‘phyto-’from Greek - phyto meaning ‘plant’) or phytoconstituents and are responsible for protecting the plant against microbial infections or infestations by pests [2].

Jatropha multifida (Linn). Physic nut or purging nut is drought resistant shrub or tree belonging to the family Euphorbiaceae, which is cultivated in central, and South America, Southeast Asia, India and Africa [3]. In Guinea, the young leaves are cooked for food [4]. In West Africa, especially in Nigeria, the leaves are used in the treatment

of oral thrush, constipation, hypertension and fever [5]. Latex from the leaf and poultices of the roots are employed as anthelmintic, treatment of wound infection and various inflammatory skin conditions [6]. All parts of *J. multifida* can be used for a wide range of purposes, the tree itself has been used for erosion control, fire wood, hedge plant and for plant protection, and also the bark is rich in tannin and yields a dark blue dye [7][8].

Investigations on the phytochemical screening of *J. multifida* stem bark and leaf extracts revealed the presence of saponins, steroids, tannins, glycosides, alkaloids and flavonoids. It is these secondary metabolites that have biological actions and which can be modified to produce drugs [9][10]. Such isolates are mostly secondary metabolites such as alkaloids, anthraquinone, tannins, glycosides, flavonoids, terpenoids and components of volatile oils [11]. Results in the past, has indicated that *J. multifida* is a potential source of natural antioxidants that could be a good agent as pharmaceutical plant [9][11].

With *J. multifida* usefulness especially in herbal application, it is of utmost importance to take into consideration the best method suitable for processing and preservation. In the developing nations, especially Africa; where the herbal practitioners are mostly in a haste to produce faster, for quicker monetary rewards. The findings of this investigation will give a suggestion as to which processing method is good and faster, without causing any hazard to human health. It will also help the nutritionist and the populace and in choosing the most preferable methods of drying of *J. multifida* leaves. In as much, as there is much work on *Jatropha* plant parts especially the seed (usefulness as a biofuel), there is little or no literature, on the effect of drying temperatures on the leaves.

MATERIALS AND METHODS

Collection of plant material

Fresh leaves of *Jatropha multifida* were collected from the College of Forestry, Jos, in the Jos North Local Government area of Plateau state, Nigeria, June, 2014, during the rainy season. The plant was identified and authenticated by Forester, Mr. Thlama Daniel Mshelbwala, of the department of Forestation in the College of Forestry, Jos, Nigeria.

Preparation of plant material

The sample was cleaned manually to remove all foreign materials such as dust, dirt and infested leaves. The fresh leaves collected were thoroughly washed. The leaves were then divided into three groups and subjected to different drying temperatures; shade drying 30 -32°C (JMLSD), oven drying at 40°C (JML40°C) and at 80°C (JML80°C).

Drying temperatures

Shade drying

The air dried leaves was spread on cotton sheets and a kept in a well-ventilated room at a temperature of about 25 ± 2°C for days. Natural air current was used for shade drying the leaves. It took about 5 days for the leaves to dry completely, become crisp and brittle to touch. The cleaned sample were blended to powder form with a high-speed blender (Braun KMM 30 mill), type 3045, CombiMax (Germany). The sample was labelled JMLSD, and kept in the fridge for further analysis.

Closed oven drying at 40°C

The washed leaves were loaded thin in the trays for drying using forced air. The oven was pre-heated to 40°C and this temperature was maintained for one hour for the leaves to dry. The leaves were dried for 4hr until it was completely dried and brittle up to breaking into pieces. The cleaned sample were blended to powder form with a high-speed blender (Braun KMM 30 mill), type 3045, CombiMax (Germany). The sample is labelled, JML40°C and stored in transparent cellophane bag, and kept in the fridge for further analysis.

Closed oven drying at 80°C

Same procedure used for the 40°C was also used, but the operational temperature was 80°C. It was labelled JML80°C.

