

Full Length Research Paper

Oyster mushroom ameliorates liver function during ramadan fast reflected by reducing the serum level of alanine aminotransferase and aspartate aminotransferase of male volunteers

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During the holy Arabic month Ramadan, the quality of food and the patterns of eating and drinking are changed as well as stopped for at least 10 to 16 h on the basis of lunar calendar. The effects of exercise and fasting solely or combined on metabolic and hematologic responses are well established. The purpose of the present study was to find out the effects of Ramadan fasting on hepatic dysfunction marker enzymes such as Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) which are considered as common liver function tests (LFTs) of adult human and corresponding change with the supplementation of oyster mushroom at iftar. The feeding of semi cooked fresh oyster mushroom at the iftar table during Ramadan fasting decreased the serum levels of ALT ($p < 0.001$) and AST (< 0.05) of male subjects indicating oyster mushroom is able to ameliorates liver functions.

Key words: *Pleurotus ostreatus*, ALT, AST, Ramadan, Iftar and male.

INTRODUCTION

Mushrooms are basically fungi, which have a fleshy and spore-bearing fruiting body. They have been in use not only for consumption purposes but also for medicinal purposes since ages. There are about 1500 species of mushrooms are now known in Japan, of which inedible, edible, and toxic mushrooms are 1200, 300, and 50 species, respectively (Kazuno and Miura, 1984). So far, various types of secondary metabolites, which show characteristic pharmacological activities, have been isolated from mushrooms around the world (Gill and Steglich, 1987). Today, mushrooms are eaten by people for their flavor, texture as well as for the health benefits

they accord. Mushrooms do certainly have enormous potential for feeding third world peoples. In the west, mushrooms are regarded as a luxury food. But in many developing countries of the world, mushroom can mean cash for the poor and a new source of nutrition.

The oyster mushroom, first cultivated in Germany as a subsistence measure during World War (Eger et al., 1976) is now grown commercially around the world for food. There are many different varieties of the exotic oyster mushroom which can be found throughout North America, Europe and Asia. Approximate nutritional value for 3.5 oz. oyster mushroom is Calories 38, Protein 15 to 25%, Fat 2.2 g, Carbohydrate 6.5 g, Fiber 2.8 g, Vitamin B₁ (Thiamine) 0.56 mg, Vitamin B₂ (Riboflavin) 0.55 mg, Vitamin B₃ (Niacin) 12.2 mg, Phosphorus 140 mg, Calcium 28 mg, Iron 1.7 mg (Anon).

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Oyster mushrooms contain most of the mineral salts required by the human body. Their niacin content is about ten times higher than any other vegetables and the folic acid in oyster mushrooms helps to cure anemia. Oyster mushrooms are suitable for people with high blood pressure, obesity and diabetes due to their low sodium/potassium ratio, starch, fat and calorific value. Oyster mushrooms are a natural source of statin (cholesterol lowering) drugs. Studies have shown that they typically contain 0.4 to 2.7% statins (Annon, 2009). Oyster mushroom contains lovastatin which works to reduce cholesterol (Gunde-Cimerman and Cimerman, 1995). It increases the levels of reduced glutathione in the liver and stimulates the activities of catalase and glutathione peroxidase in the liver (Pathak et al., 1998).

Mushrooms also contain a wide variety of bioactive molecules including terpenoids, steroids, phenols, nucleotides the glycoprotein derivatives and polysaccharides (Borchers et al., 1999). In addition to their nutritional value mushrooms are claimed to exhibit antitumour, antimicrobial activities (Wasser and Weis, 1999; Gunde-Cinoerman, 1999; Ooi, 2000), hypoglycemic and hypotensive properties (Choudhury et al., 2008). Mushroom of *Pleurotus* species are rich in medicinal value and very much effective in reducing harmful plasma lipids (Opletal et al., 1997; Jayakumar et al., 2006) and improving the levels of different cellular enzymes (Alam et al., 2007). It is generally known that lowering of plasma cholesterol levels reduces the risk of atherosclerosis and improves liver condition.

