

EFFECT OF MUSHROOM DIET ON WEIGHT GAIN OF ALBINO RATS



Biochemistry

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ABSTRACT

Mushrooms are known for good quality of protein; therefore *Pleurotus sajor-caju* was selected to study the essential amino acid content and the effect of supplementation of *Pleurotus sajor-caju* on growth of albino rats.

Rats were randomly assigned on diet containing mushroom fruiting and mushroom mycelium for a period of 30 days. On every 10th day, animals were weighed and their diet intake, remnant food and protein intake were measured. The result showed phenylalanine, methionine, tryptophan, threonine, isoleucine, lysine and histidine values of mycelium found significantly more than fruiting. In animal experiment values showed significant difference in body weight between control and experimental groups. Study concluded that the feeding of mushroom fruiting and mushroom mycelium diets helped to gain weight of albino rats because of their excellent nutritional composition.

INTRODUCTION

There has always been lack of harmony between the rapidly growing world population and the adequate supply of protein rich foods in the human diet. The mushrooms, yeast and algae are frequently mentioned as an alternative source for food. Mushrooms have been valued throughout the world as both food and medicine for thousands of years (Lindequist *et al.*, 2005; Wright 2004; and Tribe *et al.*, 1973).

Mushrooms are considered as a good source of protein, vitamins and minerals (Jiskani, 2001). *P. ostreatus* and *Pleurotus sajor-caju* are contain protein (27.4% and 26.9% respectively), carbohydrate (40.75%) and low lipid (5.4 % and 6.2 %) on dry weight basis (Dhonda *et al.*, 1996; Rai *et al.* 1988). Chang and Miles (1989) have suggested that the protein in mushroom, in general, is about twice that in asparagus and cabbage, and 4 and 12 times those in oranges and apples, respectively.

All the essential amino acids required by an adult are present in mushroom (Bisaria *et al.*, 1987). Lintgel *et al.* (1994) reported the digestibility of mushroom protein to be as high as 72-83 per cent. Quality of mushroom protein is far superior to the vegetable proteins and it is as good as or just inferior to animal protein because of presence of essential amino acids (Crisan and Sands, 1978; Bano and Rajarathnam, 1982; Chang and Miles, 1989). Quality of protein is nutritionally more important than its quantity. Requirement of protein is in fact the requirement of amino acids. Human body is incapable of producing essential amino acids. Mushrooms are well recognized for their protein quality. Keeping this in view fruiting and mycelium of oyster mushroom were analyzed for its essential amino acids content and the diet supplemented with *Pleurotus sajor-caju* was selected to feed albino rats to know the growth effect.

MATERIAL AND METHODS

The present study was conducted during 2006-2007 in the Department of Home Science, Sant Gadge Baba Amravati University, Amravati. Oyster mushroom spp. *Pleurotus sajor-caju* was selected because it is grown commercially in central India and cost of cultivation is low. Fruiting of oyster mushrooms was cultivated by polybag technique and mycelium was grown on agar-agar media. Fruiting and mycelium of oyster mushroom were harvested from

bags and media, respectively. Both were dried at 32°C temperature in the incubator. Fruiting and mycelium were ground to form fine powder. Powders were stored in airtight container. Fruiting and mycelium of oyster mushroom were subjected to analyzed essential amino acids by paper chromatography method (Thimmaiah, 1999). Oyster Mushroom diets were prepared out of fruiting and pure mycelium. Oyster mushroom diets (as shown in table 1) were fed to albino rats to study the effect on weight of albino rats.

About thirty male albino rats were obtained from Department of Biochemistry, Rastra Sant Tukdoji Maharaj Nagpur University, Nagpur. The weight of rats was between 50 to 60 grams and age was between 40 to 45 days. Rats were randomly divided to in five groups. Each group had 6 rats. Control diet was fed to first group of rats and rest four groups were kept on experimental diets. At the beginning of the experiment, all rats were fed with standard diet (Swaminathan, 1999) for one week. The observations about diet provided and left over were recorded. The duration of feeding experiment was 30 days, on every 10th day rats were weighed. Their diet intake, remnant food and protein intake were measured. The composition of control and experimental diets is given in table 1. Control diet does not contain mushroom fruiting or mycelium. Diet 1 and 2 comprise control diet and 1 and 2g oyster mushroom fruiting (OMF) respectively. Diet 3 and 4 contain control diet and 1 and 2g oyster mushroom mycelium (OMM) respectively. Water was given in ad libitum.

Table 1: Composition of control and experimental diets

S. No.	Ingredients (g)	Control diet	Experimental diets			
			Diet 1 1g OMF	Diet 2 2g OMF	Diet 3 1g OMM	Diet 4 2g OMM
1	Wheat flour	20.00	19.00	18.00	19.00	18.00
2	Roasted bengalgram dhal	58.00	58.00	58.00	58.00	58.00
3	Groundnut flour	10.00	10.00	10.00	10.00	10.00
4	Skimmilk powder	04.00	04.00	04.00	04.00	04.00
5	Casein	04.00	04.00	04.00	04.00	04.00

6	Oil	04.00	04.00	04.00	04.00	04.00
7	Oyster Mushroom Fruiting	-	01.00	02.00	-	-
8	Oyster Mushroom Mycelium	-	-	-	01.00	02.00
9	Salt mixture	00.20	00.20	00.20	00.20	00.20
10	Vitamin mixture	00.50	00.50	00.50	00.50	00.50

RESULTS AND DISCUSSION

Oyster mushroom was analyzed to find out essential amino acids and estimated mean values are given in the table 2.