Methods

Mineral Composition Analysis – was done using automatic Atomic Absorption Spectrophotometer (Unicam Model 929, Unicam Cambridge, England). Total phosphorus was determined spectrophotometrically after incubation with Molybdo- vanadate solution [12]. Analysis was done using atomic absorption spectrophotometer

Proximate Food Analysis – carried out using [12] standard procedure

Phytochemical screening - Simple chemical tests to detect the presence of alkaloids, tannins, saponins, carbohydrates, glycosides and flavonoids were done in accordance with standard methods [11][13][14].

Statistical Analysis

The data are expressed as means \pm SEM. Statistical analysis was carried out by one-way analysis of variance (ANOVA). Differences were considered to be statistically significant when $p < 0.05$.

RESULTS AND DISCUSSION

The result of the proximate composition of *J. multifida* leaves is shown in table 1. The moisture content is among the most vital and mostly used measurement in the processing, preservation and storage of food [16]. The moisture content of *J. multifida* leaves ranged from 13.35 – 6.95%, with the JML40°C with the lowest range. This may be due to the short time of oven drying at 80°C. This has then, shown that the moisture content reduces directly proportionally to temperature and duration. The result a little bit high when compared to that of sundried and oven dried from *Nsukka Moringa Oleifera* (6.12 – 5.11%) respectively [16].

Table 1- Proximate composition of *J. multifida* at different drying temperature

	JMLSD %	JML40°C %	JML80°C %
MOISTURE	13.35 \pm 0.22	6.95 \pm 0.3	7.65 \pm 0.04
CRUDE PROTEIN	21.16 \pm 0.32	21.16 \pm 0.08	20.76 \pm 0.08
CRUDE FIBRE	18.50 \pm 0.08	18.50 \pm 0.24	15.60 \pm 0.08
CRUDE FAT	3.15 \pm 0.06	3.15 \pm 0.06	2.50 \pm 0.16
ASH	9.80 \pm 0.2	13.10 \pm 0.28	5.35 \pm 0.20

All data were mean \pm standard error mean (SEM).

Proteins, another class of food often times referred to as the ‘Nitrogen-containing natural product’, have been proven to be essential for the survival of human beings and Animals [17]. Proteins have also been detected to be composed of building blocks called Amino Acids. The result for the crude-protein composition showed that, there was no significant difference between the JMLSD and JML40°C which had same result of 21. %. With the JML 80°C having the lower result of 20.76 %. This is low when compared to the protein level in some commonly consumed Sunflower oil seed (28.7%) as reported by [18]. This decreasing result with high temperature may be due to the inevitable damage to protein molecules by temperature.

Crude fibre in food or plant is an indication of the level of non-digestible carbohydrate and Lignin. The JMLSD had the highest crude fibre content of 18.50 %, while both JML40°C and JML 80°C had the lower result of both 15.60%. This result is higher than the Oven dried result of *Moringa Oleifera* from Anambra with 1.52% as reported by [16]. There is a decrease in fibre content with an increase in temperature, because of dehydration, which causes the fibre content to also decrease.

Crude fats and Lipids provides very good sources of energy and aids in transportation of fat soluble vitamins, insulates and protects internal tissues and contributes to important cell processes. More so, it is good we add little lipid/ fat to our diets because many body functions depend on lipids [19]. The JMLSD and JML40°C had the highest crude fat content of 3.15%, with the JML80°C with the lowest (2.50%). The result of JMLSD and JML40 °C is lower than that of Sundried *Moringa Oleifera* with 4.28%. The result from the different temperatures showed a decrease in fat content with increase in temperature.

