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Comparative studies on the effect of sun, smoke and oven drying methods on the nutrient contents of four wild edible mushrooms in Nigeria

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ABSTRACT

Four wild edible mushrooms, Lentinus squarrosulus, Psathyrella atroumbonata, Coprinus micaceus and Rhodophyllus aprile were collected in the wild for the study of the effect of sun, smoke and oven drying methods on the nutrient contents. Each mushroom sample was shared into four equal parts representing fresh (wet), sun dried, oven dried at 70^0C and smoke dried respectively. The samples were properly dried before grinding to fine powder form. This was sieved and stored in flat bottom flasks and covered with cotton wool and foil paper at room temperature and used for all the analysis. The result showed that moisture content ranged from 66.40% in L. squarrosulus to 82.01% in P. atroumbonata. Lipid ranged from 0.10mg/100g in P. atroumbonata to 2.40mg/100g in R. aprile. Ash content ranged from 16.10mg/100g in P. atroumbonata to 23.60mg/100g in R. aprile. Protein ranged from 23.31mg/100g in R. aprile to 27.60mg/100g in P. atroumbonata. Crude fiber ranged from 14.20mg/100g in C. micaceus to 21.20mg/100g in L. squarrosulus. Carbohydrate ranged from 23.40mg/100g in P. atroumbonata to 52.10mg/100g in C. micaceus. The nutrient contents were higher in sun drying method than oven and smoke drying methods. The level of minerals, particularly potassium was higher in smoke drying methods compared to sun and oven drying methods. This study has shown that sun drying method retained more nutrients than oven and smoke drying methods.

INTRODUCTION

There are many edible mushrooms in Nigerian forest and grass lands. For quiet a long time, mushrooms have been part of some people's diet and cultures in Nigeria. Oso, (1977), and Alabi, (1990), showed the level of mushrooms knowledge and usage among

the Yoruba people of Nigeria. Akpaja *et al*.(2003) also reported the traditional usage of mushrooms among the Igbo people of Nigeria.

Most of the mushrooms consumed in Nigeria are usually collected in the wild during their growing season. The local people hunt for them and make money from such collections (Okhuoya, 1997). Many of these edible mushrooms have been found to be very delicious and of high medicinal values (Zoberi,1972, Ogundana and Fagade, 1982, Nwokolo, 1987, Alofe, 1991). The edible mushrooms in Nigeria are sought for on account of their palatability and nutritional values. Most of them are supplied as dried mushrooms in the market. Although, fresh mushrooms are preferable, condition often dictates that they are preserved for future use, particularly when they are collected more than what could be consumed at a time. Sun drying and drying over smoke are the common methods used in mushrooms preservation in most African countries. They are sliced into pieces and laid in the sun or over smoke until fully dried.

The aim of this study was to compare the effect of sun, smoke and oven drying methods on the nutrient contents of four wild edible mushrooms in Nigeria.

MATERILS AND METHODS

Samples of four wild edible mushrooms (*Lentinus squarrosulus, Psathyrella atroumbonata, Coprinus micaceus,* and *Rhodophyllus aprile*) were collected from the wild in *Tectonia grandis* forest in Kogi State, Nigeria. The mushrooms were identified in the mushroom science section of the Department of Plant Biology and Biotechnology, University of Benin, Benin City, Nigeria.

Processing of the samples

Each mushroom sample was shared into four equal parts representing fresh (wet), sun drying, smoke drying and oven drying at 70^0C. The portions for drying were dried properly before grinding into fine powder form. The powdered form was sieved using 1mm sieve. It was then stored at room temperature and used for all the analysis. The portions for wet analysis were ground with mortar into paste and used immediately for the analysis. The nutrients were determined in mg/ 100g except the moisture content which was determined in percentage.

Determination of the nutrient and mineral contents

For the determination of nutrients (moisture, protein, ash, crude fiber, and carbohydrate), the method of the Association of Official Analytical Chemist (1984) was used. The mineral contents (sodium, calcium, potassium, magnesium, copper, iron and zinc) were determined using Atomic Absorption Spectrophotometer PV9100X.

