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Evaluation of serum iron and vitamin E in Wistar rat administered with *Boletus edulis* extracts

Abstract

This study was carried out to determine the levels of iron and vitamin E in wistar rats administered with *Boletus edulis* extracts. Twenty-four adult male rats weighing between 100g and 120g were assigned into four groups of six rats each. Group A served as a healthy Control group. Group B, C and D were administered with extract of *Boletus edulis* with a dose concentration of (40mg/kg, 80mg/kg and 120mg/kg body weight) respectively for 28 days. The results obtained showed that administration of *Boletus edulis* caused a significant increase in iron and serum vitamin E when compared with the control group ($P<0.05$). These changes in the serum iron and serum vitamin E were dose dependent. This observation probably implies that *Boletus edulis* extract could probably be beneficial in the treatment of anaemia and fertility issues.

Keywords: *Boletus edulis*, iron, vitamin E

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Introduction

Boletus edulis is the type species of the genus *Boletus*. It belongs to an edible mushroom that has the fleshy and edible fruit bodies. It is one of the most common and well-known groups of edible wild mushrooms. It can be seen on a decayed tree or on a ground where they can be picked by hand.[1] In UmuAmucha Njaba LGA of Imo State Nigeria, *Boletus edulis* is referred to as "Ero mirimiri" It is widely eaten for its nutritional value and taste as well as their supposed medicinal value. *Boletus edulis* is a mycorrhyzal fungus which grows in line with a wide variety of trees, including both conifers and broad-leaved species. The mushrooms produced by this fungus are widely used in a number of cuisines.[2]

Boletus edulis contains varying amount of protein and fibre. It also contains iron and antioxidant known as tocopherol. Consequently, it supports the immune system and reduce damage to cells and tissues. The exposure to UV light increases their concentration of vitamin D.[3] Iron is a mineral that the bodies required for different functions. For instancee, iron is part of hemoglobin, a protein which carries oxygen from the lungs throughout the bodies.[4] It helps the muscles store and use oxygen. It is also part of many other proteins and enzymes. It promotes healthy pregnancy, increased energy, and better athletic performance. Iron deficiency is usually predominant in female athletes. Though, excess iron can increase the risk of liver cancer and diabetes. Iron is mainly used for preventing and treating anemia caused by low iron levels. It is also used for anemia caused by abnormal heavy bleeding during menstrual periods.[5]

Similarly, vitamin E is vital to a functioning immune system. It is a powerful antioxidant which helps cells fight off infection. This vitamin E could help protect eyesight as well as protect cells from the damage caused by free radicals. Vitamin E is also called 'sex vitamin' because it increases blood flow and oxygen to the genitalia. In women, vitamin E can increase cervical mucus, making it easier for sperm to stay alive for longer.[6]

Traditionally, *Boletus edulis* has been linked to have potential in improving fertility as it helps protect the sperm's cell membrane from damage. Studies have shown that vitamin E improves sperm motility.[7]*Boletus edulis* has been shown to possess some healing properties that can help to improve blood building, Consequently, it helps protect the system from blood loss and maintain equilibrium of blood circulation. Mushrooms are classified as vegetables in the food world, but they are not technically plants. They belong to the fungi kingdom. Although they are not vegetables, mushrooms provide several important nutrients.[8]

The key to getting enough vitamins and minerals in the diet is to eat this edible mushrooms. It gives a nutritional breakdown of mushrooms and an in-depth look at their possible health benefits, how to incorporate more mushrooms into diet.[9] There have been some scientific reports on the use of *Boletus edulis* in the treatment of anaemia. These studies clearly elucidated the facts that really *Boletus edulis* could be effective against anaemia.[10] However, little information is known on the relevance of *Boletus edulis* in the treatment of anaemia as well as infertility. This present study was carried out to determine the effective potential of the extracts of *Boletus edulis* in rat.

Materials and methods

1.1. Material: The *Boletus edulis* was collected from the bush in UmuAmusa Njaba LGA Imo State, Nigeria between 16th and 19th July, 2020. The leaves were identified and authenticated by Botanist Imo State University Owerri, Nigeria.

1.2. Preparation of *Boletus edulis*: The *Boletus edulis* was washed thoroughly to remove dust and sand particles. It was then sundried for seven days. The dried *Boletus edulis* was ground into powder form with an electric blender. About 300grams of the pulverized dried *Boletus edulis* were macerated in distilled water for 48hours with intermittent shaking. Then it was filtered using what man filter paper, and the rotary evaporator at 40°C. The extract was kept at 4°C in a refrigerator for further use.