Ramadan is the ninth month of lunar calendar, when the Muslims prevent themselves from taking any food or drinks from dawn to dusk. It is believed that Ramadan improves health status. The body has regulatory mechanisms that reduce the metabolic rate and ensure efficient utilization of the body's fat reserves in times of hunger. Added to this, the fact that most people assume a more sedentary lifestyle whilst fasting and the implication is that a balanced diet that is even less in quantity than normal will be sufficient to keep a person healthy and active during the month of Ramadan. So the addition of edible mushroom as an after item is a fruitful purpose to improve the health and disease status of body such as the status of liver by improving the traditional hepatocellular enzymes as ALT, AST.

ALT is a transaminase enzyme. It is found in various bodily tissues, but is most commonly associated with the liver. It catalyzes the two parts of the alanine cycle. Estimation of ALT in plasma or serum is one of a group of tests known as liver function tests (LFTs) and is used to monitor damage to the liver parenchymal cells (Annon, 2010a). AST is an enzyme that is raised in the plasma in acute liver damage, as with liver cancer or hepatitis. It is also found in red blood cells, cardiac muscle, skeletal muscle, the pancreas, and the kidney. In LFTs, an elevated level of AST is a sign of serious liver damage, even before any other symptoms are seen in the patient (Annon, 2010b). So the aim of this investigation was to

evaluate the effect of mushroom on hepatic markers as ALT & AST of both fasting males during Ramadan.

MATERIALS AND METHODS

The study was conducted during the period of Ramadan from 21st August to 18th September, 2009 in association with strengthening mushroom development project, National Mushroom Development and Extension Center (NAMDEC), Sobhanbag, Savar, Dhaka.

Subjects

Fifty one male subjects were included in the study. They were divided into two groups: in group-1 (G-1), 26 subjects aged (years) from 28 to 65 and in group-2 (G-2), 25 aged matched volunteers both wanting to be fast in the whole Ramadan were considered.

Selection criteria

The subjects were explained about the study and after getting their written consent they were included. The details history was taken from the subjects which included age, sex, occupation, educational status, marital status, family history and drug history. G-1 was studied with mushroom supplementation whereas G-2 was studied without mushroom. Fifty grams of semi cooked fresh *Pleurotus ostreatus* mushroom collected from NAMDEC was administered to each individual of G-1 daily.

Exclusion criteria

Patients suffering from chronic renal diseases and those who were suffering from acute illness were excluded.

Evaluation

At the beginning of Ramadan, subjects were evaluated for health status. Fasting blood sample was collected for analysis of creatinine, ALT and AST. Just after ending of Ramadan the subjects were evaluated and all the investigation procedures were repeated. Creatinine, ALT and AST were estimated by semi-auto analyzer (3000 evaluation) using the available reagent kit.

Statistical analysis

The recorded characteristics of the subjects during Ramadan fasting analyzed by standard statistical methods using computer software, SPSS package programme.

RESULTS

Mean (\pm SE) age (years) of G-1 and G-2 were 44.88 ± 1.77 and 43.48 ± 1.67 ranging from 28 to 65 and 28 to 64 respectively (Table 1). No statistically significant mean difference of age of the two groups was seen ($p > 0.05$). Mean (\pm SE) serum creatinine (mg/dl) level of G-1 and G-2 were 0.803 ± 0.029 and 0.872 ± 0.038 , respectively (Table 1). Here also no statistically significant mean

Table 1. Comparison of age and serum creatinine level between G-1 and G-2.

Parameters	Study groups		P
	G-1 (n = 26)	G-2 (n = 25)	
Age (years)	44.88 ± 1.77	43.48 ± 1.67	> 0.05
Serum Creatinine (mg/dl)	0.803 ± 0.029	0.872 ± 0.038	> 0.05

Table 2. Evaluation of serum ALT and AST of G-1 and G-2 subjects.

