Volume 3, Issue 2, 2025

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

BIOFUNCTIONAL EFFECTS OF BUTTON MUSHROOM (AGARICUS BISPORUS) POWDER IN THE MANAGEMENT OF LIPID PEROXIDATION BIOMARKERS IN ANIMAL MODEL

Kiran Aslam[1], Aqsa Farooq[2], Areej Munir[3], Huda Ismail[4], Ayesha Asad[5], Adan Amjad[6], Maha Naseer[*7], Qura Tul Ain[8], Misbah Farooq[9]

[1]*Deparment of Nutritional Sciences, Govt Graduate College of Home Economics, Faisalabad*
[2]*Department of Nutritional Sciences, Govt College Women University, Faisalabad*
[3]*National Institute of Food Science and Technology, University of Agriculture Faisalabad*
[4]*Kinnaird College for Women University Lahore Pakistan*
[5]*Institute of Food Science and Technology, Sheffield Hallam University, Sheffield*
[6]*Lahore University of Biological and Applied Sciences, Lahore Pakistan*
[*7]*Department of Nutrition and Dietetics, the University of Faiasalabd*
[8]*Deparment pf Nutritional Sciences, Govt Graduate College of Home Economics Faisalabad*
[9]*Pakistan Railway Hospital Rawalpindi Affiliated Riphah International University, Islamabad*

[*7]mahanaseersheikh1@gmail.com

DOI: https://doi.org/10.5281/zenodo.15193222

Keywords
Button mushroom, Agaricus bisporus, therapeutic properties, management of lipid peroxidation, animal model.

Article History
Received on 03 March 2025
Accepted on 03 April 2025
Published on 11 April 2025

Corresponding Author: *
Maha Naseer

Abstract

Hypercholesterolemia is a primary cause of atherosclerosis and is a contributing factor to other risk factors. Low plasma cholesterol concentrations in the community typically lead to a lower incidence of coronary heart disease. Button mushroom is a highly nutritious food item, contain -full of vitamins and fiber as well as several type of phytonutrients. Therapeutically, button mushrooms enhance immunological health, exhibit antioxidant qualities, aid in cancer prevention, promote heart health, help with weight loss, and improve gut health through prebiotic fibers. The purpose of current research to investigate the button mushroom against the dyslipidemia in rat model. For this purpose firstly button mushroom were analyzed for it chemical composition after that to check its evaluation in hyperlipidemia experimental rats were divided into 3 different groups including a control group (normal diet; n=10), Experimental group I (hyperlipidemia rats treated with Button mushroom powder(200 mg/kg, n=10), Experimental group II (hyperlipidemia rats treated with Button mushroom powder (400 mg/kg, n=10). The results showed that Button mushroom contained moisture (12.5±0.33%), nitrogen free extract (52.2±2.7%) ash (7.92±0.23%), crude fiber (12.65±3%), crude protein (17.21±2%) and crude fat (1.86±1%). Along with appreciable content of contains magnesium (1001±4.3), Manganese (15.1±0.05), zinc (52.4±0.3), Sodium (64.65±0.02), Potassium (15.77±2.1), Iron (34.34±0.22) and copper (8.5±0.02). It's also showed that both treatment

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

groups showed a decrease in plasma lipid parameters and increased high-density lipoprotein content in blood as compared to control group. So, it was concluded that button mushroom depicts a significant impact on the treatment of hyperlipidemia and associated parameters.

