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Analysis of the Bioactive Nutrients and Pharmacologically Active Substances in *Pleurotus tuber-regium*

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ABSTRACT

Background and Objective: Mushroom is used as a source of food by Nigerians, but chemical composition information on them is scanty. In trying to bridge this gap of paucity of information, this research investigated the proximate, vitamin, antinutritional, and mineral analysis studies on *Pleurotus tuber-regium*, commonly referred to as Osu. **Materials and Methods:** The proximate analysis was carried out using the method of the Association of Official Applied Chemists (AOAC). The Colometric method was used to analyze vitamins A, B12, and E, while the Titrimetric method was used to analyze vitamins B3, B6, and C. Spectrophotometric methods were used to analyze vitamins D, K, B1, and B2. The mineral concentration was determined using Atomic Absorption Spectrometry method and minerals analyzed includes Se, Ar, Mg, Na, Cu, Ni, Zn, Mn, Cr, Fe, Ca, k, Mo and Co. **Results:** The moisture content of 58.67%, ash content of 0.4995%, protein content of 1.4%, carbohydrate content of 27.28%, fat content of 3.2% and crude fiber of 9.3%. The results revealed that *Pleurotus tuber-regium* contains vitamin C (272.8 mg/g), vitamin A (4.3 mg/g). The results revealed that certain antinutrients such as oxalate (7795.3 mg/%), terpenoid (34.77 mg/%), steroid (16.68 mg/%), cyanogenic glycoside (10.8 mg/%) etc., are present in *Pleurotus tuber-regium* which reduces the risk of various cancer, cardiovascular diseases and many more. **Conclusion:** The result of this research shows that Osu has high nutritional value and is beneficial to humans, both young and old.

KEYWORDS

Pleurotus tuber-regium, proximate analysis, vitamin, antinutrients, minerals, bioactive nutrients

INTRODUCTION

Pleurotus tuber-regium (Fig. 1) is a basidiomycete that forms a large, spherical to ovoid, subterranean sclerotium composed of fungus tissue[1]. The sclerotium is dark brown on the outside and white inside. *Pleurotus tuber-regium* is common and popularly consumed in Nigeria, where the sclerotium is usually lifted out of soil or wood[2]. As a fungus, it grows on the drill dust of wood such as *Treculia africana* (breadfruit), *Elaeis guineensis*, and *Daniella oliveri* tree[3]. Yongabi *et al.*[4] had reported the nutritional, phytochemical, and mineral compositions of the sclerotium of *Pleurotus tuber-regium* and its application in the management of headache, stomach ailments, colds and fever[2], asthma, smallpox, and high blood pressure[5].

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Fig. 1: *Pleurotus tuber-regium*

Among the natives of Nigeria, *Pleurotus tuber-regium* is known as "Osu" in Igbo, "Ohu" in Yoruba and "Katala" in Hausa. It is a species of fungus that produces true sclerotia[6]. Odiase-Omoighe and Agoreyo[1] reported that the mushroom is also indigenous to tropical Africa and the Australasian-Pacific Region. Economically, *P. tuber-regium* is of great importance in Nigeria, both the sclerotium and the mushrooms. For it to be eaten, the sclerotium and the mushrooms are processed and used in making soup. The pileus and stipe of the mushroom are cut into pieces, boiled, and added to soups. In this form, it replaces melon in okro or vegetable soup[2]. Its consumption is widespread, and the locals collect the sclerotia from the wild. However, the growing method of this fungus has been established to produce sclerotia using lignocellulosic agricultural wastes as cultivation substrates[1].

The genus *Pleurotus* (oyster mushroom) comprises some of the most popular edible mushrooms belonging to the family Pleurotaceae. According to Gbasouzor and Chukwu[7], many *Pleurotus* mushrooms are primary decomposers of hardwood trees and are found worldwide. It is a saprotroph that acts as a primary decomposer of wood. Cultivated around the World for food and its medicinal value, it can also be used industrially for mycoremediation purposes. The mushroom is quite adaptable to a range of climates and substrate materials, making itself the second most common mushroom produced worldwide following button mushroom[7].

Pleurotus tuber-regium (Fig. 1) is a tuberous basidiomycete, order Agaricales and family Pleurotaceae[7]. The sclerotium is spherical to ovoid. It is dark brown on the outside and white on the inside[2,3].

Pleurotus tuber-regium is a white rot fungus that derives nutrients from the degradation of lignocelullosic material and is commercially found in open places, associated with manure and already rotting debris[8]. Naturally, dead wood is colonized by mycelia or airborne spores. Once the substrate is fully colonized and has reached an advanced stage of decay, sclerotia will be formed, given a favourable condition. Odiase-Omoighe and Agoreyo[1] revealed that the sclerotia survives the dry and hot season until the rain returns, at which point the sclerotia will either continue to enlarge or form sporophores[9].

