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The Effect of Drying Method on the Nutrients and Non-Nutrients Composition of Leaves of *Leptadenia hastata* (Asclipiadaceae)

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Abstract: The effect of sun, oven and solar drying on the nutrients and non-nutrients composition of leaves of *Leptadenia hastata* was investigated. All the drying methods were found to significantly decrease ($p<0.05$) magnesium content in sun (1.49±0.49 mg 100 g^{-1}), followed by oven (1.27±0.06 mg 100 g^{-1}) and the lowest in solar dried (0.93±0.07 mg 100 g^{-1}) leaves compared to fresh sample. Drying methods with exception of oven drying did not significantly ($p>0.05$) lower lipids content. The drying processes employed significantly ($p<0.05$) decreased carbohydrate, crude protein, magnesium and moisture content. Potassium, ash and crude fibre were significantly ($p<0.05$) increased. Oven drying significantly reduced acid value (2.82±0.41%), followed by sun (2.12±0.65%) and solar drying (1.76±0.21%) in decreasing order. Tannins, saponins, volatile oils, saponin glycosides and alkaloids were detected in fresh and dried samples. These compounds with exception of saponins and saponin glycosides (sun and oven dried) decreased in trace amounts upon drying. The results reinforce the growing awareness that the leaves of *Leptadenia hastata* can contribute useful amounts of nutrients to human diets and reduction of toxic non-nutrients compounds upon drying.

Key words: Drying method, *Leptadenia hastata*, nutrients, non-nutrients

INTRODUCTION

Drying has been used traditionally as a method of preserving leafy vegetables in Nigeria and other developing countries. In Nigeria, one of such plant vegetables is leaf of *Leptadenia hastata*. The rationale for drying is to reduce the moisture content to a level, which prolongs shelf life during storage, reduces colonization by microorganisms and as a source of food after rainy season (Eklou *et al*., 2006). Fruits and other foodstuffs with high moisture content, provide a favourable condition for the growth of micro-organisms, which lead to their spoilage and wastage (Ladan *et al*., 1997). Drying is one of the methods of food preservation adopted in order to decrease losses in quality and quantity, which will otherwise occur (Habou *et al*., 2003). Sun drying is the most widely used method of drying agricultural produce in most of the developing countries of the tropical region. Solar drying is an elaboration of sun drying and is considered to be an efficient system of utilizing solar energy. Generally, solar drying tends to be the most hygienic method of drying (Bala and woods, 1994).

Processing makes foods safe including the leafy vegetables for consumption and also destroys pathogenic microorganisms. The effect of food processing on nutrient content will depend on the

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sensitivity of the nutrient to the various conditions prevailing during the process, such as heat, oxygen, pH and light (Morris *et al*., 2004). In Sokoto, Nigeria, leaves of *Leptadenia hastata* serve as one of the most widely used vegetables in meals and are preserved traditionally using sun drying (open air). This has risk of possible contamination by microorganisms, lack of protection from dust, infestation by insects, rodents and the quality of the products are seriously degraded and sometimes inedible (Diamante and Munro, 1993). Two processes occur during drying; the addition of heat and removal of moisture from the food (Morris *et al*., 2004).

Leptadenia hastata (family Asclipiadaceae) is a twiner with a corky bark on the older stems. It has well developed, half-succulent and persistent petiole leaves with a thick greenish sap. The leaves are more abundant and fresh during rainy season (Aliero *et al*., 2001). *Leptadenia hastata* is commonly used in Niger republic in day to day cooking and is considered as hunger food due to its very important content of valuable nutrients (Freiberger *et al*., 1998). The plant has been reported to be safe with low LD_{50} of 1513 mg kg^{-1} (Tambaura *et al*., 2005). It contains triterpenes, fatty acids, amino acids, poly-oxypregnane, lutein and β-carotene (Aquino *et al*., 1996; Nikiema *et al*., 2001; Tambaura *et al*., 2005) and selenium and phosphorus (Freiberger *et al*., 1998).

The objectives of our study were to compare the traditional sun drying with other drying methods with regard to the effect on nutrient and non-nutrients compositions on the dried samples using fresh sample as basis for comparison. The study was conducted at Department of Biochemistry, Faculty of Science, Usmanu Danfodiyo University, Sokoto, Nigeria, from June to July 2006.

MATERIALS AND METHODS

Chemicals

Most of the chemicals used were of analytical grade.

