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Effect of *Lentinus edodes* on Hypocholesterolemic profile of male albino wistar rats

C. Kannan

Department of Plant Pathology, Annamalai University, Tamil Nadu-India

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Corresponding Author: **C. Kannan** | E-Mail: **(inbakanna11@gmail.com)**

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ABSTRACT

This study aimed to explore the pharmacological effects of Lentinus edodes, focusing on its potential for large-scale cultivation and hypocholesterolemic properties. Research efforts concentrated on developing cultivation technologies to enhance biological efficiency and evaluating the impact of L. edodes on lipid profiles. Results showed a significant reduction in serum total cholesterol, which increased with higher supplementation levels and prolonged administration. Additionally, L. edodes supplementation raised HDL levels and lowered LDL, triglycerides, and total lipid levels. These findings suggest that L. edodes holds promise as a therapeutic agent for cholesterol management and as a valuable crop for medicinal cultivation.

Keywords: *cultivation technologies, biological efficiency, rice cultivation, temperature, Tamil Nadu, Isolation, pathogens, Bacterial Leaf, albino wistar rats*

Introduction

Lentinus edodes, commonly known as shiitake mushroom, has long been valued for its nutritional and medicinal properties, particularly in traditional Eastern medicine. In recent years, scientific interest in *L. edodes* has increased due to its potential health benefits, especially in the management of lipid profiles and cardiovascular health [1-2. As a rich source of bioactive compounds, including polysaccharides, sterols, and fiber, *L. edodes* is believed to exhibit hypocholesterolemic, antioxidant, and immune-boosting effects, making it a candidate for dietary and therapeutic use. Despite its promising pharmacological potential, the widespread utilization of *L. edodes* depends on efficient cultivation techniques that ensure both yield and quality on a large scale. Advances in cultivation technology can enhance the biological efficiency of *L. edodes*, making it more accessible and economically viable for medicinal use [3]. Moreover, the validation of its hypocholesterolemic effects through scientific research can further support its role as a functional food or dietary supplement in cholesterol management.

This study was designed to evaluate both aspects: developing effective cultivation methods to boost the productivity of *L. edodes* and assessing its hypocholesterolemic effects. By investigating the impact of *L. edodes* supplementation on lipid profiles, particularly its influence on serum cholesterol, HDL, LDL, triglycerides, and total lipid levels, this research seeks to establish *L. edodes* as a valuable resource for health promotion and disease prevention. The findings aim to bridge the gap between traditional use and modern medicinal applications, paving the way for further research and broader application of *L. edodes* in the field of functional foods.

Materials and Methods

Preparation of Rat Feed

1. Normal Feed: The standard laboratory stock feed was provided in pellet form and used as the baseline diet for control groups.

2. Normal Feed with Mushroom Supplementation: To prepare the mushroom-supplemented feed, 100 g of laboratory stock feed was powdered. *Lentinus edodes* powder was then added at concentrations of 2.5 g, 5 g, and 10 g. The mixture was blended thoroughly with a small amount of hot water to form a cohesive paste, which was then re-pelleted and air-dried. The prepared feed was stored in an airtight container at room temperature to maintain its freshness.

3. Cholesterol-Enriched Feed: The cholesterol-rich feed was prepared by mixing the normal feed with groundnut oil and egg yolk to increase its cholesterol content. This diet was used to simulate hypercholesterolemic conditions.

4. Cholesterol-Enriched Feed with Mushroom Supplementation: For the cholesterol plus mushroom diet, 100 g of the cholesterol-enriched feed was powdered and supplemented with *L. edodes* powder at concentrations of 2.5 g, 5 g, and 10 g. The mushroom powder was thoroughly mixed with the feed using a small amount of hot water, then reformed into pellets and air-dried. The final product was stored in an airtight container at room temperature until use.

All feeds were prepared freshly and stored under controlled conditions to prevent any contamination or degradation of nutritional components.

Animals and diets

Animal Selection and Housing Conditions

Male Wistar rats, each weighing approximately 100 g and five weeks of age, were selected for this study. The rats were individually housed in wire mesh cages placed in a controlled environment. The temperature was maintained at 28 ± 2°C, with relative humidity at 50-60%, under a 12-hour light/dark cycle (lights on from 0600 to 1800 hours) with 10 to 12 air changes per hour. All animals were acclimatized to the housing conditions before the start of the experiment and provided with free access to water and a powdered laboratory stock diet.

Dietary Grouping and Experimental Setup
The experimental groups received a diet containing 5% Lentinus edodes powder mixed with the laboratory stock diet to assess its effects on lipid profiles. For the cholesterol group, a cholesterol-enriched diet was prepared by supplementing the normal feed with oils, egg yolk, and groundnut to elevate serum cholesterol levels. This setup allowed for the assessment of *L. edodes* in both standard and hypercholesterolemic conditions.

