

# NUTRIENT COMPOSITION OF *PLEUROTUS TUBERREGIUM* (FR) SING'S SCLEROTIA

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## ABSTRACT

The amino acid and mineral profile of *Pleurotus tuberregium* sclerotia, was investigated. Every 100g of the protein *Pleurotus tuberregium* sclerotia contains 25.93g of essential amino acids, 1.50g of sulphur-containing amino acids and 6.15g of aromatic amino acids. It is rich in the essential amino acids, histidine, leucine and phenylalanine, with the sulfur containing amino acids (Methionine and Cystine) as its limiting amino acid(s), and chemical scores of 36%, 88% and 26% with reference to human milk, adult requirements and egg protein, respectively. The sclerotia are rich in the mineral elements: copper, iron, magnesium and manganese. The present study shows that the sclerotia are rich source of minerals with a rich protein that may require the supplementation of the sulfur-containing amino acids.

**KEY WORDS:** Amino acids, mineral elements, nutrient composition, *Pleurotus tuberregium* Sclerotia, protein score.

## INTRODUCTION

*Pleurotus tuberregium* (Fr) Sing is an edible mushroom that is found in both tropical and subtropical regions of the world [Okhuoya and Okogbo, 1991], especially in southern Nigeria. The mushroom looks somewhat like an oyster mushroom (*Pleurotus ostreatus*) except that, when mature, the cap curves upward to form a cup-like shape. It forms large spherical to ovoid, subterranean sclerotia (or underground tuber) which sometimes measure up to 30cm in diameter, in addition to a mushroom [Okhuoya and Okogbo, 1991; Fasidi and Olorunmaiye, 1994]. The sclerotium is dark brown on the outside and white on the inside. The fungus infects dry wood, where it produces the sclerotium, usually buried within the wood tissues or between the wood and the bark. In Nigeria both the sclerotium and the mushroom are eaten. The sclerotium, which is hard, is peeled and ground for use in a vegetable soup [Fasidi and Olorunmaiye, 1994]; or is used in traditional medical practice, in preparation of cures for headache, stomach ailments, colds and fever, asthma, smallpox and high blood pressure [Okhuoya and Okogbo, 1991; Fasidi and Olorunmaiye, 1994; Aloba, 2003]. They are sometimes used for induction of weight gain in malnourished babies [Aloba, 2003]. In this study, we investigated the amino acid, mineral and vitamin composition of *Pleurotus tuberregium* (Fr) Sing's sclerotia, in order to provide nutritionists with data for easy assessment of its nutritional contribution.

## MATERIALS AND METHODS

**Collection of plant samples:** Samples of fresh *Pleurotus tuberregium* Sclerotia were bought from Mile 3 Market, Port Harcourt, Nigeria. After due identification at the University of Port Harcourt Herbarium, Port Harcourt, Nigeria, they were rid of dirt and stored for subsequent analysis.

**Determination of amino acid composition:** The amino acid profile of the sample was determined using methods described by Spackman *et al.* [1958]. The sample was dried to a constant weight, defatted (by placing a known weight of the dried sample in an extraction thimble and extracting with chloroform/methanol (2:1) mixture, in a soxhlet extractor, for 15hours), hydrolyzed, evaporated in a rotary evaporator and loaded into a Technicon Sequential Multi-sample Amino Acid Analyzer (TSM-1), model DNA 0209 (Technicon Instruments Corporation, Tarrytown, New York). The reproducibility and sensitivity of the machine were  $\pm 3\%$  and 25nmol respectively. The carrier gas was nitrogen, with column operating conditions of 0.50mL/min flow rate, 60°C operating temperature, C-3 resin, 23cm resin bed for acid/neutral and 5cm bed for basic amino acids. 5 $\mu$ L and 10 $\mu$ L of the samples were injected for the acid/neutral and basic runs respectively. Then the chemical score of the protein was determined by comparing the amino acid composition obtained herein, with WHO reference protein pattern [FAO/WHO/UNU, 1991], according to the following formula:

$$\text{Chemical score (\%)} = \frac{\text{amount of a particular amino acid per 100g of the test protein} \times 100}{\text{amount of same amino acid per 100g of reference protein}}$$

**Determination of mineral composition:** This was carried out as earlier reported by Ikewuchi and Ikewuchi [2009], using Inductively Coupled Plasma Optical Emission Spectrophotometer (ICPOES), Model TL 6000

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Jarrell-Ash. The correlation of the standards for the calibration curve was greater than 0.99998.