Plant Material and Preparation

Leptadenia hastata was obtained from within Usmanu Danfodiyo University Campus Sokoto, Nigeria. The plant sample was authenticated at the Herbarium, Botany unit, of the same institution. Voucher specimen was deposited in the Herbarium for reference. The leaves collected were first washed with large amount of water to remove dust and some portions were dried to a constant weight using different drying methods. Fresh sample was used as control.

Sun Drying

The leaves were kept under the sun (ambient temperature 35-41°C) in June 2006, between 10.30 am-5.30 pm daily till the leaves attained constant weight.

Solar Drying

A solar dryer designed by the Sokoto Energy Research Center, Usmanu Danfodiyo University Sokoto, Nigeria was used as solar dryer for the sample. The dryer is a combine direct and indirect rocked thermal storage passive cabinet dryer. The dryer stores heat in rock bed, a device intended to overcome temperature fluctuations during sun set hours. The temperature of the drying chamber ranged between 42 and 63°C while that of the solar dryer of the leaves collector was between 40 and 73°C. Solar drying took place between 10.30 am-5.30 pm daily till the sample attained a constant weight (Matazu and Haroun, 2004).

Oven Drying

The leaves were oven dried (60°C) using hot air oven (Stuart Scientific oven, England) for 24 h to obtain a completely dried sample.

Nutrients and Non-Nutrients

The dried and fresh leaves were analysed for moisture content using the method of Oyeleke (1984) and crude protein content by modified Kjeldhal method. The method of Yawas and Obi (2001) was employed in the analysis of carbohydrates. Ash content was determined by the method of Samuel *et al.* (1997). Crude lipid and fibre content were determined by the procedures of Association of Official Analytical Chemists (AOAC, 1980). Acid value was determined by the method of Chopra and Kanwar (1991). Phytochemical screening was done using standard procedures of Harbone (1973), Trease and Evans (1978) and El-Olemyl *et al.* (1994).

RESULTS

The results of proximate, mineral element and phytochemical compositions of fresh and dried leaves of *leptadenia hastata* are presented in Table 1, 2 and 3, respectively. The ambient temperature at the period of drying ranged from 35-41°C (mean 38°C). The time taken for the leaves to attain constant weight was 25, 9 and 17 h for sun, oven and solar drying, respectively. For sun and solar drying, the drying was done over a period of 5 and 4 days, respectively due to interruption by rainfall. The final moisture, carbohydrate and crude protein are presented in Table 1 and were significantly decreased ($p<0.05$) upon drying. There was no significant ($p>0.05$) increase and decrease of sodium and calcium content by all the drying methods.

Oven dried leaves had significantly lowest moisture content followed by solar with highest moisture content in sun (range 7.30-10.16%) dried leaves (Table 1) compared to fresh sample. Significant ($p<0.05$) decrease of carbohydrates and crude protein with a non significant ($p>0.05$) decrease of lipid content was observed upon drying when compared with fresh sample. The higher ash content of oven-dried followed by sun-dried with solar dried leaves having the lowest were observed.

Qualitative analysis of phytochemical compounds in leaves extracts of *Leptadenia hastata* showed the presence of tannins, saponins, volatile oils, saponin glycosides and alkaloids (Table 3). However, these compounds were decreased with the drying methods. The acid value was significantly reduced in oven (2.82±0.41%) followed by sun (2.12±0.65%) and solar-dried samples (1.76±0.21%) in decreasing order (range 1.76-2.82%). This shows that the acid value was reduced by the drying methods.

Table 1: Proximate composition of fresh and dried leaves of *Leptadenia hastata*

Drying method	Protein (%)	Lipids (%)	Carbohydrates (%)	Ash (%)	Fibre (%)	Moisture (%)
Sun	8.40±0.33^{c}	8.66±0.41^{a}	60.23±3.27^{c}	13.83±1.22^{a}	8.83±0.73^{b}	10.16±1.14^{c}
Solar	7.67±0.49^{d}	8.66±0.40^{a}	67.83±5.72^{b}	8.33±0.98^{b}	7.50±0.49^{c}	9.16±0.82^{b}
Oven	9.61±0.65^{b}	6.66±0.57^{b}	58.56±4.89^{d}	13.83±0.90^{a}	11.33±1.06^{a}	7.33±0.49^{b}
Fresh (control)	10.86±0.73^{a}	8.16±0.24^{a}	77.80±6.53^{a}	2.33±0.33^{c}	1.83±0.16^{d}	78.16±7.35^{a}

Values are means±standard deviation. Means in a column followed by same letter(s) are not significantly different using LSD at 5% (n = 4), Analysis of variance, complete randomized design, statistical analytical system (1988). SAS/STAT user's guide. Release (6,0.35. A. Cary, N.C, USA) was used to analyze the data. LSD = Least Significant Difference