INTRODUCTION

Hyperlipidemia, a non-communicable disease is characterized by high serum lipid levels which include low-density lipoproteins, cholesterol and triglycerides (1).Hypercholesterolemia is one of the major causes of atherosclerosis. Although there are many causes, hypercholesterolemia is the permissive factor that allows other risk factors to operate. (2) Hyperlipidemia is the leading risk factor for cardiovascular diseases (CVDs) (3). According to the World Health Organization, hypercholesterolemia is responsible for 56% of ischemic heart disease and 18% of cerebrovascular disease globally (4). Coronary heart disease is a leading cause of death in Britain. According to a recent Department of Health survey, the average plasma cholesterol concentration in the UK is 5.9 mmol/l, which is significantly higher than the 4 mmol/l seen in rural China and Japan.(5) Natural food elements, such as polyphenols, polysaccharides, and bioactive peptides, have demonstrated potential in controlling chronic diseases like diabetes, cardiovascular problems, and obesity by modulating metabolic pathways and lowering inflammation(6). Phytonutrients, which are naturally occurring substances in plants, play an important role in disease prevention and therapy. These bioactive chemicals, such as flavonoids, carotenoids, and polyphenols, have antioxidant, anti-inflammatory, and immune-modulatory activities. Flavonoids, for example, have been proven to impact gut microbiota, which is important in the treatment of inflammatory bowel disease (IBD). Phytonutrients help slow the progression of chronic diseases like cancer, diabetes, and cardiovascular disorders by lowering oxidative stress and inflammation. (7)Similarly, many studies have been conducted to verify the effectiveness of certain mushrooms that have the tendency to reduce higher levels of lipids Button mushrooms (*Agaricus bisporus*), which belong to the Agaricaceae family, are well known for their nutritional and medicinal properties. They include bioactive components such as polysaccharides, phenolic acids, and ergothioneine, which aid in their antioxidant and anti-inflammatory activities. (8). These mushrooms are low in calories and fat, but high in dietary fibre, B vitamins, selenium, and potassium, making them an excellent complement to a heart-healthy diet (9). Button name is the Japanese derived and it is also known as black forest mushroom or black oak mushroom (10) which is an edible mushroom that is highly considered therapeutic for its nutritional qualities. Button possesses many protective functions such as it has strong protective role in cardiovascular diseases (CVDs), it also contains hypolipidemic, immunomodulatory, hepatoprotective and anti-viral roles (11). In the treatment of dyslipidemia, button mushrooms have been demonstrated to improve lipid profiles by decreasing total cholesterol, triglycerides, and low-density lipoprotein (LDL) levels while boosting high-density lipoprotein (HDL). Their bioactive chemicals serve to control lipid metabolism and reduce oxidative stress, both of which are important in the prevention of cardiovascular disease. Studies have indicated that including button mushrooms into the diet can promote overall cardiovascular health and help manage dyslipidemia.(12)

Despite the increased interest in natural dietary constituents such as mushrooms for hyperlipidemia treatment, considerable research gaps exist. Mushrooms include bioactive substances such polysaccharides and β-glucans that can reduce lipid levels, but their exact mechanism of action in human lipid metabolism remains unknown. The majority of studies have been conducted on animal models or in vitro, indicating the need for large-scale, well-designed clinical trials to evaluate efficacy and safety in people.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

MATERIALS AND METHODS

Collection and preparation of raw material

Button mushroom was collected from the local area of Punjab and then grind into find powder and pack in polythene cover to avoid any polythene attach and for further usage

Chemical composition of button mushroom powder

Proximate analysis

The sample of mushroom powder was investigated for its proximate analysis such as
moisture, crude fat, ash, crude fibre and crude protein, which were measured using AOAC
(2012) techniques (13)

Minerals determination of Button Mushroom powder

The following minerals sodium, potassium, phosphorous, calcium, magnesium Selenium ,zinc and iron were analyzed by using atomic absorption spectrometry (14).

Phytochemical analysis of Button Mushroom powder

Phytochemical analysis of button mushroom powder investigated for determination of total phenolic content (TPC) and total flavonoids content (TFC) TFC was determined using a colorimetric method as described by (Islam T et al). The TPC was expressed as gallic acid equivalents (mg GAE/g sample) in accordance to standard calibration curve of gallic acid with linear range of 50e500 mg/mL (R2 > 0.99). And TFC was expressed as catechin equivalents (mg CAE/g sample) in accordance to standard calibration curve of catechin with linear range from 10 to 250 mg/mL (R2 > 0.99) (15).

