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Influences of *Pleurotus Sajor-caju* Diets on Performance and Biochemical Parameters in Experimental Rats

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Abstract

The cap and stalk of *Pleurotus sajor-caju* mushroom were analysed for proximate composition and used for a 28 day feeding trial in experimental rats. Protein composition of cap (26.33%) and stalk (22.59 %) were relatively high while the crude fat cap (3.67%), stalk (2.6%) was low. Plasma urea of rats fed mushroom cap (25.6±0.3) and stalk (21.7±0.4) were lower than that of the control (31.0±0.3) diet fed rats. The plasma creatinine of rats fed mushroom cap (4.2 ±0.3) and stalk (3.1±0.1) were lower than that of the control (6.9±0.3).Performances of rats fed mushroom showed that daily feed intakes (g) were found to be lower in rats fed mushroom stalk (9.8±0.0) than those fed control diet. Also, daily feed intake was found to be higher in rats fed mushroom cap (10.2±0.0) than the control (9.8±0.0) diet. There were no significant differences in the feed gain ratio of rats fed cap, stalk, and casein control diet. The implication of these results is that mushroom diet is an important source of nutrients which supported growth without eliciting toxicological effects.

Keywords: *Pleurotus sajor-caju*; Proximate compositions; Urea; Creatinine; Crude protein; Feed gain ratio

Introduction

Mushrooms are saprophytic fungi which produce a wide range of extracellular enzymes that enable them to degrade complex organic matter into soluble substances for the purpose of nutrition [1]. Edible mushrooms such as *Pleurotus sajor-caju*, *Agaricus bisporus*, *Pleurotus abolorus*, *Pleurotus florida* have been recognized as delicacies in human diet. They have been known to be cultivated by the Chinese for centuries [2].

Edible mushrooms are important sources of nutrients valuable as health foods because they are low in calories but high in vegetable proteins. These offer advantages over animal proteins in human nutrition in countries where animal proteins are expensive and inadequate and over plant proteins because it contains some essential amino acids especially lysine and leucine in high concentrations [3].

Edible mushrooms such as *Pleurotus* species contain substances that aid the body's immune systems e.g. *Pleurotus folrida* possess antioxidant and anti-tumor activities [4,5], while *Tremella fuciformis* (wood ear) is an immune stimulant. *Pleurotus sajor-caju* contains ingredients that modulate hypertension by affecting the rennin-angiotensin system [6,7]. Edible mushrooms represent a good source of high value of nutrients. They are good sources of proteins and vitamins such as vitamins A, B_1, B_2, C, and D_2, niacin and minerals like phosphorus, iron and calcium [8,9].

Pleurotus sajor-caju (polyporaces: polyporacea) is an edible cosmopolitan mushroom [10]. Originating from India, it grows naturally on a succulent plant in the foothills of the Himalayas. It is believed to be indigenous to South East Asia where it is commercially being cultivated on farm waste products such as banana pseudo stems, rice or wheat, straw, pine needles and dust [3,11]. *Pleurotus sajor-caju* is an important commercially produced mushroom because it can produce a broad spectrum of lignocellulotic enzymes and this is reflected in its ability to grow on waste residue of widely varying composition [1]. Earlier report on *Pleurotus sajor-caju* have been on the chemical composition [12]. The foregoing hopes to draw attention to influences of *Pleurotus sajor-caju* diet on some biochemical parameters in experimental rats.

Materials and Methods

Collection of mushrooms

Pleurotus sajor-caju fruit bodies were obtained from local markets around Ado-Ekiti, Nigeria. Samples were cleaned, separated into cap and stalk, oven dried at 60°C and powdered in a Philips blender.

Experimental animals

Wistar strain male albino rats (n=15) of the same litter weighing 40-50g were obtained from the rat colony of the Department of Biochemistry of University of Ilorin, Nigeria. Rats were divided into 3 groups. Group 1 rats were fed mushroom cap diet; group 2 rats were fed mushroom stalk diet while group 3 rats were fed the casein control diet. The rats were acclimatized for seven days, thereafter housed in individual steel cages. Feeds and water were given to them ad libitum.