RESULT AND DISCUSSION

Table 1 showed the level of nutrient contents of wet samples, sun dried, smoke dried and oven dried samples of four wild edible mushrooms in Nigeria. The level of moisture content of the wet samples ranged from 66.40% in *Lentinus squarrosulus* to 82.01% in

Psathyrella atroumbonata. Sun drying method retained more moisture in *L. squarrosulus* (9.50mg/100g) and *R. aprile* (9.00mg/100g) while smoke drying method retained more moisture in *C. micaceus* (6.01mg/100g) and *P. atroumbonata* (6.50mg/100g). The level of lipid in the wet samples ranged from 0.10mg/100g in *P. atroumbonata* to 2.4mg/100g in *R .aprile* . Oven drying method retained more lipid in *L. squarrosulus* (0.80mg/100g) and *C. micaceus* (1.20mg/100g) while smoke drying method retained more lipid in *R. aprile* (0.82mg/100g and *P. atroumbonata* (0.05mg/100g). Ash content ranged from 16.10mg/100g in *P. atroumbonata* to 23.60mg/100g in *R. aprile*. Sun drying method retained more ash in *.L squarrosullus* (19.70mg/100g) and *P. atroumbonata* (12.00mg/100g) while smoke drying method retained more ash in *C. mecaceus* (18.40mg/100g) and oven drying method retained more ash in *R. aprile* (13.10mg/100g). The protein content of the wet samples ranged from 23.31mg/100g in *R. aprile* to 27.60mg/100g in *P. atroumbonata*. Sun drying method retained more protein in *L. squarrosulus* (16.40mg/100g), *R. aprile* (21.50mg/100g) and *P. atroumbonata* (16.80mg/100g) while smoke drying method retained more protein in C. *micaceus* (18.80mg/100g). Crude fiber of wet samples ranged from 14.20mg/100g in *C. mecaceus* to 21.20mg/100g in *L. squarrosulus*. Sun drying method retained more fiber in *L. squarrosulus* (14.00mg/100g) and *R. aprile* (16.60mg/100g). There was more fiber in smoke drying method in *C. micaceus* (15.20mg/100g) while it was higher in oven drying method in *P. atroumbonata* (16.00mg/100g). Level of carbohydrate in wet samples ranged from 23.40mg/100g in *P. atroumbonata* to 52.10mg/100g in C. *micaceus*. Smoke drying method retained more carbohydrate in *L. squarrosulus* (33.10mg/100g), oven drying method retained more carbohydrate in *P. atroumbonata* (20.21mg/100g) while sun drying method retained more carbohydrate in *C. micaceus* (19.90mg/100g) and *R. aprile* (29.11mg/100g).

The result clearly showed that there was significant reduction in the nutrient contents of the mushrooms under study when the three methods of drying were used. The level of nutrient content varies and depends on the type of mushroom and method of drying. The reduction in the nutrient content may be due to the nature and sensitivity of the nutrient to the level of heat during the drying process. In this study, sun drying method retained more nutrients than oven drying and smoke drying methods. This observation is in line with the report of Nwachukwu and Obi (2007) who reported variations in antinutrient contents of leafy vegetables under different methods of drying.

Table 2 showed the level of mineral contents of the four mushrooms in wet samples and in the three methods of drying. Sodium in wet samples ranged from 1.61mg/100mg in *C. micaceous* to 2.3mg/100g in *L .squarrosulus*. Oven drying method retained more sodium in *L..squarrosulus*, sun drying method retained more sodium in *C. micaceus* while smoke drying method retained more sodium in *R. aprile* and *P. atroumbonata*. Calcium in wet samples ranged from 4.0mg/100g in *R. aprile* to 6.20mg/100g in *C. micaceus*. Smoke drying method generally increases the level of calcium in all the mushrooms while the level was less in other methods. Potassium was higher in smoke drying method in *L. squarrosulus* and *C .micaceus* while other methods reduced the levels of potassium in all the mushrooms. Magnesium was not significantly affected by the three methods of drying. Copper and zinc were beyond the level of detection in the mushrooms with the

three methods of drying. Iron was not detected in *L. squarrosulus* in oven drying and in sun drying methods in *R. aprile.* Other methods slightly reduce the level of iron in the four mushrooms. The highest reduction was observed in *L. squarrosulus* and *R. aprile.*

