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## Mineral Content of *Psathyrella tuberculata* (PAT.) Smith Commonly Consumed and Commercialized in the Local Markets of Abidjan (Côte d'Ivoire)

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### ABSTRACT

*Psathyrella tuberculata* is a small saprophyte mushroom growing in the forest. It is edible and sold in the local markets of Côte d'Ivoire. Despite its current use in cuisine as alternative to fish or meat, the nutritional composition has been less documented. Thus this study was carried out to evaluate its nutritional value as calcium, copper, magnesium, iron, selenium and zinc content in the edible carpophores of *P. tuberculata*. Significant differences were noticed between amounts of the minerals identified ( $P < 0.001$ ). Of all the six minerals, calcium was the most abundant ( $102.627 \pm 0.002$  mg/100g). Conversely selenium was the less abundant mineral ( $1.984 \pm 0.002$  mg/100g). Otherwise, amounts of copper, iron, magnesium and zinc were respectively  $1.870 \pm 0.002$  mg/100g,  $53.338 \pm 0.002$  mg/100g,  $73.138 \pm 0.002$  mg/100g,  $13.159 \pm 0.002$  mg/100g and suggested to be sufficient to cover daily intakes. The carpophores of *P. tuberculata* are to be considered as a better food because of its nutritional value and health benefit. For sustainable use, domestication should be practiced and forests should be preserved.

**Keywords:** *Psathyrella tuberculata* - nutritional value - mineral content - Abidjan - Côte d'Ivoire

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## INTRODUCTION

*Psathyrella tuberculata* (Pat.) Smith (Psathyrellaceae) is a small saprophyte mushroom widely spread in West-Africa and growing in the forest especially on trees like *Elaeis guineensis*, *Mangifera indica*, *Vittelaria paradoxa*<sup>1</sup>. It is a small white mushroom, with a globular and conical cap. This mushroom is one of the two wild mushrooms specie called “black mushroom” in Côte d’Ivoire. The other one, *Psathyrella atroumbonata* Pegler (Psathyrellaceae), can be found in the savannah. The harvest of *P. tuberculata* occurs during the raining season. The carpophores are generally dried after harvest turning them in darkness color and can be stored for many weeks.

This mushroom meets importance for people’s welfare in Africa as commercial product, folk medicine ingredient or food<sup>2-6</sup>. Though, the ethnobotanical uses of *P. tuberculata* are multiple and it is known under several vernacular names. The “Abbey” in Côte d’Ivoire call it “djidjruwa”<sup>5</sup>. In Togo the “Kotokoli” call it “kpandjoulassi”. Among all the uses assigned to *P. tuberculata*, food takes an importance part. In fact, the carpophores are consumed in rural and urban areas, particularly in Côte d’Ivoire<sup>7-9</sup>. It tastes delicious in family meals as fresh or dried<sup>10</sup> and the **carpophore serves** as alternative to fish or meat during shortage. Sometimes it is used in cuisine as stainer for the cooking of “black rice”, one ceremonial meals of weddings or birthdays (Aké, 2015)<sup>5</sup>.

Despite its use as food, the nutritional value of the carpophores has been less documented in Côte d’Ivoire. Few data are reported<sup>11,6</sup>. Nutrients such as macronutrients, moisture, ashes and fibers have been determined for the carpophores of some mushrooms specie included *P. tuberculata*. The others mushrooms specie investigated were *Hirneola auricular-judae*, *Lentinus bruneofloccosus*, *Pleurotys ostreatus*, *Termitomyces letestui* and *Volvariella volvacea*. In addition, secondary metabolites as polyphenols, flavonoids, tannins and vitamin C were mentioned. Moreover some minerals have been investigated except selenium.

Minerals play several roles for body’s development. They are known as body builder like the teeth and the bones which are essentially composed of magnesium and calcium. Copper is necessary to build hemoglobin. The action of iron is vital to increase red blood cells; while selenium and zinc have antioxidant properties<sup>9</sup>.

Thereby analyze the carpophores of *Psathyrella tuberculata* for mineral content seems necessary to best knowledge relating to its nutritional importance and health benefit.

So, the objective of this study was to evaluate the nutritional value of the carpophores of *Psathyrella tuberculata* by determining their mineral content as calcium, copper, magnesium, iron, selenium and zinc.

## MATERIALS AND METHOD

### Fungal material collecting and botanical identification

The carpophores of *Psathyrella tuberculata* used in this work were collected dried during the fall November 2011 after purchase nearby the wholesalers at the market “Gouro” of Adjamé, in the District of Abidjan. Wholesalers were supplied from the western Côte d’Ivoire, in the forest area. A sample of 500g was constituted, packed in sterile plastic bag and carried to the Laboratoire National d’Appui au Développement Agricole (LANADA) of Abidjan for analyze. A little amount was taken to the Centre National de Floristique (CNF) at the University Félix Houphouët-Boigny, Abidjan, for botanical identification.

### Samples preparation

The carpophores of *P. tuberculata*, were stored frozen at -4°C until use. After defreeze, that raw material was dried at laboratory temperature for eighteen (18) hours. Thereafter about 25 g was ground into powder with an electrical grinder (JANKE & KUNKEL IKA-Labotechnik). Then an amount of 0.5g of powder was digested according to dry way. The test portion weigh was set into digestion vessels. The vessels were set in an electric stove (OBERSAL, HENGSTLER MOD.12 PR/300 série 8B). Then the stove was closed and digestion operated at 550°C during two (02) or four (04) hours. After that, the digestion vessels were removed from the oven and let cool thoroughly. Twenty-five (25) ml of nitric acid (concentration: 0.1N) was transferred to the obtained ash and put into test tubes of 10ml to be deeply mixed with a vortex (WWR) after filtration with Whatman paper (diameter: 15 cm). The stock solution was diluted with pure nitric acid, from 1/100 to 1/10 000. A blank with nitric acid (0.1N) was also prepared.