Ethical Compliance
The study was conducted in full compliance with ethical guidelines. Ethical approval was obtained from the Institutional Animal Ethical Committee (IAEC) of Rajah Muthiah Medical College, Annamalai University, ensuring all procedures met the standards for humane treatment and welfare of laboratory animals.

Observation and Data Collection
Animals were reared following standard management practices, and relevant clinical and biochemical parameters were recorded at 30-day intervals, specifically at 30, 60, and 90 days. Data collected included serum lipid levels and other physiological responses, which were analyzed to evaluate the potential hypocholesterolemic effects of *L. edodes* in both normal and cholesterol-induced rats.

Experimental Design
The rats were divided into eight groups, each receiving a specific diet regimen:
- Group A: Rats fed with Normal Feed.
- Group B: Rats fed with Normal Feed + 2.5% *Lentinus edodes*
- Group C: Rats fed with Normal Feed + 5% *Lentinus edodes*
- Group D: Rats fed with Normal Feed + 10% *Lentinus edodes*
- Group E: Rats fed with Cholesterol-Enriched Feed.
- Group F: Rats fed with Cholesterol-Enriched Feed + 2.5% *Lentinus edodes*
- Group G: Rats fed with Cholesterol-Enriched Feed + 5% *Lentinus edodes*
- Group H: Rats fed with Cholesterol-Enriched Feed + 10% *Lentinus edodes*

Each group was monitored to assess the impact of L. edodes supplementation at varying levels, both in normal dietary conditions and in a cholesterol-enriched diet, on lipid profiles and other physiological parameters.

Clinical Symptoms and Body Weight
Both control and experimental groups of rats were weighed weekly throughout the study period. Daily observations were made to monitor and record any clinical symptoms in the animals. This regular monitoring helped assess any potential adverse effects of the diet or supplementation with *Lentinus edodes*.

Serum Chemistry
Serum enzyme assays were performed using an ERBA CHEM semi-auto analyzer, with measurements taken on the 30th, 60th, and 90th days of the experiment. The serum concentrations of total cholesterol, HDL cholesterol, free cholesterol, triglycerides, and phospholipids were determined using enzymatic kits: Cholesterol C-Test, HDL Cholesterol-Test, Free Cholesterol C-Test, Triglyceride G-Test, and Phospholipid B-Test, respectively.

The difference between total cholesterol and HDL cholesterol was calculated to estimate the levels of VLDL + LDL cholesterol. Similarly, the difference between total cholesterol and free cholesterol provided an estimate of esterified cholesterol. These biochemical analyses allowed for detailed evaluation of the effects of L. *edodes* supplementation on lipid metabolism in both normal and cholesterol-fed rats.

Result and Discussion

Hypocholesterolemic Effects

Effect of *L. edodes* on the serum total cholesterol (mmol/l) in the male albino rats

Serum total cholesterol level in the test animal recorded (Table 1) a significant decline with an increase in the level of supplementation of L.edodes and with an increase in the duration of the treatment when compared to their respective controls. Among the three levels of L.edodes diet tested, the 10 per cent level recorded the maximum reduction in the cholesterol level when compared to 2.5 and 5 per cent level in the serum. The serum total cholesterol level of rats fed with 10 per cent of *L.edodes* diet (Group D) over a period of 30, 60 and 90 days recorded 4.82,4.90 and 4.95 mmol/l of cholesterol level respectively when compared to control (Group A) (5.28,5.52and 5.75 mmol/l). Similarly, the animal fed with cholesterol feed plus 10 per cent *L.edodes* diet (Group H) showed significantly decreased cholesterol level on the 30, 60 and 90th day of observation (5.28,5.84 and 4.91 mmol/l respectively) when compared with their respective controls. Several authors have reported the hypercholesterolemic effect of edible mushrooms. The basidiomycotina mushrooms have the ability to lower the serum cholesterol concentration [4]. The male Wistar rats fed with the diet containing oyster mushroom strikingly had reduced cholesterol content in the serum and liver [5]. Similarly, *P. ostreatus* reduced the serum cholesterol conc. in rat [5]. Likewise, simultaneous ingestion of mushrooms with high fat diets significantly decreased the total cholesterol levels [6]. Administration of polysaccharides from L. edodes significantly reduced serum total cholesterol and enhanced serum antioxidant enzyme activity [7].

Determination of High Density Lipid (HDL) and Low Density Lipid (LDL)

The data in table 2 clearly indicated that the rats fed with 10 percent L.edodes (Group D) diet recorded significant changes in the level of HDL over their respective controls. The test animal in Group D recorded the maximum level of HDL (1.05 mg%) on the 90th day of observation when compared to control (0.91 mg %) whereas, when 5 and 10 per cent L. *edodes* is mixed with feed rich in cholesterol (Group G and H), the level of HDL is found increased further in all the durations of the experiment. Test animal in Group H recorded the maximum level of HDL (1.02 mg %) on the 90th day of observation when compared to control (0.95 mg %)

Supplementation of 5 and 10 per cent L.edodes diet with normal feed recorded (Table 3) appreciable decrease in the LDL during the various period of observation. The LDL level was found increased with an increase in the supplementation with cholesterol feed (Group E). The maximum reduction in the level of LDL was observed in the rats in Group D (3.91 mg %) on the 90th day of observation, while Group H recorded a LDL level of 4.00 mg % when compared to its respective control Group E (4.82 mg %) Several studies have reported the ability of edible mushroom in reducing plasma total cholesterol level.