Bamigboye *et al*.[10] revealed that basidiocarps can be induced by burying the sclerotia in soil because of its economic importance in food and medicine preparations[2,11,12].

Africans have used the tuber-like sclerotia from *Pleurotus tuber-regium* to solve various health challenges such as skin diseases, inflammation, childhood malnutrition, headache, stomach problems, cold, asthma, fever, high blood pressure, diabetes, and small pox[2,12]. Because. *Pleurotus tuber-regium* is used in various combinations in the management of certain ailments, some Nigerian native doctors use those

combinations and other ingredients in their medicine. In the Southeast of Nigeria, it is used in the management of heart problems, asthma, cough, and obesity[1,13]. While in Ghana, they are used in medicine for illnesses that relate to malnutrition and anemia in children and the rural areas as one of the ingredients in embalming dead bodies[14]. Gregori *et al.*[15] stated that *Pleurotus* species have been shown to possess several medicinal properties, such as antitumour, immunomodulatory, antioxidant, anti-inflammatory, hypocholesterolemic, antihypertensive, antihyperglycemic, antimicrobial and antiviral activities. In particular, polysaccharides appear to be potent antitumour and immuno-enhancing substances. According to Odiase-Omoighe and Agoreyo[1], recent scientific studies have shown that sclerotia of *Pleurotus tuber-regium* contain polysaccharides and other compounds with positive medicinal benefits. Publications from Asia have shown that the fresh sclerotia of this fungus have high contents of useful compounds like β-glucan and lectin that have promising medicinal properties. Iwuagwu and Onyekweli[9] showed that the powder obtained from the mycelia of the edible giant mushroom, *Pleurotus tuber-regium*, may be used as an alternative to maize starch BP as a tablet disintegrant. The *Pleurotus* powder showed superior flow, swelling capacity, and high-water retention capacity compared to maize starch BP. Tablets prepared with *P. tuber-regium* powder disintegrated faster than those prepared with maize starch BP at concentrations. The ability of *Pleurotus* powder to swell by over three times its volume in the presence of water may be responsible for its ability to function as a tablet disintegrant. Equally, Badalyan *et al.*[16] reported that the antagonistic/antifungal activity of *P. tuber-regium* against filamentous fungi can be used as new and effective antimycotic drugs, which are very important tools for preventing and treating widely spread resistant human and animal infections (e.g., mycoses) caused by opportunistic fungi in an immunocompromised host. Today, this fungus has attained international recognition and is actively studied in laboratories in the US, Europe, and Asia for its application in modern medicine[17].

This research aims to determine the nutritional composition, vitamins, minerals and anti-nutritional contents of *Pleurotus tuber-regium*. Since mushroom is used as a source of food by Nigerians, this research reports on the analytical determination of the proximate, minerals, antinutrient, and vitamin composition of *Pleurotus tuber-regium*.

MATERIALS AND METHODS

Sample collection, identification, and preparation: The fresh samples of *Pleurotus tuber-regium* were collected from St. Anthony Parish, Ifite, Awka, Anambra State, Nigeria, and were identified by Mr. Maxwell Nwatu of the Botany Department, Nnamdi Azikiwe University, Awka, Nigeria. The study was carried out from June to August, 2022 at the Applied Biochemistry Department, Research Laboratory, Nnamdi Azikiwe University, Awka, and Glanson Research Laboratory, Awka, both in Anambra State, Nigeria.

The fresh samples collected were air-dried for 2 weeks at room temperature. The dried materials were reduced to coarse form using a pestle and mortar and further pulverized to very fine particles with an electric blender and stored in an air-tight container for analysis.

Proximate analysis: The proximate components such as moisture content, ash content, crude fibre, and crude protein contents were determined using methods as described by AOAC and Helrich[18].

Determination of crude fat (Soxhlet Fat Extraction Method): Dry 250 mL clean boiling flasks in oven at 110°C for about 30 min. Transfer into a desiccator and allow to cool. Weigh correspondingly labeled, cooled boiling flasks. Fill the boiling flasks with about 300 mL of petroleum ether (boiling point 60°C). Plug the extraction thimble lightly with cotton wool. Assemble the Soxhlet apparatus and allow to reflux for about 6 hrs. Remove thimble with care and collect petroleum ether in the top container of the set-up and drain into a container for re-use. When the flask is almost free of petroleum ether, remove and dry at 105°C for 1 hr. Transfer from the oven into a desiccator and allow to cool; then weigh.