## RESULTS AND DISCUSSION

The amino acid profile and chemical scores of the protein are given in Tables 1-2 respectively. Every 100g of this protein contains 25.93g of essential amino acids, 1.50g of sulfur-containing amino acids and 6.15g of aromatic amino acids (Table 1). It is rich in the essential amino acids, histidine, leucine and phenylalanine, and can meet their minimum daily requirements [McGilvery and Goldstein, 1983; FAO/WHO/UNU, 1991]. In comparison to the WHO reference protein patterns [FAO/WHO/UNU, 1991], its limiting amino acid(s) are the sulfur-containing amino acids (Methionine and Cystine), with chemical scores of 36%, 88% and 26% with reference to human milk, adult requirements and egg protein, respectively (Table 2). The implication of this is that there is need for the supplementation of the sulfur containing amino acids while consuming this protein. Alternatively, this may be augmented by combining this protein with another that is rich in the sulfur-containing amino acids. In comparison to the egg protein reference, this protein's chemical score is less than those reported for maize (55%), rice (67%), millet, soy bean (74%), peanuts (65%), African locust bean (55%), yam (75%), human milk (100%), cow milk (95%) and beef (69%) [FAO, 1981; McGilvery and Goldstein, 1983].

The mineral composition of *P. tuberregium Sclerotia* is shown in Table 3. The calcium content of *P. tuberregium Sclerotia* is less than those reported for *Boerhavia diffusa* (174.09mg/100g), *Commelina nudiflora* (240.00mg/100g) [Ujowundu *et al.*, 2008], soyabeans (186.2mg/100g) [Elegbede, 1998] and cashew nut (43.02mg/100g) [NutritionData, 2008; Nandi, 1998]. It contains less sodium than that reported for *B. diffusa* (162.50mg/100g) and *C. nudiflora* (75.55mg/100g) [Ujowundu *et al.*, 2008], soyabeans (24.8mg/100) [Elegbede, 1998], and a comparable sodium content to cashew nut (5-13.02mg/100g) [Nandi,

1998; NutritionData, 2008]. It contains more potassium than *B. diffusa* (0.91mg/100g) and *C. nudiflora* (0.78mg/100g) [Ujowundu *et al.*, 2008], but however, a lower one than soyabeans (47.7mg/100g) [Elegbede, 1998] and cashew nut [631.8mg/100g, NutritionData, 2008; 880mg/100g, Nandi, 1998]. *P. tuberregium Sclerotia* is rich in magnesium. A 100g serving can provide about 104 - 116% of the RDA (Table 3). The level of magnesium recorded here is higher than that reported for *B. diffusa* (8.68mg/100g) and *C. nudiflora* (6.63mg/100g) [Ujowundu *et al.*, 2008] but less than those of soyabeans (98.6mg/100g) [Elegbede, 1998] and cashew nut [280mg/100g, Nandi, 1998; 272.87mg/100g, NutritionData, 2008]. The present study shows that *P. tuberregium Sclerotia* is moderately rich in manganese. A 100g serving can provide about 39 - 44% of the RDA (Table 3). This manganese level is less than those reported for *B. diffusa* (0.43mg/100g), *C. nudiflora* (0.14mg/100g) [Ujowundu *et al.*, 2008], soyabeans (2.5mg/100g) [Elegbede, 1998] and cashew nut [2.0mg/100g, Nandi, 1998; 1.71mg/100g, NutritionData, 2008]. It is also moderately rich in iron, with a 100g serving likely to provide about 33 -37% of the RDA. Its iron content is higher than those reported for *B. diffusa* (0.012mg/100g) and *C. nudiflora* (0.017mg/100g) [Ujowundu *et al.*, 2008], lower than those of soyabeans (1.0mg/100g) [Elegbede, 1998], *Amarantus hybridus* (110mg/100g), *Talinum triangulare* (40mg/100g) and *Telferia occidentalis* (30mg/100g) [Oguntona, 1998], and comparable to that of cashew nut (6-8mg/100g) [Nandi, 1998; NutritionData, 2008]. Another mineral element found in moderate quantity in *P. tuberregium Sclerotia* is copper. A 100g serving can provide about 50 - 56% of the RDA. This copper content is lower than the copper content of soyabeans (0.3mg/100g) [Elegbede, 1998] and cashew nut (2.0mg/100g) [Nandi, 1998; NutritionData, 2008]. The zinc content is less than that of cashew nut (4.00-5.35mg/100g) [Nandi, 1998; NutritionData, 2008], *A. hybridus* (10mg/100g), *T. triangulare* (10mg/100g) and *T. occidentalis* (10mg/100g) [Oguntona, 1998].