1.3. Experiment animals: Twenty-four apparently healthy adult male wistar rats weighing between 100g to 120 were used for the study. They were kept in a clean plastic cage and housed in the experimental animal house of Imo State University. The wistar rats were acclimatized for a period of 14days, during which they

were fed properly with commercially prepared growers mash made by Grand Cereals Ltd and distilled water was provided *ad libitum*. The study was approved by the institutional Ethical Committee.

1.4. **Experimental design:** The animals were randomly assigned into four groups of six rats each. Each group was treated either with distilled wistar only or with single dose of variable doses of *Boletus edulis*. These are classified as follows; Group A is the control that was only administered with the rat diet. Group B, C and D were administered with extract of *Boletus edulis* with a dose concentration of (40mg/kg, 80mg/kg and 120mg/kg body weight) respectively for 28 days.

1.5. **Blood collection:** After treatment with *Boletus edulis* extract for 28 days, all the animals (Group A to D) were weighed and anaesthetized in a glass jar containing cotton wool soaked in chloroform. Blood samples were collected by Cardiac Puncture using sterile needle and syringe. The blood samples were put into EDTA containers properly labeled for analysis within 24hours of collection. Iron test was done by the standard method while Vitamin E was determined by Colombo ML[11].

Statistical analysis

All results were expressed as mean ±standard deviation. The data was analyzed using one-way analysis of variance (ANOVA) followed by student's t-test. $P < 0.05$ was considered as statistically significant.

Results

Table 1.

Table 1 The lipid profile and selenium concentrations among different groups

Group	iron(mcg/dL)	Vitamin E(µg/mL)
A	39.40±9.48	9.11±4.03
B	42.03±8.76	12.30±4.67
C	50.74±10.20 *	14.33±4.32
D	54.58±9.12*	16.66±5.89*

* = significantly different when compared with Control (Group A) at P<0.05

Discussion

The effect of *Boletus edulis* on iron and Vitamin E in wistar rats were evaluated. *Boletus edulis* is a fungi that possesses healing properties.[12] In this study, administration with *Boletus edulis* extract produced a significant increase in the serum iron concentration in rats.

It was observed that administration of *Boletus edulis* significantly increased the level of iron when compared with the control. Iron has several vital functions in the body. It serves as a carrier of oxygen to the tissues from the lungs by red blood cell haemoglobin, as a transport medium for electrons within cells, and as an integrated part of important enzyme systems in various tissues. Iron is an essential mineral.[13]

Iron is a crucial component of hemoglobin, the substance in red blood cells, that carries oxygen from the lungs to transport it throughout the body. Hemoglobin represents about two-thirds of the body's iron. If there is no enough iron, the body can't make enough healthy oxygen-carrying red blood cells. It has been noted that without healthy red blood cells, the body can't get enough oxygen. If there is no enough oxygen in the body, it is going to become fatigued.[15]

Most of the iron in the body is present in the erythrocytes as haemoglobin, a molecule composed of four units, each containing one heme group and one protein chain. The structure of haemoglobin allows it to be fully loaded with oxygen in the lungs and partially unloaded in the tissues (e.g., in the muscles). The iron-containing oxygen storage protein in the muscles, myoglobin, is similar in structure to haemoglobin but has only one heme unit and one globin chain. This is in line with the work of Borchers AT.[12]

Vitamin E level was observed to be significantly increased when compared with the control. Vitamin E is a potent chain-breaking antioxidant that inhibits the production of reactive oxygen species molecules when fat undergoes oxidation and during the propagation of free radical reactions.[16] It is primarily located in the cell and organelle membranes where it can exert its maximum protective effect, even when its concentration ratio may be only one molecule for every 2,000 phospholipid molecules. It acts as the first line of defence against lipid peroxidation, protecting the cell membranes from free radical attack.[14] Studies have shown that a mixture of tocopherols has a stronger inhibitory effect on lipid peroxidation induced in human erythrocytes compared to alpha-tocopherol alone. Vitamin E increases the orderliness of the membrane lipid packaging, thus allowing for a tighter packing of the membrane and, in turn, greater stability to the cell.[6]

Vitamin E has been found to be very effective in the prevention and reversal of various disease complications due to its function as an antioxidant, its role in anti-inflammatory processes, its inhibition of platelet aggregation and its immune-enhancing activity.[17]

In conclusion, iron and Vitamin E were increased in animals administered with *Boletus edulis* extract. Hence, *Boletus edulis* extract could probably be beneficial in the treatment of anaemia and infertility.

Acknowledgments

None.

Conflicts of interest

The authors declare no conflicts of interest.

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