Carbohydrate determination using differential method:

100-(Protein (%)+Moisture (%)+Ash (%)+Fat (%)+Fibre (%))

Vitamin analysis:

- Vitamin A was determined by the Calorimetric method of Kirk and Sawyer[19]
- Vitamin C was determined by the Titrimetric method reported by Kirk and Sawyer[19]
- Vitamin E was determined by Futter-mayer colometric method with association of vitamin chemist's[19]
- Vitamin B1, B2, B12, and B9 were determined by Ikewuchi and Ikewuchi[20]
- Vitamin B3 (Nicotinamide) and vitamin B6 were determined Spectrophotometrically[21]
- Vitamin D and K: Total vitamin D and K were estimated by Moulick *et al*.[22]

Antinutrients

Oxalates concentration (titration method): This determination involves three major steps: Digestion, oxalate precipitation, and permanganate titration.

Digestion: The sample (2 g) was suspended in 190 mL of distilled water in a 250 mL volumetric flask. The HCl (10 mL) was added, and the suspension digested at 100°C for 1 hr. Cooled and then made up to the 250 mL mark before filtration.

Oxalate precipitation: Duplicate portions of 125 mL of the filtrate were measured into beakers, and four drops of methyl red indicator were added. This was followed by the addition of NH_4OH solution (dropwise) until the test solution changed from salmon pink color to a faint yellow color pH 4-4.5. Each portion is heated to 90°C, cooled and filtered to remove precipitate containing ferrous ions. The filtrate was again heated to 90°C and 10 mL of 5% $CaCl_2$ solution was added while being stirred constantly. After heating, it was cooled and left overnight at 25°C. The solution was then centrifuged at 2500 rpm for 5 min and the supernatant was decanted, and the precipitate was completely dissolved in 10 mL of 20% (v/v) H_2SO_4 solution.

Permanganate titration: At this point, the total filtration resulting from the digestion of 2 g of flour was made up to 300 mL. Aliquots of 125 mL of the filtrate were heated until near boiling and then titrated against 0.05 M standardized $KMNO_4$ solution to a faint pink color which persists for 30 sec, and calcium oxalate content was calculated using the formula:

$$\left(\frac{T \times (Vme)\,(Df) \times 105)}{(ME) \times Mf}\right)(mg / 100\ g)$$

where, T is the titre of $KMnO_4$ (mL), Vme is the volume-mass equivalent (i.e. 1 mL of 0.05 m $KMnO_4$ solution is equivalent to 0.00225 g anhydrous oxalic acid). The Df is the dilution factor Vt/A (2.4 where, Vt is the total volume of titrate (300 mL) and A is the aliquot used (125 mL), ME is the molar equivalent of $KMnO_4$ in oxalate ($KMnO_4$ redox reaction), and Mf is the mass of sample used[22].

Saponins concentration: Exactly 5 g of the sample was put into 20% acetic acid in ethanol and allowed to stand in a water bath at 50 for 24 hrs. This was filtered, and the extract was concentrated using a water bath to one-quarter of the original volume. Concentrated NH_4OH was added drop-wise to the extract until the precipitate was complete. The whole solution was allowed to settle, and the precipitate was collected by filtration and weighed. The saponin content was weighed and calculated in percentage[23].

Calculation:

$$\text{Saponin content (\%)} = \frac{(\text{Weight of filter paper} + \text{residue}) - (\text{Weight of filter paper})}{\text{Weight of sample analyzed}} \times 100$$

Cardiac glycosides concentration: Wang *et al.*[24] method was used, to 1 mL of extract was added 1 mL of 2% solution of 3,5-DNS (dinitro salicylic acid) in methanol and 1 mL of 5% aqueous NaOH. It was boiled for 2 min (until brick-red precipitate was observed), and the boiled sample was filtered. The weight of the filter paper was recorded before filtration. The filter paper with the absorbed residue was dried in an oven at 500°C till dryness, and the weight of the filter paper with the residue was noted.

The cardiac glycoside was calculated in percentage.

Calculation:

$$\text{Cardiac glycoside (\%)} = \frac{(\text{Weight of filter paper} + \text{residue}) - (\text{Weight of filter paper})}{\text{Weight of sample analyzed}} \times 100$$

Tannins concentration (Follin Dennis titration): The Follin Dennis titrating method[25] was used. To 20 g of the crushed sample in a conical flask was added 100 mL of petroleum ether and covered for 24 hrs. The sample was then filtered and allowed to stand for 15 min, allowing petroleum ether to evaporate. It was then re-extracted by soaking in 100 mL of 10% acetic acid in ethanol for 4 hrs. The sample was then filtered, and the filtrate was collected.