Table 2: Mineral element composition of fresh and dried leaves of *Leptadenia hastata*

Drying method	Na (mg 100 g^{-1})	K (mg 100 g^{-1})	Ca (mg 100 g^{-1})	Mg (mg100 g^{-1})
Sun	1.26±0.16^{a}	1.28±0.16^{a}	0.10±0.02^{c}	1.49±0.49^{c}
Solar	1.23±0.24^{a}	0.67±0.08b	0.12±0.02^{b}	0.93±0.07^{b}
Oven	1.29±0.48^{a}	1.31±0.49^{a}	0.12±0.08^{b}	1.27±0.06^{b}
Fresh (control)	1.23±0.08^{a}	0.49±0.08^{c}	0.18±0.06^{a}	3.50±0.73^{a}

Values are means±standard deviation. Means in a column followed by same letter(s) are not significantly different using LSD at 5% (n = 4), Analysis of variance, complete randomized design, statistical analytical system (1988). SAS/STAT user's guide. Release (6,0.35. A. Cary, N.C, USA) was used to analyze. LSD = Least Significant Different. Na = Sodium, Ca = Calcium, K = Potassium and Mg = Magnesium

Table 3: Phytochemical screening of fresh and dried leaves extracts of *Leptadenia hastata*

	Drying method			
	Sun	Oven	Solar	Fresh
Tannins	+	+	+	+++
Saponins	+++	+++	+	+++
Flavonoids	-	-	-	-
Volatile oils	+	-	+	+++
Saponin glycosides	+++	+++	+	+++
Cardiac glycosides	-	-	-	-
Anthraquinone	-	-	-	-
Anthraquinone glycosides	-	-	-	-
Cyanogenic glycosides	-	-	-	-
Alkaloids	+	+	+	+++

+ = Trace amount, +++ = Presence, - = Absence

DISCUSSION

Heating can have both beneficial and detrimental effects on the nutrients content of foods. It generally improves the digestibility of foods, making some nutrients more available (Morris *et al*., 2004). Moisture content of vegetables and fruits provides an enabling environment for the growth of microorganisms. Generally removal of moisture results in increased concentration of nutrients (Morris *et al*., 2004). For vegetables and fruits to be preserved or kept for long time to be used, the moisture content has to be reduced. This will inhibit the autolytic enzymes (Ladan *et al*., 1997).

The significant ($p<0.05$) decrease in the macronutrients content (Table 1) of the dried leaves could be attributed to stability of the bonds involved in the macronutrients. The decrease in protein content was found to be commensurate with the intensity of heat applied due to the efficiency of the dryers. The observed decrease could be attributed to the ability of the dryers to concentrate energy which could in turn cause some denaturation of protein in the dried samples. Nutritional losses during drying occur to great extent due to application of heat, there by decreasing the concentration of some nutrients especially protein (Morris *et al*., 2004). Loss of nutrients which occur during drying can be minimized by drying at low temperatures for shorter period (Morris *et al*., 2004).

Higher ash content from the results (Table 1) indicated probable high mineral elemental composition of the leaves of *Leptadenia hastata*. The significant ($p<0.05$) increase of potassium in the dried samples are added advantage and can be use for therapy (Dzomeku *et al*., 2006). The higher ($p<0.05$) calcium and phosphorus also in the dried samples are vital for bone. A similar observation was reported with tomatoes, though a different vegetable by Ladan *et al*. (1997). The increased ash and crude fibre content could also be due to the method of analysis and genetic changes. Non-nutrients in foodstuffs are known to be decreased by heat upon processing as indicated from the results obtained (Matazu and Haroun, 2004). This may explain the decrease of these non-nutrients in the dried leaves and probably increase the bioavailability of micronutrients such as calcium and magnesium, to the body.

From the results, the leaves of *Leptadenia hastata* have indicated valuable nutrients in fresh and dried samples and with reduction of some toxic non-nutrients by the drying methods. The solar drying could be the most preferred method of drying the leaves of *Leptadenia hastata* because it is hygienic faster and has less effect on the nutrients when compared with oven dried sample. The lost nutrients during drying should be complemented with other rich sources of the micronutrients and macronutrients.

REFERENCES

Aliero, B.L., M.A. Umaru, H.A. Suberu and A. Abubakar, 2001. A Hand Book of Common Plants in North Western Nigeria. Usmanu Danfodiyo University Press, Sokoto, Nigeria, pp: 78-79.