Table 2: Essential amino acids (% crude protein) in fruiting and mycelium of oyster mushroom

S. No.	Essential amino acids	Fruiting Mean \pm SD	Mycelium Mean \pm SD	't' value
1	Phenylalanine	4.00 \pm 0.10	6.50 \pm 0.10	10.00*
2	Valine	5.10 \pm 0.10	4.30 \pm 0.28	01.40
3	Methionine	2.20 \pm 0.10	2.60 \pm 0.37	02.00
4	Tryptophan	1.50 \pm 0.10	2.10 \pm 0.10	03.33*
5	Threonine	5.10 \pm 0.10	7.50 \pm 0.10	08.06*
6	Isoleucine	3.40 \pm 0.10	4.20 \pm 0.11	05.80*
7	Leucine	6.50 \pm 0.10	5.20 \pm 0.10	05.90*
8	Lysine	6.40 \pm 0.10	7.00 \pm 0.11	01.66
9	Histidine	2.10 \pm 0.10	2.50 \pm 0.01	00.86

* Significant at 0.05 level of probability

The fruiting and mycelium contained all essential amino acids but in varying amount. Fruiting contained 4.00 per cent and mycelium contained 6.50 per cent phenylalanine. It reveals that mycelium found to be better than fruiting in respect of phenylalanine which could be seen from the significant 't' value (10.00) at 5 per cent level of significance.

Valine present in fruiting and mycelium found to be 5.10 and 4.30 per cent, respectively. However, 't' value (1.40) reveals that there was no significant in the content of valine in fruiting and mycelium. Fruiting contained 2.20 per cent and mycelium 2.60 per cent methionine. This shows that both fruiting and mycelium were similar in methionine content, as could be seen from non significant difference between fruiting and mycelium at 5 per cent level of probability.

Fruiting and mycelium contained 1.50 per cent and 2.10 per cent tryptophan, respectively. Mycelium found to be better than fruiting in respect of tryptophan content as 't' value shows significant difference between fruiting and mycelium at 5 per cent level of significance.

Fruiting contained 5.10 per cent threonine and in mycelium it was found to be 7.50 per cent. It shows that mycelium found to be better source of threonine than fruiting as significant difference could be found between fruiting and mycelium at 5 per cent level of probability ($t=8.06$).

Isoleucine present in fruiting was 3.40 and 4.20 per cent in mycelium. It indicates that the mycelium found to be better in isoleucine than fruiting, as 't' value (5.80) found to be significant at 5 per cent level of probability. Fruiting contained 6.50 per cent and mycelium contained 5.20 per cent leucine. Fruiting found to be better than mycelium in respect of leucine as significant difference could be noticed from the 't' value (5.90).

Fruiting contained 6.40 per cent lysine and mycelium contained 7 per cent lysine. Though mycelium showed high amount of lysine than fruiting but 't' value showed no significant difference between

fruiting and mycelium and thus both are at par as far as lysine content is concerned.

Fruiting contained 2.10 per cent and mycelium contained 2.50 per cent histidine. Both fruiting and mycelium contained similar amount of histidine as no significant difference could be noticed ($t=0.86$).

Animal experiment

The observed values of feeding experiment about total diet intake, total protein intake and the total gain in body weight on 10th, 20th and 30th day are given in tables 2, 3 and 4, respectively.

Table 2: Mean diet intake, protein intake, weight gain of albino rats on 10th day

S. No.	Diets	Protein g/100g diet	Actual diet intake (g) Mean \pm SD	Actual protein intake (g)	Weight gain (g) Mean \pm SD
1	Control	22.12	102.08 \pm 2.91	22.67	22.50 \pm 2.12
2	1g OMF	22.54	102.03 \pm 1.67	22.99	22.58 \pm 1.02
3	2g OMF	22.87	104.03 \pm 2.95	23.79	27.24 \pm 2.43
4	1g OMM	22.68	102.88 \pm 2.50	23.33	24.50 \pm 2.32
5	2g OMM	23.15	104.12 \pm 4.02	24.10	29.18 \pm 1.16

Data in table 2 indicates that the gain in body weight of rats kept on experimental diets was better than control diet. It was noted that the weight gain of rats fed on 2g OMF (27.24 \pm 2.43) and 2g OMM (29.18 \pm 1.16) was better than 1g OMF (22.58 \pm 1.02) and 1g OMM (24.50 \pm 2.32) diets. It was also observed that the gain in weight of rats fed on diet 1 and 2 comprise OMM was better than the diets 3 and 4 contains OMF. The results thus lead to the conclusion that higher the content of mushroom, better the weight gain. However, mushroom mycelium was found effective than the fruiting of oyster mushroom.