The 25 mL of NH_4OH was added to the filter to precipitate the alkaloids. The alkaloids were heated with an electric hot plate to remove some of the NH_4OH still in solution. The remaining volume was measured to be 33 mL. Five milliliters of this was taken, and 20 mL of ethanol was added to it. It was titrated with 0.1M NaOH using phenolphthalein as an indicator until a pink end point was reached. Tannin content was then calculated in percentage ($C_1V_1 = C_2V_2$) molarity.

Calculation:

Data

C_1 = Concentration of tannic acid
C_2 = Concentration of base
V_1 = Volume of tannic acid
V_2 = Volume of base

Therefore:

$$C_1 = C_2V_2V_1$$

$$\text{Tannic acid content (\%)} = \frac{C1 \times 100}{\text{Weight of sample analyzed}}$$

Phytates concentration: Phytate contents were determined using the method of Young and Greaves[26] as adopted by Lolas and Markakis[27]. The 0.2 g of each of the differently processed *Colocasia* samples was weighed into different 250 mL conical flasks. Each sample was soaked in 100 mL of 2% concentrated HCL for 3 hrs, the sample was then filtered. Fifty milliliters of each filtrate was laced in a 250 mL beaker,

and 100 mL distilled water was added to each sample. Ten milliliters of 0.3% ammonium thiocynate solution was added as an indicator and titrated with standard iron (iii) chloride solution, which contained 0.00195 g iron per 1 mL:

$$\text{Phytic acid} = \frac{\text{Titre value} \times 0.00195 \times 1.19 \times 100}{\text{Weight of sample}}$$

Phenols concentration: The quantity of phenol was determined using the spectrophotometer method[28]. The sample is boiled with 50 mL of $(CH_3CH_2)_{20}$ for 15 min. Five milliliters of the boiled sample was then pipetted into a 50 mL flask, and 10 mL of distilled water was added. After the addition of distilled water, 2 mL of NH_4OH solution and 5 mL of concentrated CH_3 $(CH_2)_3CH_2OH$ were added to the mixture. The samples were made up to the mark and left for 30 min to react for color development and were measured at 505 nm wavelength using a spectrophotometer.

Cyanogenic glycosides concentration and acid titration method: Samples (10-20 mg) are placed, ground to pass N0.20 sieve into 800 mL Kjeldahl flask. As 100 mL H_2O is added and macerated at room temperature for 2 hrs. The H_2O (100 mL) is added, steamed, and distilled, collecting distillate in 20 mL, 0.02 N $AgNO_3$ acidified with 1 mL HNO_3. Before distillation adjusts appropriately, the tip of the condenser dips below the surface of the liquid in the receiver. When 150 mL is passed over, filtered and distilled, it is passed through a Gooch wash receiver and Gooch with a little H_2O. Excess $AgNO_3$ is titrated in combined filtrate and washed with 0.02N KCN, using Fe alum indicator. As 1 mL 0.02N $AgNO_3$ = 0.54 mg HCN[28].

Determination of steroid content: As 1.0 g of the powdered sample was weighed and mixed in 100 mL of distilled water in a conical flask. The mixture was filtered, and the filtrate was eluted with 0.1 N ammonium hydroxide solution. Two milliliters of the eluent was put in a test tube and mixed with 2 mL of chloroform. Three milliliters of ice-cold acetic anhydride was added to the mixture in the flask. Two drops of (200 mg/dL) standard sterol solution was prepared and treated as described for the test as blank. The absorbance of the standard and the test was measured, zeroing the spectrophotometer with blank at 420 nm:

$$\text{Calculation (mg / 100 mL)} = \frac{\text{Absorbance of test}}{\text{Absorbance of standard}} \times \text{Concentration of standard}$$

Determination of iodine: Iodine was determined with the alkaline dry ash technique[29]. This was done by adding 0.5 g of each sample into nickel crucibles. One milliliter of a mixture of 0.5 M sodium hydroxide and 0.1 M potassium nitrate was added to the samples, mixed, and allowed to dry. The containers were then covered with aluminium foil and placed in a muffle furnace. The samples were heated to 250°C, held for 15 min, heated further to 480°C, again held for 15 min, and finally brought to 580°C. They were maintained at this temperature for 3 hrs, after which they were allowed to cool to room temperature. The resultant ash was extracted with three successive 2 mL portions of a 1.0 mL sodium hydroxide made up of double distilled water. The solution was centrifuged at 2500 g for 20 min using polypropylene centrifuge tubes and the supernatant solution collected for iodine determination. The heat destroyed the organic matrix. The sodium hydroxide was used to keep the iodine in a non-volatile form, while the potassium nitrate was used to increase the oxidation of the organic matter. Then, 1 mL of sample solution was added to cuvette at 35°C, and 1 mL of arsenic reagent was added. Their action was started by the addition of 1 mL of ceric reagent. The initial reaction rate was calculated from the change in absorbance at 420 nm. The iodine concentrations of the samples were determined from the formula:

$$\text{Concentration of sample (mg / L)} = \frac{\text{Absorbance of sample}}{\text{Absorbance of standard}} \times \text{Concentration of standard}$$

Determination of saponin: Exactly 5 g of the sample was put into 20% acetic acid in ethanol and allowed to stand in a water bath at 50°C for 24 hrs. This was filtered, and the extract was concentrated using a water bath to one-quarter of the original volume. Concentrated NH_4OH was added drop-wise to the extract until the precipitate was complete. The whole solution was allowed to settle, and the precipitate was collected by filtration and weighed. The saponin content was weighed and calculated in percentage[30]:

Calculation:

$$\text{Saponin content (\%)} = \frac{(\text{Weight of filter paper} + \text{residue}) - (\text{Weight of filter paper})}{\text{Weight of sample analyzed}} \times 100$$

Determination of terpenoid: As 1.0 g of the powdered sample was weighed and mixed in 100 mL of distilled water in a conical flask. The mixture was filtered, and the filtrate was eluted with 0.1 N ammonium hydroxide solution. Two milliliters of the eluent was put in a test tube and mixed with 2 mL of chloroform. 3 mL of ice-cold acetic anhydride was added to the mixture in the flask. Two drops of (200 mg/dL) standard sterol solution was prepared and treated as described for the test as blank. The absorbance of the standard and test was measured, zeroing the spectrophotometer with a blank at 503 nm[30]:

$$\text{Calculation (mg / 100 mL)} = \frac{\text{Absorbance of test}}{\text{Absorbance of standard}} \times \text{Concentration of standard}$$

Determination of minerals: The working principle of an atomic absorption spectrometer (AAS) is based on the sample being aspirated into a flame, where it is atomized. A light beam from a source lamp, specific to the element of interest, passes through the flame into a monochromator and then onto a detector. The detector measures the amount of light absorbed by the atomized element in the flame. Since each metal has its own characteristic absorption wavelength, a lamp containing that element is used, which minimizes spectral or radiation interference. The amount of energy absorbed at the characteristic wavelength is directly proportional to the concentration of the element in the sample[31].

Dry preparation of sample for minerals: Two grams of the sample were weighed and heated in a furnace for 2 hrs at 550°C. Dilute it with 20 mL of 20% H_2SO_4 and filtered it with a filter paper[31].

Preparation of reference solution: A series of standard metal solutions in the optimum concentration range was prepared; the reference solutions were prepared daily by diluting the single stock element solutions with water containing 1.5 mL concentrated nitric acid/litre. A calibration blank was prepared using all the reagents except for the metal stock solutions. A calibration curve for each metal was prepared by 87 plotting the absorbance of standards versus their concentration[31].

RESULTS

Proximate analysis of *Pleurotus tuber-regium* findings: The result revealed that *Pleurotus tuber-regium* is rich in moisture and carbohydrates. It contains a small quantity of ash, fiber, fat, and protein shown in Fig. 2.

Vitamin content of *Pleurotus tuber-regium*: The result shows that *Pleurotus tuber-regium* is very rich in vitamin C. It also contains little quantity of vitamin A and vitamins B1, B2, B3, B6, B12, E, D, and K shown in Fig. 3.

Antinutrients analysis of *Pleurotus tuber-regium*: The chart (Fig. 4) shows that *Pleurotus tuber-regium* contains a high concentration of oxalate with the insignificant quantity of steroids, terpenoids, phenol, cyanogenic glycoside, phytate, tannin, cardiac glycoside, saponin, and iodine value.