Table 2- Mineral composition of *J. multifida* at different drying temperature

	JMLSD	JML40 °C	JML80 °C
POTASSIUM	29.40 \pm 1.25	29.10 \pm 1.22	29.23 \pm 1.00
CALCIUM	62.10 \pm 2.02	61.65 \pm 2.00	61.90 \pm 1.80
MAGANESE	0.37 \pm 0.01	0.37 \pm 0.03	0.37 \pm 0.02
IRON	1.42 \pm 0.01	1.30 \pm 0.02	1.20 \pm 0.02
PHOSPHORUS	1.60 \pm 0.02	2.25 \pm 0.03	1.80 \pm 0.01
COPPER	0.36 \pm 0.02	0.32 \pm 0.01	0.32 \pm 0.02
ZINC	0.03 \pm 0.01	0.05 \pm 0.02	0.05 \pm 0.01

All data were mean \pm standard error mean (SEM).

The Ash content is a measurement of the mineral content of the original food [15]. Ash in food contributes the residue remaining after all the moisture has been removed as well as the organic acid etc) have been incinerated at a

temperature of about 500°C. The sample result showed that JML 40 °C had the highest ash content, followed by the JMLSD with 9.80 and the JML 80 °C with the lowest Ash content of 5.35%. This agrees with the ash content of leave Protein concentrate of *Cnidocolus aconitifolius* of 13.68%, as reported by [20].

Minerals are considered to be essential in human nutrition (Ibanga and Okon, 2009) and generally, minerals from plant sources are less-bioavailable when compared to that from animal sources [21]. Table 2 shows the mineral composition of *J. multifida* at the different drying temperatures. Although, the minerals were nutritively and quantitatively above average in most of the minerals. The JMLSD had the highest mineral content in Potassium (29.40), Calcium (62.10), Iron (1.42), and Copper (0.36). The JML40 °C had the highest Phosphorus mineral content (2.25), and also Nickel (0.08), even though the mineral content in Nickel was very low. While, JML40 °C and JML80 °C, had the same higher amount of Zinc (0.05), with the JMLSD with the lowest in Zinc (0.03). The values obtained for *Jatropha multifida* are quite lower than those of *Senna alata* and *Cajanus cajan* (medicinal plants), both reported by Lawal [22]. *Moringa oleifera* leaves reported by [23] and *Lophira lanceolata* seeds reported by [24]. These minerals are vital for the overall mental and physical well-being; and are important constituent of bones, teeth, tissues, muscles, blood and nerve cells [25]. They generally help in maintenance of acid-base balance, response of nerves to physiological stimulation and blood clotting [26].

Table 3, showed the phytochemical screening and amount present in the quantity of the *J. multifida* at different drying temperatures. It is a known fact that these antinutrients reduce the bioavailability of nutrients in the food and plants [27]. The JML80 °C had the highest presence of all of the anti- nutrients, with the JMLSD with the lowest presence of these anti-nutrients. It was obvious from this result, that shade drying for five days reduces quantity of anti-nutrients. The increase with anti-nutrients presence , with an increase in closed oven temperature suggest that one of the best methods of reducing anti-nutrients is through open air and for a period of time. Phytochemicals are biologically active compounds, found in plants in small amounts, which are not established nutrients but which nevertheless contribute significantly to protection against degenerative disease [28].

Table 3- The phytochemical constituents of *Jatropha multifida* leaves at different drying temperatures

	Alkaloid	Saponins	Tannins	Flavonoids	Carbohydrates	Cardiac glycosides
JLSD	++	+	+	++	+	ND
JL40	++	-	++	++	++	ND
JL80	+++	+	+++	+++	++	ND

All data were mean \pm standard deviation of triplicate determinations

Note

+ signifies present, ++ signifies very present, +++ signifies heavily present, - signifies absent
ND – Not detected

CONCLUSION

This study has shown that the temperature of drying *Jatropha multifida* leaves, a medicinal plant is very important. For nutritional considerations, shade drying for days is the best option. For the phytochemical presence which gives bioactive ingredient, the JML40 °C is best suitable. We would like to suggest further work in the quantification of the phytochemicals, especially, tannins, saponins, flavonoids and alkaloids, at different drying temperatures.

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