Investigation of Therapeutic potential of button mushroom for the management of hyperlipidemia

The study sought to assess the anti-hyperlipidemic effects of button mushroom (*Agaricus bisporus*) powder on male albino rats. Male albino rats weighing 150-200 grams were obtained from NIH Islamabad and put into three groups. The experimental design allowed researchers to analyze the mushroom posdwer lipid-lowering potential by measuring changes in lipid profiles such as cholesterol, triglycerides, and lipoprotein levels. This study emphasizes the therapeutic potential of button mushrooms as a natural treatment for hyperlipidemia.

Study Duration

The study was conducted for 8 weeks. The trial started in first week of November 2023 and it continued till the last Week of December 2023.

Induction of hyperlipidemia

In the dietary method, rats are fed specially formulated HFD containing high levels of cholesterol, saturated fats, and sometimes cholic acid for 2 weeks. This diet mimics the lipid profile changes seen in hyperlipidemia, including elevated cholesterol and triglyceride levels.These methods are widely used in research to study lipid metabolism and evaluate potential lipid-lowering therapies Furthermore, dietary supplements of mushroom powder with 200 and 400 mg doses were administered continuously from week 4 to week 8 after the induction of hypercholesterolemia (16).

Table 1: Treatment Groups And Treatment Plan

Groups	Title	Treatment
G_0	Control group	No treatment
G_1	Treatment group 1	Button powder 200mg/kg
G_2	Treatment group 2	Button powder 400mg/kg

Collection of blood samples

At the beginning and end of the trial blood samples of each rat from the antemedial cubital vein were drawn In sample collecting tubes (17).

Biochemical parameters

All collected samples were analyzed foe the lipid profile HDL, LDL, VLDL, TG, cholestrol biomarkers test by using this protocol prescribed by (18)

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

STATISTICAL ANALYSIS

The obtained data was statistically assessed using SPSS version 20 and reported as means ± SD. A one-way analysis of variance (ANOVA) was performed to assess significance among the study parameters as indicative of significance ($p < 0.05$), following the guidelines of (19).

Results

Proximate composition

Button mushroom powder contained moisture (16.5±0.33%), nitrogen free extract (52±2.7%) ash (7.96±0.23%), and crude fiber (12.65±3%) (Crude protein (17.21±2%) and crude fat (1.86±1%)

Table 2: Mean ± S.D for proximate % composition for Button extract on dry weight basis.

Proximate analysis	Composition %
Moisture	(12.5±0.33%)
Ash	(7.92±0.23%)
Crude protein	(17.21±2%)
Crude fibre	(12.65±3%)
Crude fat	(1.86±1%)
Nitrogen free extract	(52.2±2.7%)

Mineral analysis

Button mushroom powder was also analyzed for its mineral that showed the different content of various minerals

Table 3: Minerals in button powder Mushroom

Minerals	Content (mg/100g)
Copper	8.5±0.02
Zinc	52.4±0.3
Phosphorous	5.54±1.1
Magnesium	1001.2±4.3
Manganese	15.1±0.05
Iron	34.34±0.22
Sodium	64.65±0.02
Potassium	15.76±2.1
Selenium	0.18±0.01
Calcium	245.90±0.07

Phytochemical analysis: Button extract was analyzed for TPC and TFC analysis. The significant amount of TPC and TFC depicted in table 4.

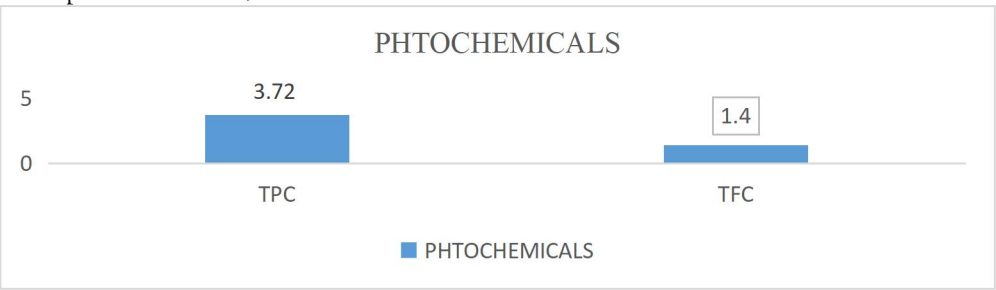

Figure 1 Phytochemical content

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Anti-hyperlipidemic potential of button mushroom powder