Table 3: Mean diet intake, protein intake, weight gain of albino rats 20th day

S. No.	Diets	Protein g/100g diet	Actual diet intake (g) Mean \pm SD	Actual protein intake (g)	Weight gain (g) Mean \pm SD
1	Control	22.21	110.12 \pm 4.28	24.45	27.18 \pm 3.51
2	1g OMF	22.54	112.02 \pm 2.10	25.24	28.01 \pm 2.51
3	2g OMF	22.87	118.16 \pm 5.02	27.02	31.21 \pm 1.15
4	1g OMM	22.68	112.78 \pm 1.75	25.57	30.04 \pm 1.52
5	2g OMM	23.15	115.21 \pm 2.04	26.67	33.50 \pm 2.64

Data in table 3 indicates that the highest weight gain of albino rat (33.50g) was observed in 2g OMM diet. Rats kept on control diet (27.18g) and 1g OMF diet (28.01g) showed low weight gain. The results showed that oyster mushroom mycelium was found better in increasing the body weight of albino rats and followed by OMF and OMM diets.

Table 4: Mean diet intake, protein intake, weight gain of albino rats on 30th day

S. No.	Diets	Protein g/100g diet	Actual diet intake (g) Mean \pm SD	Actual protein intake (g)	Weight gain (g) Mean \pm SD
1	Control	22.21	130.10 \pm 2.32	28.89	29.01 \pm 1.73
2	1g OMF	22.54	131.12 \pm 3.98	29.55	28.50 \pm 3.05
3	2g OMF	22.87	136.22 \pm 3.23	31.15	33.48 \pm 2.00
4	1g OMM	22.68	132.18 \pm 2.05	29.97	31.50 \pm 1.52
5	2g OMM	23.15	135.61 \pm 4.01	31.39	36.11 \pm 3.00

Perusal of data in table 4 reveal that the highest weight gain of albino rat (36.11g) was found in 2g OMM diet, relatively protein intake was 31.39g. One gram OMF supplemented rat group showed lower weight gain (28.50g) than control group (29.01g) but 2g OMF supplemented group showed better weight gain (33.48g) than 1g OMF fed group. The results thus lead to conclude that weight gain of rat fed on OMM diet was better than the OMF diet. As the amount of mushroom increases weight also increases. However, mushroom mycelium diet were found effective than the fruiting diet.

The data in respect of mean weight gain of albino rats on 10th day, 20th day and 30th day of control and experimental diets (1g and 2g OMF and OMM diets) have been presented in table 5 for comparison.

Table 5: Weight gain (g) of albino rats (control with 1g and 2g doses of fruiting and mycelium each)

S. No.	Diets (n=6)	Days			
		10 th day	20 th day	30 th day	1 st - 30 th days
1	Control	22.50	27.18	29.01	78.69
2	1g OMF	22.58	28.01	28.50	79.09
3	2g OMF	27.24	31.21	33.48	91.93
4	1g OMM	24.50	30.04	31.50	86.04
5	2g OMM	29.18	33.50	36.11	98.79
	F Test	33.00*			

* Significant at 0.05 level of probability Two way ANOVA was applied for testing the significance of difference of means of control and experimental diets (1g and 2g OMF and OMM diets each) and data obtained have been presented in table 5.

Table 5 reveals that on 10th day the diet intake of albino rats were low, therefore, showed low weight gain. The plausible reason for low consumption of diet was albino rats were not accustomed to the diets. On 20th and 30th day, more weight gain was observed because of increased intake of diet and relative increase in protein intake. Overall weight gain pattern reflects that as diets comprising oyster mushroom increases body weight also increases. *In vivo* proteins are required for tissue development and oyster mushroom comprises good amount of protein. The 2g OMF and 2g OMM diets fed groups showed better weight as compared to 1g OMF and 1g OMM diets. Significant differences were found between weight gain of albino rats fed on different diets.

The quality of food protein depends upon its amino acid composition, especially that of essential amino acids. *In vivo* essential amino acids perform many functions but lysine, leucine, valine and histidine are especially required for growth and as such oyster mushroom comprise these four amino acids in good quantity as reported by Rai (1995).

Results show that the quality of protein depends on presence of all essential amino acids in food; as such oyster mushroom mycelium and fruiting contained all essential amino acids. The mean values of phenylalanine, tryptophan, threonine and isoleucine indicate that the content of these amino acid was definitely higher in mycelium than fruiting. Whereas, the fruiting of oyster mushroom definitely contained higher amount of leucine than the mycelium. The results of the animal experiment proved that the supplementation of oyster mushroom diets showed significant weight gain of albino rats. Thagumanaven and Maniekam (1980). Too observed weight gain in rats fed on *Pleurotus sajor-caju* due to its high digestibility. Similar result was also observed by Samajpati (1979).

CONCLUSION

Present investigation proved that the Oyster mushroom fruiting and mycelium contribute all essential amino acids. Phenylalanine,

methionine, tryptophan, threonine, isoleucine, lysine and histidine values of mycelium found significantly more than fruiting. The supplementation of oyster mushroom helped to gain weight of albino rats because of its excellent nutritional composition.

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