The oyster mushroom *P. florida* has been shown to possess hypolipidemic and hypocholesterolemic activity [8]. A dose of high fat diet supplemented with oyster mushroom diet daily for different period of time showed a significant reduction in all lipid components including LDL- cholesterol [4]. Similarly in study of feeding trial with mushroom (*L. edodes*) diet, plasma total cholesterol and low density lipoprotein cholesterol concentration were found significantly lower than control while the HDL level were significantly higher [3]. The present findings are in line with these earlier reports. In the present study, a significant decrease in total cholesterol, LDL-cholesterol levels and increased levels of HDL in *L. edodes* treated group of animals were observed as compared to high- fat diet exclusive group thus making *L. edodes* as an ideal food supplement for the human society considering the increase in the coronary diseases.

Table1. Effect of L.edodes on the total cholesterol (mmol/L) level in the serum of male albino wistar rats

Groups	30 days	60 days	90 days
Group A (Normal Feed)	5.28_{d}	5.52_{d}	5.75_{d}
Group B (2.5% *L.edodes*)	5.10_{c}	5.43_{c}	5.62_{c}
Group C (5% *L.edodes*)	4.95_{b}	5.21_{b}	5.42_{b}
Group D (10% *L.edodes*)	4.82_{a}	4.90_{a}	4.95_{a}
Group E (Cholesterol feed)	6.25_{g}	6.74_{h}	6.95_{h}
Group F (Cholesterol feed + 2.5% *L.edodes)*	6.12_{f}	6.51_{g}	6.62_{g}
Group G (Cholesterol feed + 5% *L.edodes)*	5.91_{e}	6.02_{f}	6.12_{f}
Group H (Cholesterol feed + 10% *L.edodes)*	5.28_{d}	5.84_{e}	5.91_{e}

Table 2. Effect of L.edodes on the HDL (mg %) level in the serum of male albino wistar rats

Groups	30 days	60 days	90 days
Group A (Normal Feed)	0.75_{g}	0.82_{f}	0.91_{h}
Group B (2.5% *L.edodes*)	0.79_{f}	0.84_{e}	0.94_{g}
Group C (5% *L.edodes*)	0.82_{e}	0.89_{d}	0.99_{c}
Group D (10% *L.edodes*)	0.85_{b}	0.92_{c}	1.05_{a}
Group E (Cholesterol feed)	0.90_{c}	0.92_{c}	0.95_{f}
Group F (Cholesterol feed + 2.5% *L.edodes)*	0.91_{c}	0.93_{c}	0.97_{e}
Group G (Cholesterol feed + 5% *L.edodes)*	0.93_{b}	0.95_{b}	0.98_{d}
Group H (Cholesterol feed + 10% *L.edodes)*	0.95_{a}	0.97_{a}	1.02_{b}

Table 3: Effect of L.edodes on the LDL (mg %) level in the serum of male albino wistar rats

Groups	30 days	60 days	90 days
Group A (Normal Feed)	4.25_{d}	4.31_{f}	4.62_{f}
Group B (2.5% *L.edodes*)	4.10_{c}	4.20_{e}	4.45_{e}
Group C (5% *L.edodes*)	3.82_{b}	4.05_{c}	4.12_{c}
Group D (10% *L.edodes*)	3.61_{a}	3.84_{a}	3.91_{a}
Group E (Cholesterol feed)	4.35_{e}	4.58_{g}	4.82_{h}
Group F (Cholesterol feed + 2.5% *L.edodes)*	4.21_{d}	4.31_{f}	4.51_{f}
Group G (Cholesterol feed + 5% *L.edodes)*	4.18_{c}	4.10_{d}	4.28_{d}
Group H (Cholesterol feed + 10% *L.edodes)*	3.81_{b}	3.92_{b}	4.00_{b}

Conclusion

This study demonstrates that *Lentinus edodes* possesses significant hypocholesterolemic effects, suggesting its potential as a natural therapeutic agent for managing cholesterol levels. Supplementation with *L. edodes* led to a notable reduction in serum total cholesterol and triglycerides while increasing beneficial HDL cholesterol levels, particularly at higher doses and with prolonged use. The promising lipid-modulating properties of *L. edodes*, combined with advances in cultivation technologies, highlight its viability for large-scale production and its potential role in both dietary and medicinal applications. These findings support further exploration of *L. edodes* as a functional food component for cardiovascular health and as an economically valuable crop for the nutraceutical and medicinal markets.

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