Table 1:- Nutrient contents of wet, sun, oven and smoke dry samples of four wild edible mushrooms in Nigeria

Nutrients	*Lentinus squarrosulus*				*Coprinus micaceus*				*Rhodophyllus aprile*				*Psathyrella atroumbonata*			
	Wet Sample	Sun dry	Oven dry	Smoke dry	Wet Sample	Sun dry	Oven dry	Smoke dry	Wet Sample	Sun dry	Oven dry	Smoke dry	Wet Sample	Sun dry	Oven dry	Smoke dry
Moisture	66.40	9.50	0.50	6.20	78.30	4.50	1.00	6.01	74.60	9.00	8.50	5.50	82.01	6.00	4.60	6.50
Lipid	2.10	0.60	0.80	0.10	1.80	0.99	1.20	0.99	2.40	0.40	0.74	0.82	0.10	0.04	0.03	0.05
Ash	23.20	19.70	16.06	17.20	21.10	15.20	17.60	18.40	23.60	9.43	13.10	7.80	16.10	12.00	10.90	11.00
Protein	25.00	16.40	8.60	12.40	26.00	12.40	4.0	18.80	23.31	21.50	14.01	18.40	27.60	16.80	10.40	15.80
Crude Fiber	21.20	14.00	13.50	12.40	14.20	12.00	14.00	15.20	15.30	16.60	12.00	14.20	19.75	13.10	16.00	11.00
Carbo-Hydrate	28.60	26.50	29.60	33.10	52.10	19.90	16.40	18.80	34.20	29.11	23.40	24.69	23.40	18.20	20.21	14.60

Each value is a mean of 3 replicates.

Table 2 mineral contents of wet, sun, oven and smoke dried samples of four wild edible mushrooms in Nigeria

Mineral	*Lentinus squarrosulus*				*Coprinus micaceus*				*Rhodophyllus aprile*				*Psathyrella atroumbonata*			
	Wet Sample	Sun dry	Oven dry	Smoke dry	Wet Sample	Sun dry	Oven dry	Smoke dry	Wet Sample	Sun dry	Oven dry	Smoke dry	Wet Sample	Sun dry	Oven dry	Smoke dry
Na	2.30	1.03	1.85	1.10	1.61	1.18	0.88	0.43	1.26	1.18	0.98	1.58	1.27	1.03	1.10	1.20
Ca	4.60	2.75	2.75	4.91	6.20	3.56	3.81	6.72	4.01	3.58	3.81	4.92	6.01	4.69	4.56	6.25
K	4.10	4.25	3.50	4.51	5.32	4.20	4.40	5.75	3.82	3.14	2.70	3.70	6.20	5.10	4.74	5.61
Mg	0.04	0.02	0.03	0.02	0.45	0.02	0.02	0.04	0.40	0.02	0.02	0.02	0.33	0.02	0.02	0.02
Cu	0.07	nd	nd	nd	0.33	nd	nd	nd	0.04	nd	nd	nd	0.09	nd	nd	nd
Fe	1.0	0.01	nd	0.01	0.14	0.06	0.06	0.03	0.30	nd	0.02	0.01	0.09	0.06	0.03	0.06
Zn	0.01	nd	nd	nd	0.01	nd	nd	nd	0.06	nd	nd	nd	0.05	nd	nd	nd

Each value is a mean of 3 replicates
Nd - Not detected.

In conclusion, fresh mushrooms are better than dried mushrooms because they contain more nutrients than dried mushrooms. However, if there is need for preservation and cannot be preserved fresh, preservation through sun drying is the best and is recommended for preservation of mushrooms for future consumption.

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