Diet formulation

The percentage composition of experimental diets is shown on Table 2. Powdered mushroom was incorporated into the diet group at 10% protein level. Vitamin/mineral mixture and vegetable oil were added at 5% level and corn starch was used to make up the diet to 100. Casein was the protein source for the control.

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Blood sample collection

After 28 days of feeding experimental diets, rats were sacrificed by neck decapitation and blood were obtained from the rats via cardiac puncture and collected into EDTA bottles. The blood samples collected were analysed for plasma urea and creatinine concentrations.

Estimations

Plasma urea concentration of metabolites was determined by the method of Searcy et al. [13] while a plasma creatinine concentration was determined by the method of Slot, [14]. Crude protein was determined by the method of AOAC, [15]. Proximate chemical composition of the samples was determined by the method of AOAC, [16]. Organs (liver, kidney, heart, and small intestines) were excised and weighed.

Statistical analysis

Data obtained were expressed as means of triplicate determinations. The Level of significance was set at $p \leq 0.05$ (17)

Results

The bolden figures are corrected to 1 decimal places are directed by the reviewers.

Discussion

The proximate composition of the cap and stalk of the *Pleurotus sajor-caju* are presented in Table 1. The crude protein concentration of cap *Pleurotus sajor-caju*, (26.3±0.01) is slightly higher than the stalk *Pleurotus sajor-caju* (22.5±0.3). The protein values of both cap and stalk is higher than the average proteins present in mushrooms (17.5%) [18]. Both cap and stalk is higher when compared with other mushrooms like *Agaricus bisporus* (16.40±0.01) and *Agaricus bisporus* (19.5±0.01) but lower when compared to *Termitomyces mammiforms* (36.8%).The moisture content of cap *Pleurotus sajor-caju* is comparable to those obtained from *Termitomyces mammiforms.* However, the cap *Pleurotus sajor-caju* moisture content is higher when compared with *Agaricus bisporus* (5.2±0.1) but lower to *Agaricus bitorquis* (12.1±0.13). The carbohydrate concentrations is comparable to previously reported for *Pleurotus sajor-caju* (39.8) by [7]. The ash content of (10.4±0.02) for cap is comparable to those obtained for *Agaricus bisporus* 11.01±0.02 and *Agaricus bitorquis* 10.11±0.10 [2]. The crude fibre composition of the cap was relatively higher than that of the cap.

Parameters	Cap	Stalk
Moisture	10.2±0.0	10.1±0.0
Crude Protein	26.3±0.0	22.5.±0.3
Crude fibre	8.9±0.1	16.2±0.3
Crude fat	3.7±0.2	2.6±0.1
Ash	10.4±0.2	8.5 ±1.0
Total Carbohydrate	38.2±0.0	40.0± 0.1

Table 1: Proximate composition (%) of cap and stalk of *Pleurotus sajor-caju.*

Sample	Cap Diet	Stalk Diet	Control Diet
Casein	_____	_____	11.5
Cornstarch	41.6	21.3	78.5
Mushroom	48.4	68.7	_____
Vegetable oil	5.0	5.0	5.0
Vit/Mineral	5.0	5.0	5.0
% crude protein	20.7	14.6	87.0

Table 2: Percentage composition of experimental diets.

Sample	Urea(mg/dL)	Creatinine (mg/dL)
Cap	25.6±0.3	4.20±0.3
Stalk	21.7±0.4	3.1±0.1
Control	31.0±0.3	6.9±0.3

Data are mean ± S.D values for triplicates of determinations.
Cap group = Basal diet +10% cap of *Pleurotus sajor-caju*
Stalk group = Basal diet +10% stalk of *Pleurotus sajor-caju*
Control group = Basal diet + casein

Table 3: Plasma urea and creatinine concentration (mg/dL) in blood of rats fed *Pleurotus sajor- caju diets.*

Sample	Daily weight gain (g)	Daily feed intake (g)	Feed gain ratio
Cap	3.3±0.0	10.2±0.0	3.1±0.0
Stalk	3.3±0.0	9.8±0.0	2.9±0.0
Control	3.3±0.0	9.8±0.02	2.9±0.0

Data are mean± S.D values for triplicates of determinations.
Cap group = Basal diet +10% cap of *Pleurotus sajor-caju*
Stalk group = Basal diet +10% stalk of *Pleurotus sajor-caju*
Control group = Basal diet + casein

Table 4: Nutrient Utilization and performance of rats fed *Pleurotus sajor-caju* diets.