**Table 1:** Amino acid profile of protein from *Pleurotus tuberregium Sclerotia*

Amino acid	Composition		
	Mg/100g protein	g/100g sample	
		Fresh	Dry
Lysine*	30.1	1.94	2.14
Histidine*	22.5	1.45	1.60
Arginine	37.4	2.41	2.66
Aspartate	67.0	4.31	4.77
Threonine*	25.0	1.61	1.78
Serine	30.5	1.96	2.17
Glutamate	92.7	5.96	6.60
Proline	30.7	1.97	2.19
Glycine	28.2	1.81	2.01
Alanine	30.0	1.93	2.14
Cystine	8.0	0.51	0.57
Valine*	35.0	2.25	2.49
Methionine*	7.0	0.45	0.50
Isoleucine*	34.0	2.19	2.42
Leucine*	70.2	4.51	5.00
Tyrosine	26.0	1.67	1.85
Phenylalanine*	35.5	2.28	2.53
TEAA	259.3	16.68	18.46
TNEAA	350.5	22.54	24.96
TSCAA	15.0	0.96	1.07
TAAA	6.15	3.96	4.38

\*Essential amino acids. TEAA= Total Essential Amino Acid. TNAA= Total Nonessential Amino Acid. TSCAA= Total Sulphur-Containing Amino Acid. TAAA= Total Aromatic Amino Acid.

**Table 2:** Comparison of protein from *Pleurotus tuberregium Sclerotia*, with WHO reference protein pattern [FAO/WHO/UNU, 1991]

Amino acid	Reference Patterns (mg/g protein)			Amino Acid Scores (%)		
	Human Milk	Adult	Egg	*A	*B	**C
Histidine	26	16	22	87	141	102
Isoleucine	46	13	54	74	262	63
Leucine	93	19	86	76	370	82
Lysine	66	16	70	46	188	43
Methionine + Cystine	42	17	57	36	88	26
Phenylalanine + Tyrosine	72	19	93	85	324	66
Threonine	43	9	47	58	278	53
Valine	55	13	66	64	269	53

\*A = compared to human milk protein pattern; \*B = compared to adult reference pattern; \*\*C = compared to egg protein pattern.

**Table 3:** Mineral element composition of *Pleurotus tuberregium Sclerotia*

Mineral element	Composition			
	/100g Dry weight		/100g Wet weight	
	Mg	%DV	Mg	%DV
Calcium	11.28±0.06	1.22	10.19±0.05	1.10
Copper	0.11±0.00	55.85	0.10±0.00	50.77
Iron	0.66±0.01	36.4	0.60±0.01	33.1
Magnesium	46.47±0.30	116.18	41.96±0.27	104.90
Manganese	0.09±0.00	44.18	0.08±0.00	39.27
Potassium	2.57±0.01	0.73	2.32±0.01	0.66
Sodium	8.82±0.06	5.25	7.96±0.05	4.74
Zinc	0.07±0.00	4.67	0.06±0.00	4.00

Values are means ± SD of two determinations. Percent Daily Values (%DV) are for adults or children aged 4 or older, and are based on a 2,000 calorie reference diet. The daily values may be higher or lower based on individual needs [FAO, 2004; NutritionData, 2008].

## CONCLUSION

The present study shows that *Pleurotus tuberregium Sclerotia* is rich in the mineral elements copper, iron, magnesium and manganese. It also indicates that use of the protein from *P. tuberregium Sclerotia* requires the supplementation of the sulfur-containing amino acids.

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