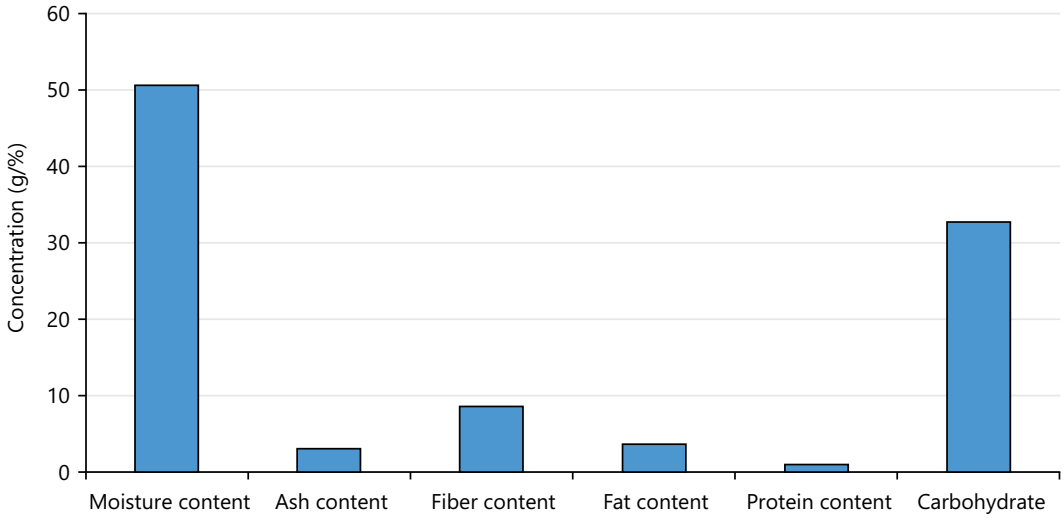

Fig. 2: Proximate composition of *Pleurotus tuber-regium*

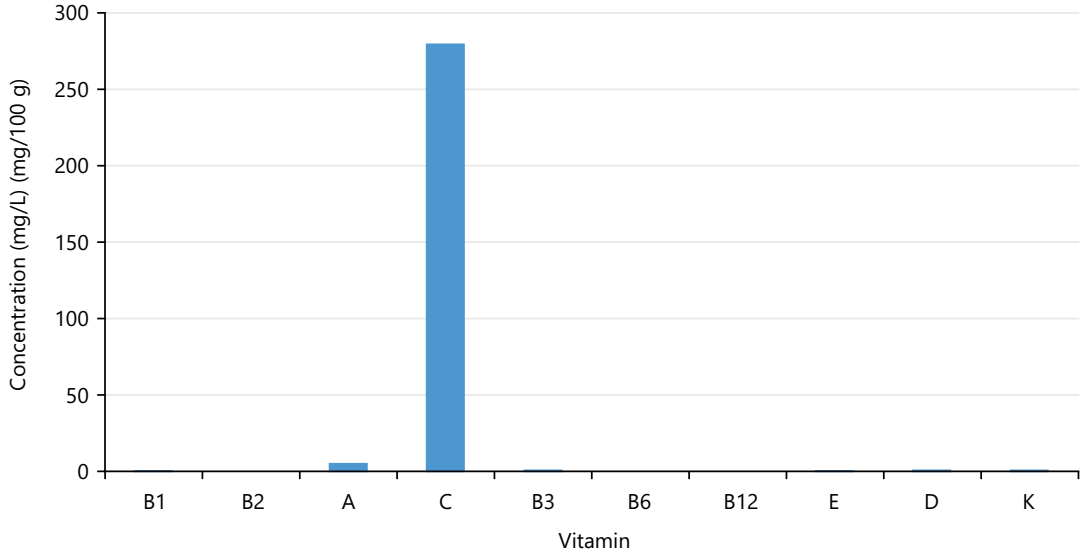

Fig. 3: Vitamin contents of *Pleurotus tuber-regium*

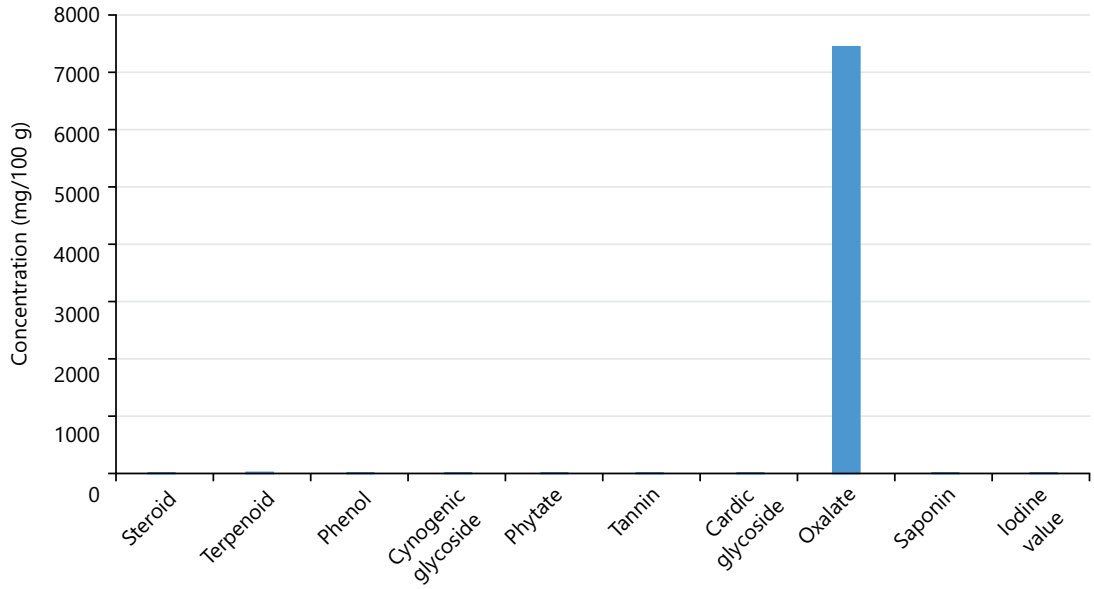

Fig. 4: Antinutrient composition of *Pleurotus tuber-regium*

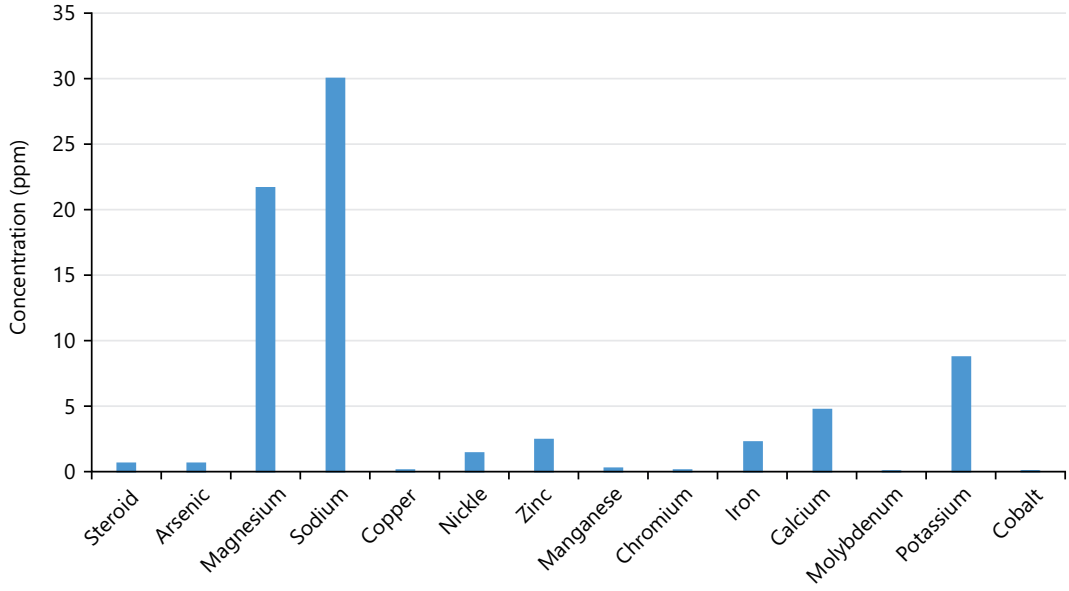

Fig. 5: Mineral contents of *Pleurotus tuber-regium*

Mineral analysis of *Pleurotus tuber-regium*: Figure 5 reveals that *Pleurotus tuber-regium* contains various mineral, which includes sodium in large quantity, magnesium in sufficient quantity, potassium, calcium, iron, selenium, arsenic, zinc, nickel, manganese, copper, and an insignificant quantity of chromium, molybdenum, and cobalt.

DISCUSSION

The nutritional analysis of *Pleurotus tuber-regium* revealed that it is of high nutritional value. The proximate analysis carried out on *Pleurotus tuber-regium* contains a high concentration of moisture content, rich in carbohydrates and fibre but a minute quantity of fats and protein. For this reason, it is a good source of energy[1]. Low levels of protein obtained may be attributed to the fact that the young fruit bodies were generally richer in protein than the matured fruit bodies. Therefore, it is suggested that the young sporocarps should be preferred to the matured fruit bodies[32]. The vitamin analysis carried out showed that *Pleurotus tuber-regium* contains a high amount of vitamin C and a considerable amount of vitamin A, which is needed for the growth and repair of tissues in all parts of the body. It is also used to form an important protein used to make skin, tendons, ligaments, and blood vessels. *Pleurotus tuber-regium* was also found to contain a considerable amount of vitamin A, which is vital for normal vision, the immune system, and reproduction. It also helps the heart, lungs, kidneys and other organs work properly. The antinutritional analysis carried out revealed that *Pleurotus tuber-regium* has a high level of oxalate, which main health concern is binding to minerals in the gut and prevent the body from absorbing them. It also contains terpenoid, steroids and cyanogenic glycosides. The mineral analysis carried out showed that *Pleurotus tuber-regium* contains macro elements such as sodium and potassium which is used for maintaining fluid balance; magnesium which is needed for nerve transmission, calcium required for muscle contraction, zinc that aids normal foetal development and iron. The proximate, vitamin content, antinutrient and mineral analysis help identify the nutritional value of *Pleurotus tuber-regium* which is important for food formulation plans.