This study is carried out to investigate the effectiveness of (*Agaricusbisporus*),on hyperlipidemia. For this purpose, male albino rats were studied will be in 3 groups: control group (G_0), treatment group 1 (G_1) and treatment group 2 (G_2). Each group will contain 10 male albino rats. Control group was given with no treatment. G_1 was given with 200mg/kg and G_2 was given with 400mg/kg for8 weeks. Before and after the treatment period the blood samples were gathered for analysis of lipid profile (HDL, LDL, cholesterol and triglycerides).

Table 5: Mean ± S.D for serum lipid profile levels in rats

parameters	G_0	G_1	G_2
TC	104±5.2	102±3.4	90.3±4.4
TG	62.4±10.2	58±11.3	42.6±0.9
HDL	24.78±1.2	29.21±2.1	35.32±0.2
LDL	16±6.3	15±6.3	13.21±0.9
VLDL	44.31±5.3	32.31±4.4	24.47±4.8
TL	322.73±9	301.90±4.8	255.17±6.8

Discussion

Mushrooms have been increasingly recognized for their potential in managing hyperlipidemia due to their bioactive compounds. Studies have shown that certain edible mushrooms, such as *Agaricus bisporus* and *Ganoderma applanatum*, exhibit hypolipidemic effects by reducing lipid profiles and improving liver enzyme activity. These effects are attributed to their ability to modulate lipid metabolism, enhance antioxidant activity, and regulate gene expression related to fatty acid oxidation. Current investigations highlight their role as a natural and effective alternative to synthetic hypolipidemic drugs, with fewer side effects (20)

The results of proximate analysis showed to predict the worth of the raw material being used on being its composition and for the usage of various purposes. Button mushrooms (*Agaricus bisporus*) are highly valued for their nutritional composition, which plays a significant role in their health benefits, including their potential in managing hyperlipidemia. Their proximate composition includes a high moisture content (approximately 90%), making them low in calories. They are rich in proteins carbohydrates and dietary fiber. (21)The mineral composition findings have shown that sodium, zinc, iron, potassium, magnesium are found in greater amounts than others and all these findings are consistent with the previous study on mineral contents of button (22). The phytochemical properties were also investigated that showed that button possess important antioxidant and phytochemical properties. The phytochemicals are phenolic compounds that plays role in prevention of oxidative stress. The findings of TFC and TPC were remarkable and also in-accordance with the previous ones.previous studies have highlighted the therapeutic potential of these phytochemicals. For instance, research has demonstrated that the phenolic content in button mushrooms contributes significantly to their ability to scavenge free radicals and reduce lipid peroxidation. Additionally, ergothioneine has been identified as a potent antioxidant that supports cardiovascular health by mitigating oxidative damage.(23)

The investigation of the dose dependent treatments on the hyperlipidemia rats showed the significant reduction in elevated cholesterol, triglycerides, LDL and VLDL. However, HDL in serum has significantly increased. The reduction in lipid profile in blood is due to the chemical compounds found in button and it's phytochemical and antioxidant potential. These are effective in lowering the oxidative stress and reducing cholesterol and triglycerides and LDL. The increase in HDL showed that button is the contributor to the hypolipidemic effect. Mushrooms' bioactive components have led to increased recognition of their potential in the treatment of hyperlipidaemia (24)Certain edible mushrooms, such as Agaricus bisporus and Ganoderma applanatum, have been demonstrated in studies to have hypolipidemic effects by lowering