### Analytical method

Minerals were detected and quantified in a flame atomic absorption spectrophotometer (FAAS) system (VAyRIAN) according to the method<sup>12</sup>.

### Nutritional value

The nutritional value of the six minerals has been established using literature data. Daily intakes required were considered to appreciate the nutritional value of the carpophores of *P. tuberculata* (table 1).

**Table 1: Daily Intakes Required for Minerals**

Minerals	Daily intakes required (mg/day)	Categories	References
Ca	500 – 1200	Children	Martin, 2001
	900 – 1200	Adults	
Cu	0,8 - 2	All	Aké, 2015
Fe	7 - 8	Children	Martin, 2001
	10	Adults men	
	15	Adults women	
	25 - 30	Pregnent women	
Mg	360 -410	Children	Aké, 2015
	310-400	Adults	
Se	20* - 45*	Children	Aké, 2015
	50* - 60*	Adults	
Zn	10	All	Aké, 2015

\*Amount in µg/day

### Statistical analysis

Means of triplicate readings and standard deviation were determined and analyzed throughout ANOVA one-way ( $\alpha=0.05$ ) completed by Tukey test using standard procedures with SPSS software (SPSS 20.0).

### RESULTS AND DISCUSSION

The amounts of calcium, copper, iron, magnesium, selenium and zinc from the carpophores of *P. tuberculata* are shown in table 2. Regarding the results, the minerals amounts were significantly different ( $P<0.001$ ). The most abundant mineral was calcium ( $102.627\pm 0.002$  mg/100g). While selenium ( $1.984\pm 0.002$  mg/100g) occurred in fewer amounts in this food. These amounts were lower than those reported in previous study (Zoho *et al.* 2016)<sup>11</sup>. They reported the presence of calcium ( $330.43\pm 0.06$  mg/100g), copper ( $67.47\pm 0.02$  mg/100g), iron ( $262.96\pm 0.12$  mg/100g) and magnesium ( $233.55\pm 0.05$  mg/100g). The amounts of calcium ( $102.627\pm 0.002$  mg/100g) and magnesium ( $73.138 \pm 0.002$  mg/100g) were also lower than those obtained by Anin *et al.* (2007), which were respectively  $104.41\pm 1.67$  mg/100g and  $179.54\pm 11.01$  mg/100g. But, the amounts of iron ( $53.338\pm 0.002$  mg/100g) and zinc ( $13.159\pm 0.002$  mg/100g) were higher than those obtained by these authors. The amounts of the six minerals vary because samples and methods used differ from one study to another one. Contrary to previous studies in Côte d'Ivoire, selenium has been detected in the carpophores of *P. tuberculata*. That should probably be of first report in Côte d'Ivoire.

**Table 2: Mineral content of the carpophores of *Psathyrella tuberculata***

Minerals	Means Amounts (mg/100g of DM)± SD
Ca	102.627 ± 0.002 <sup>a</sup>
Cu	1.870 ± 0.002 <sup>b</sup>
Fe	53.338 ± 0.002 <sup>c</sup>
Mg	73.138 ± 0.002 <sup>d</sup>
Se	1.984 ± 0.002 <sup>e</sup>
Zn	13.159 ± 0.002 <sup>f</sup>
<b>Statistical parameters</b>	
<i>F</i>	4,532E8
<i>ddl</i>	5
<i>P</i>	< 0.001

Means followed by different superscript in the same column are significantly different

DM = Dried Matter; SD= Standard Deviation

Although calcium was more abundant (102.627±0.002 mg/100g) than the others minerals, daily intakes could not be obtained<sup>13</sup> with 100g of “black mushroom’s” carpophores. In the same order magnesium (73.138±0.002 mg/100g) demand for body’s care should not be satisfied. Only copper, iron, selenium and zinc daily intakes could be covered with 100g of the carpophores of *P. tuberculata*<sup>9</sup>. Calcium, copper, iron and zinc intervene to preserve blood and could prevent anemia<sup>5,9</sup>. According to Reinhard *et al.*,<sup>15</sup> zinc is involved in the phenomenon of cicatrization. For Alaje *et al*<sup>16</sup>., zinc is essential to the production of insulin which is useful for the metabolism of glucose. Others effects are known, particularly for magnesium which acts against arteriosclerosis<sup>17</sup> or blood high-pressure<sup>18</sup>. Aké<sup>9</sup> reported that selenium and zinc have antioxidant activity.

Whatever different amounts of these minerals were found, *P. tuberculata* remains of better food. Its interest relatively to food security is noticeable, because the carpophores of this mushroom species are well consumed in rural areas<sup>9,10</sup>.

## CONCLUSION

This study has led to the determination of calcium, copper, iron, magnesium, selenium and zinc in the carpophores of *Psathyrella tuberculata* sold in the local markets of Abidjan. The most important mineral was calcium. But that mushroom species is rich in copper, iron, selenium and zinc regarding the possibility to cover the daily intakes required for body’s care and development. These results confirm the nutritional value of the carpophores of wild African edible mushrooms specie reported in several scientific works. They justify the great consumption of this mushroom in Southern Côte d’Ivoire. Because of the health benefits of these minerals determined, *P. tuberculata* could be recommended to cure or prevent anemia, arteriosclerosis, haemorrhage,

bones and teeth strokes. For sustainable use domestication should be practiced and forests have to be safeguard.

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