Pleurotus tuber-regium is of great economic importance. Both the sclerotium and the mushrooms are eaten. The outer brown portion of the sclerotium is peeled off, and the inner white portion cut into small pieces, ground, and used in making soup. In this form it may replace melon in okro or vegetable soup. The pileus and stipe of the mushroom are cut into pieces, boiled and added to okro or vegetable soup[2]. Odiase-Omoighe and Agoreyo[1] stated that analysis of both sclerotia and sporophores show that they are rich in carbohydrates, proteins, vitamins and minerals while low in fats. According to Alobo[33]; the

mushroom has 16.5% dry matter and of the dry matter, 7.4% is crude fiber, 14.6% crude protein and 4.48% fats and oils. Protein levels of Shiitake and *P. ostreatus* are higher than that of wheat. Shiitake is 18%, *P. ostreatus* is 30% while wheat is 13% and milk 25% (all based upon dry weight). Fat levels are comparable to those of other mushroom species. Total sugar content is about 18.6%, with high concentrations of galactose and low concentrations of glucose and maltose. Levels of oxalic acid, which can reduce the food value, were low as were levels of hydrocyanic acid, which can be toxic. The mushrooms also contained low levels of vitamin C. Experiments conducted by Ohiri[32] showed that ethanol, soluble sugar, and lipid content of the mushroom were generally low. This suggests that diabetics and those with heart or weight problems can consume this mushroom. *Pleurotus tuber-regium* has the highest amount of crude fiber compared with other wild edible mushrooms[32]. Young fruitbodies of *P. tuber-regium* were generally richer in protein than the matured fruitbodies. Therefore, it is suggested that the young sporocarps should be preferred to the matured fruitbodies. Hence, fruitbodies of the mushroom can be eaten as a protein supplement or as an alternative to fish and meat in rural areas where these items are not affordable. Vegetarians also eat mushrooms because it serve as an alternative protein supplement in their diets. Mushroom proteins are generally higher than those of green vegetables and oranges[33]. According to Odiase-Omoighe and Agoreyo[1], research is already going on to incorporate sclerotium powder into bread as a cheap source of protein supplement to bread.

The results obtained show that *Pleurotus tuber-regium* is of high nutritional and medicinal quality. More intake of the mushroom, especially the young sporocarp for both young and old recommended.

CONCLUSION

Pleurotus tuber-regium is a good source of vitamin and also carbohydrate and accredited to have medicinal value. Thus, consumption of *Pleurotus tuber-regium* can help boost the immune system due to its high content of vitamin C and A, which is needed to maintain a healthy life and also prevent or lower the risk of several chronic and cardiovascular diseases. A considerable amount of selenium was found and is a constituent of selenoprotein, known as an antioxidant and catalyst for the production of active thyroid hormones. Also, zinc was found in minute quantity and is needed for the body's defensive system to properly work. Zinc also plays a role in cell division and growth, wound healing, and the breakdown of carbohydrates. *Pleurotus tuber-regium* is cheap and easily accessible and is also important to an extent in mycofiltration and waste water purification.

SIGNIFICANCE STATEMENT

Hunger arises from food insecurity, driven by acute poverty and food inaccessibility. Incorporating *Pleurotus tuber-regium* into diets can enhance food and nutritional security. Mushrooms are highly valued for their flavor, texture, and therapeutic benefits. They contain 90% water and 10% dry matter, with a rich physicochemical composition. Nutrient-dense, they provide high protein, fiber, vitamins, and essential minerals like iron and phosphorus while being low in fat. Their bioactive compounds offer medicinal benefits, aiding in the management of hypertension, diabetes, high cholesterol, and tumors. Additionally, their dietary fiber supports blood glucose regulation and exhibits antiviral, antithrombotic, and immunomodulatory effects. With exceptional nutritional and medicinal properties, mushrooms serve as a functional food that promotes overall health and disease prevention.

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