AOAC, 1980. Association of Official Analytical Chemists. Official Methods of Analysis of the AOAC. 13th Ed., Washington DC., pp: 18-62.

Aquino, R., G. Peluso, N.D.E. Tommassi, F. D.E. Simone and C. Pizza, 1996. New polyoxypregnane ester derivates from *Leptadenia hastata*. J. Nat. Prod., 59: 555-564.

Bala, B.K. and J.L. Woods, 1994. Simulation of the indirect natural convection solar drying of rough rice. Solar Energy, 53: 259-266.

Chopra, S.L. and J.S. Kanwar, 1991. Acid value. Analytical Agricultural Chemistry. 4th Edn., Kalyani Publishers New Delhi-Ludhiana, pp: 349-350.

Diamante, L.M. and P.A. Munro, 1993. Mathematical Modeling of the Thin layer solar Drying of sweet potatoes. Solar Energy, 51: 271-276.

Dzomeku, B.M., R.K. Bam, E. Abu-Kwarteng and A.A. Ankomah, 2006. Comparative study on the nutritional values of FHIA-21 (Tetraploid Hybrid) and Apem (Triploid French Plantain) in Ghana. J. Plant Sci., 1: 187-191.

Eklou, A.S., M.S. Ines, N. Francis, S. Moussa, O.A. Ayoni, S. Kayode and T.D. Daniel, 2006. Comparative studies of drying methods on the seed quality of interspecific NERICA rice varieties (*Oryza glaberrimax*, *Oryza sativa*) and their parents. Afr. J. Biotechnol., 5: 1618-1624.

EL-Olemyl, M.M., F.J. AL-Muhtadi and A.A. Afifi, 1994. Experimental phytochemistry. A Laboratory Manual, College of Pharmacy. King Saud University, King Saud University Press, pp: 1-134.

Freiberger, C.E., D.J. Vandergat, A. Pastuszyn, R.S. Glew, G. Mounkarla, M. Millson and R.H. Glew, 1998. Nutrient content of edible leaves of seven wild plants from Niger. Plant Foods. Hum. Nutr., 53: 57-69.

Habou, D., A.A. Asere and A.M. Alhassan, 2003. Comparative study of the drying rate of tomatoes and pepper using forced and natural convection solar dryers. Nig. J. Renew. Energ., 14: 36-40.

Harbone, J.B., 1973. Phytochemical Methods. A Guide to Modern Techniques of Plant Analysis. 3rd End.,Chapman and Hall. London, pp: 7-13, 60, 89, 131-135, 186-188, 203, 279.

Ladan, M.J., M.G. Abubakar and M. Lawal, 1997. Effect of solar drying on the nutrient composition of tomatoes. Nig. J. Renew. Energ., 5: 67-69.

Matazu, I.K. and A.A. Haroun, 2004. The effect of drying method on the nutrients and non-nutrients composition of the fruit of *Hibiscus esculentus* (Okra). Nig. J. Renew. Energ., 11: 9-13.

Morris, A., A. Barnett and O. Burrows, 2004. Effect of processing on nutrient content of foods. Cajarticles, 37: 160-164.

Nikiema, J.B., R. Vanhaelen-Fastre, M. Vanhaelen, J. Forotaine, C. De Gracf and M. Heenen, 2001. Effect of anti-inflammatory triterpenes isolated from *Leptadenia hastata* laxexan keratinocyte proliferation. Phytother. Res., 15: 131-134.

Oyeleke, O.A., 1984. Outline of Food Analysis, Department of Biochemistry, A.B.U. Zaria, Nigeria.

Samuel, A.L., V.J. Temple and O. Ladeji, 1997. Chemical and Nutritional Evaluation of the seed Kernel of *Balanites aegyptica*. Nig. J. Biotech., 8: 57-63.

Tamboura, H.H., B. Bayala, M. Lompo, I.P. Guissou and L. Sawadogo, 2005. Ecological distribution, morphological characteristics and acute toxicity of aqueous extracts of *Holarrhena floribunda* (G. Don) Durand and schinz, *Leptadenia hastata* (pers) decne and *Cassia sieberiana* (D.C.) used by veterinary healers in Burkina Faso. Afr. J. Trad. Comp. Alt. Med., 2: 13-24.

Trease, G.E. and W.C. Evans, 1978. A Textbook of Pharmacognosy. 11th Edn., Bailliere Tindall, London, pp: 530.

Yawas, D.S. and A.I. Obi, 2001. Development and Performance Evaluation of a family size solar dryer for fruits and vegetables. Nig. J. Renew. Energ., 9: 1-2.