Organ	Cap diet	Stalk diet	Control diet
Liver	3.4±0.2	4.6±0.0	5.9±0.2
Kidney	0.01±0.01	0.01±0.00	0.5±0.00
Heart	0.4±0.0	0.5±0.00	0.5±0.3
Small intestine	3.9±0.1	4.96±0.3	5.0±0.3

Data are mean± S.D values for triplicates of determinations
Cap group = Basal diet +10% cap of *Pleurotus sajor-caju*
Stalk group = Basal diet +10% stalk of *Pleurotus sajor-caju*
Control group = Basal diet + casein

Table 5: Relative Organ weight (g/100g body wt) of rats fed *Pleurotus sajor-caju* diets.

Table 3 shows the plasma urea and creatinine concentrations (mg/dl) of rats fed cap, stalk and control diet. The mean plasma urea concentrations (mg/dl) were found to be lower in rats fed mushroom cap (25.6±2.04) and stalk (21.7±2.45) diets compared with the control diet fed (31.0±2.02).Plasma urea is derived from dietary protein and endogenous protein catabolism [19]. A decrease in dietary proteins results in reduction of plasma urea concentration which is influenced by protein quality and quantity [20]. Hence plasma urea concentrations can be used to predict protein quality [21]. Reduction of dietary protein results in decreased faecal urinary and total nitrogen excretion [22].The higher plasma mean urea concentration of the control rats (31.0±0.3) might be due to the higher quality of the control diet. Animal proteins are usually of higher quality than those of plant origin [23-25] stated that dietary proteins reduce plasma urea concentration. This might explain the lowered plasma urea concentration in cap and stalk diets fed rats. Plasma creatinine concentration distribution showed no significance differences ($p \leq 0.05$) between the treatment groups and the control. This may suggest the low rate of conversion of muscle creatine of rats to creatinine [26].

Nutritional Performance of rats fed mushroom diets is shown on Table 4. There were no significant changes ($p \leq 0.05$) in the daily feed intake in all the rats fed mushroom cap (10.2±0.03) and stalk (9.8±0.01) diets compared with the control fed rats (9.8±0.02). Daily weight gain for the groups fed mushroom diets were lower than that of the control. There was an appreciable weight gain in all the rats fed mushroom cap and stalk diets [3]. Feed gain ratio in all the groups fed mushroom diets suggest adequate utilization of diets.

Table 5 shows the relative organ weights of rats fed mushroom and control diets. There was no significant difference ($p \leq 0.05$) between the liver weights of rats fed wild cap diet and the control diet-fed rats. Organs from stalk diets fed rats significantly different from one another and the control. This suggests that the *Pleurotus sajor-caju* diets were not toxic as liver hypertrophy has been related to toxicity in rats. The kidney weights of rats fed cap and stalk s diets showed no significant differences ($p \leq 0.05$) from one another and also when compared with the control. Muscle and liver tissues are more susceptible to effects of dietary proteins than kidneys [27]. Hence, an increase in kidney weight could be an indication of a toxic environment. The mushroom diet treatment groups had significant lower ($p \leq 0.05$) relative heart weight than the control group. The above results showed that the cap and stalk wild-obtained *Pleurotus sajor-caju* diets are not likely to cause any toxicological insult to vital organs and hence, safe for consumption.

In conclusion, it can be seen from the results gotten in this research that *Pleurotus sajor-caju* is a good source of quality protein has been shown to enhance growth without eliciting toxicological insults on major organs in experimental rats. Since this species of mushroom is already widely accepted as an important source of inexpensive nutrients, we further encourage its husbandry.

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