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

lipid levels and increasing liver enzyme activity.These benefits are attributable to their capacity to alter lipid metabolism, increase antioxidant activity, and regulate gene expression associated with fatty acid oxidation. Current studies emphasize their significance as a natural and effective alternative to synthetic hypolipidemic medications, with fewer adverse effects.(25)

Conclusion

In conclusion, button mushrooms (Agaricus bisporus) have tremendous promise as a natural, functional diet in the treatment of hyperlipidaemia. Their nutritional composition, rich in protein and fibre with low fat, and phytochemicals such phenolic compounds, flavonoids, ergothioneine, and β-glucans, contribute to their antioxidant and lipid-lowering properties. By controlling lipid metabolism, decreasing oxidative stress, and altering cholesterol levels, button mushrooms can supplement traditional lipid-lowering medications, providing a dietary-based approach to enhancing cardiovascular health. Continued research and clinical trials are required to confirm their effectiveness and investigate their potential applications in preventative and therapeutic nutrition.

Conflict of Interest:

All the authors have no conflict of interest.

Acknowledgements:

I would like to thank all the authors for their contribution in this manuscripts.

REFERENCES

Chen Z, Peto R, Collins R, MacMahon S, Lu J, Li W. Serum cholesterol concentration and coronary heart disease in population with low cholesterol concentrations. BMJ 1991;303:276-82

Charlton-Menys V, Durrington PN. Human cholesterol metabolism and therapeutic molecules. Exp Physiol 2008; 93:27-42.

Gong, X., Li, X., Xia, Y., Xu, J., Li, Q., Zhang, C. and Li, M., 2020. Effects of phytochemicals from plant-based functional foods on hyperlipidemia and their underpinning mechanisms. *Trends in Food Sci. & Tech.*, *103*, pp.304-320.

World Health Organization. (2014) Global status report on no communicable diseases.

Wood DA, Wray R, Poulter N, Williams B, Kirby M, Patel V, et al. JBS2: joint British guidelines on prevention of cardiovascular disease in clinical practice. Heart 2005;91(suppl V):v1-52.

Hadidi, M.; Jafarzadeh, S.; Forough, M.; Garavand, F.; Alizadeh, S.; Salehabadi, A.; Khaneghah, A.M.; Jafari, S.M. Plant protein-based food packaging films; recent advances in fabrication, characterization, and applications. *Trends Food Sci. Technol.* **2022**, *120*, 154–173. [Google Scholar] [CrossRef]

Molodecky NA, Soon IS, Rabi DM, Ghali WA, Ferris M, Chernoff G, et al. Increasing incidence and prevalence of the inflammatory bowel diseases with time, based on systematic review. *Gastroenterology*. (2012) 142:46–54. doi: 10.1053/j.gastro.2011.10.001

Amin, Z.S., Abbas, S., Munir, A., Qadri, M.M.A., Raza, M., Danish, M., Khan, S., Hafey, B., Hanif, M.K. and Kashif, H., 2022. Role of Medicinal Mushroom Lentinula edodes in Nutrition, Nutraceutics and Ethnopharmacology. *J. of Pharm. Res. Int.*, *34*(30A), pp.18-35.

Khan, H., Sabir, M. and Abdul Khaliq, R.A., 2022. Nutritive value of mushrooms from Azad Kashmir, Pakistan. *MYCOPATH*, *1*(1).

Wasser, S.P., 2005. Button (Lentinus edodes). *Enc. of dietary sup.*, pp.653-664.

Kaptoge, S.; Pennells, L.; De Bacquer, D.; Cooney, M.T.; Kavousi, M.; Stevens, G.; Riley, L.M.; Savin, S.; Khan, T.; Altay, S.J. World Health Organization cardiovascular disease risk charts: Revised models to estimate risk in 21 global regions. *Lancet Glob. Health* **2019**, *7*, 1332–1345.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Ramos, M.; Burgos, N.; Barnard, A.; Evans, G.; Preece, J.; Graz, M.; Ruthes, A.C.; Jiménez-Quero, A.; Martínez-Abad, A.; Vilaplana, F.J. *Agaricus bisporus* and its by-products as a source of valuable extracts and bioactive compounds. *Food Chem.* **2019**, *292*, 176–187.