Study groups	Name of the parameters	Serum levels (U/L)		P
		Pre Ramadan (Mean ± SE)	Post Ramadan (Mean ± SE)	
G-1	ALT	20.42 ± 1.05	15.77 ± 0.68	< 0.001
	AST	28.61 ± 0.99	25.30 ± 1.12	< 0.01
G-2	ALT	23.44 ± 3.76	26.36 ± 3.66	> 0.05
	AST	32.28 ± 3.18	33.08 ± 3.25	> 0.05

Results show mean ± SE. Data were analyzed by Pair t test. Means were significantly different at $p < 0.05$ at 95% confidence limit.

difference of creatinine between the two groups was observed ($p > 0.05$).

Results show mean ± SE. Data were analyzed by unpaired 't' test. Means were significantly different at $p < 0.05$ at 95% confidence limit.

In G-1 supplemented with mushroom as ifter item, the mean (± SE) of serum ALT (U/L) before and after Ramadan were 20.42 ± 1.05 and 15.77 ± 0.68, respectively. A statistically significant mean difference of ALT ($p < 0.001$) was observed in pre and post Ramadan state. The mean (± SE) serum level of AST of pre and post Ramadan samples were 28.61 ± 0.99 and 25.30 ± 1.12, respectively. Here also a statistically significant mean difference between the two periods ($p < 0.01$) was observed (Table 2). In G-2 who was not supplemented with mushroom as ifter item, the mean (± SE) serum ALT (U/L) before and after Ramadan was 23.44 ± 3.76 and 26.36 ± 3.66, respectively. No statistically significant mean difference of ALT ($p > 0.05$) was observed before and after Ramadan. The mean (± SE) serum level of AST of pre and post Ramadan samples were 32.28 ± 3.18 and 33.08 ± 3.25, respectively. Here was also no statistically significant mean difference between the two periods ($p > 0.05$). In this observation it is seen that there is no reduction of both serum ALT and AST levels at post Ramadan state. Rather a small rise of these two plasma enzymes was seen, ($p > 0.05$) although it is not statistically significant (Table 2).

Results show mean ± SE. Data were analyzed by Pair t test. Means were significantly different at $p < 0.05$ at 95% confidence limit.

The mean serum levels of ALT of G-1 and G-2 before Ramadan were 20.42 ± 1.05 and 23.44 ± 3.76, respectively. No statistically significant mean difference ($p > 0.05$) was observed between the two groups of pre

Ramadan state. Whereas after Ramadan those levels were 15.77 ± 0.68 and 26.36 ± 3.66, respectively (Figure 1). Here a significant mean difference between the two groups was observed ($p < 0.01$). Simultaneously, the serum levels of AST of G-1 and G-2 before Ramadan were 28.61 ± 0.99 and 32.28 ± 3.18, respectively. No statistically significant mean difference ($p > 0.05$) between the two groups was observed. Whereas after Ramadan, those levels were 25.30 ± 1.12 and 34.08 ± 3.25. Here a statistically significant mean difference ($p < 0.05$) was observed in case of AST levels of G-1 and G-2 (Figure 1) after Ramadan. These observations indicate that in normal condition both ALT and AST levels in G -1 and G -2 persist in same plan which are significantly reduced by mushroom containing ifter after Ramadan period.