Heleno, S.A., Barros, L., Martins, A., Morales, P., Fernandez-Ruiz, V., Glamoclija, J., Sokovic, M. and Ferreira, I.C., 2015. Nutritional value, bioactive compounds, antimicrobial activity and bioaccessibility studies with wild edible mushrooms. *LWT-Food Sci. and Tech.*, *63*(2), pp.799-806

Dastagir[1], G. H. U. L. A. M., Hussain[1], F. A. R. R. U. K. H., & Rizvi, M. A. (2014). Mineral composition of plants of family Zygophyllaceae and Euphorbiaceae. Pak. J. Bot, 46(3), 887- 896

Islam, T., Yu, X. and Xu, B., 2016. Phenolic profiles, antioxidant capacities and metal chelating ability of edible mushrooms commonly consumed in China. *LWT-Food Sci. and Tech.*, *72*, pp.423-431.

Valappil, G.P.; Julius, S.; Krishnankutty, J.K. Hypolipidemic Activity of *Pleurotus florida* against Triton WR 1339 Induced Hyperlipidemia. *Lett. Appl. NanoBioSci.* **2020**, *10*, 2107–2116.

Parasuraman, S.; Raveendran, R.; Kesavan, R.J. Blood sample collection in small laboratory animals. *J Pharmacol Pharmacother.* **2010**, *1*, 87.

Ohkawa, H.; Ohishi, N.; Yagi, K. Assay for lipid peroxides in animal tissues by thiobarbituric acid reaction. *Anal. Biochem.* **1979**, *95*, 351–358.

Mishra, P.; Singh, U.; Pandey, C.M.; Mishra, P.; Pandey, G.J. Application of student's t-test, analysis of variance, and covariance. *Ann. Card. Anaesth.* **2019**, *22*, 407.

Alarcon-Aguilara, F.J.; Roman-Ramos, R.; Perez-Gutierrez, S.; Aguilar-Contreras, A.; Contreras-Weber, C.C.; Flores-Saenz, J.L. Study of the anti-hyperglycemic effect of plants used as antidiabetics. Journal of ethnopharmacology 1998, 61, 101-110, https://doi.org/10.1016/S0378-8741(98)00020-8.

Aguirre, L.; Frias, J.M.; Barry-Ryan, C.; Grogan, H. Assessing the effect of product variability on the management of the quality of mushrooms (Agaricus bisporus). Postharvest Biology and Technology 2008,49, 247-254, https://doi.org/10.1016/j.postharvbio.2008.01.014

Baird, R.B.; Eaton, A.D.; Clesceri, APHA.American Public Health Association): Standard method for the examination of water and wastewater. Washington DC (US): AWWA (American Water Works Association) and WEF (Water Environment Federation 2012, 20, 141-142

Chen, G., Wang, H., Zhang, X. and Yang, S.T., 2014. Nutraceuticals and functional foods in the management of hyperlipidemia. *Crit. rev. in food sci. and nutr.*, *54*(9), pp.1180-1201

Akindele, A. J., Wani, Z. A., Sharma, S., Mahajan, G., Satti, N. K., Adeyemi, O. O., Mondhe, D. M., & Saxena, A. K. (2015). In vitro and in vivo an- ticancer activity of root extracts of Sansevieria liberica Gerome and Labroy (Agavaceae). Evidence-Based Complementary and Alternative Medicine, 2015, 560404. https://doi.org/10.1155/2015/560404

Asadi-Samani, M., Kafash-Farkhad, N., Azimi, N., Fasihi, A., Alinia- Ahandani, E., & Rafieian-Kopaei, M. (2015). Medicinal plants with hepatoprotective activity in Iranian folk medicine. Asian Pacific Journal of Tropical Biomedicine, 5(2), 146–157. https://doi.org/10.1016/S2221-1691(15)30159-3