DISCUSSION

There was no variation in the age of the two groups of study subjects. Serum creatinine level of subjects was estimated to exclude the renal alignment and there is also no significant difference of the two study groups. Considering the obtained findings of the study it is observed that supplementation of a considerable amount (50 g per day) of *P. ostreatus* regularly as ifter item (1 month) significantly reduces the hepatocellular enzymes ALT and AST in serum in comparison to non mushroom supplemented control subjects. Although the exact mechanism is not clear but it might be due to presence of various hepatoprotective substances present in *P. ostreatus*. In a study Bobek et al. (1997b) observed a significant reduction of cholesterol in serum (31 to 46%) and liver (25 to 30%) in Wister rats fed a diet containing

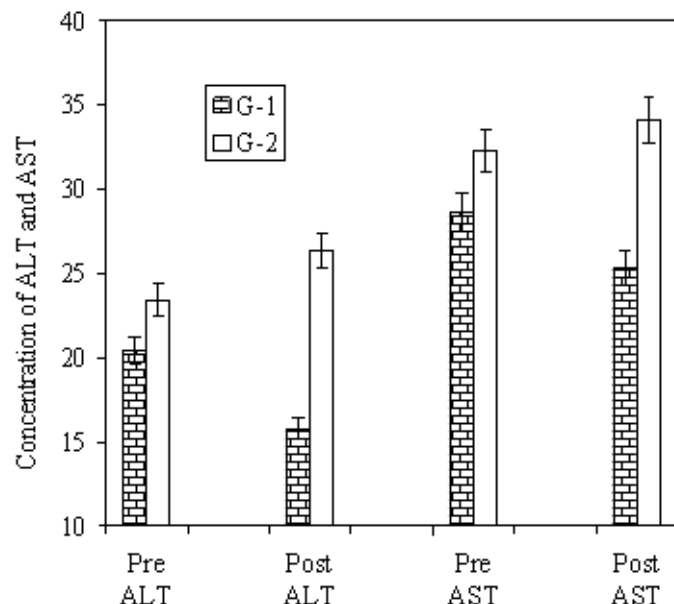


Figure 1. comparison of ALT and AST of pre and post Ramadan periods.

5% *P. ostreatus* for 52 weeks. These observations were supported by the findings of Hossain et al. (2003). They suggested that 5% *P. ostreatus* supplementation provides health benefits, at least partially, by acting on the atherogenic lipid profile in the hypercholesterolaemic condition. It is now established that excess lipid accumulation in the liver causes fatty change and ultimately responsible for hepatocellular injury.

In a study Jayakumar et al. (2006) observed that administration of the extract of *P. ostreatus* reduces significantly the plasma level of AST, ALT and Alkaline phosphatase (ALP) and increases significantly the hepatic concentration of antioxidant enzymes reduced glutathione (GSH), catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase (Gpx) on Carbon tetra chloride induced liver damage in male Wister rats. *P. ostreatus* feeding may involve the suppression of endogenous cholesterol biosynthesis by inhibiting the activity of HMG-CoA reductase. Mushroom feeding also significantly decreased hepatic cholesterol suggesting the clearance of this sterol component from liver tissue. This may relate to the mushroom-induced enhanced activity of 7 α -hydroxylase (a key enzyme of cholesterol catabolism) and bile acid secretion and the subsequent increased excretion of cholesterol through the faeces (Hossain et al., 2003). Hypercholesterolaemia produces oxidative stress (Joseph et al., 1996) and for such case antioxidants, particularly reduced glutathione, are important factors involved in bile formation and bile flow and act as a driving force (Ballattori and Truong, 1992).

Although lots of study conducted in different corner of the world with *P. ostreatus* but most of them were limited in animal subjects. In this respect we might be pioneer as

the study was conducted among the targeted human population. Our study is consistent with Bobek et al. (1997a) and Jayakumar et al. (2006) which gives the guidelines of hepatoprotective effects of oyster mushroom.

Conclusion

Oyster mushroom along with the beneficial effects of Ramadan shows a significant role on improving liver function of fasting male volunteers. Although mushrooms are increasingly being recognized as important food products for their significant role in human health, nutrition and disease, their consumption in many developing countries, particularly in Bangladesh, is extremely limited. But considering the health and medicinal benefit, it is essential to include it as a high profile food especially for the patients of impaired liver functions.

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