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FORTIFICATION OF PAKISTANI DISHES WITH OYSTER MUSHROOMS

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Oyster mushroom (*Pleurotus ostreatus*) was incorporated into six traditional Pakistani dishes. Protein contents of mushroom fortified dishes increased from 4.29 to 93.33% organoleptic evaluation showed that all mushroom fortified dishes were readily acceptable.

Key words: Pleurotus, Nutritive value, Fortification.

INTRODUCTION

The rate of food production in most of the developing countries is not commensurate with the rate of population growth [1-2]. A large section of the population in these countries lives on substandard diets [3]. The inhabitants obtain their calories mostly from cereals, tubers and vegetables which contain small amount of protein. The widening gap between supply and demand of protein can be bridged by supplementing the existing resources with unconventional sources of protein e.g. plant leaves, oil seed cakes, mushrooms, etc. Unlike plant leaves and oil seed cakes edible mushrooms are free from antinutritive factors, toxins and allergens [4], hence the production of mushrooms as a fungal protein or flavouring agent has a most attractive prospect.

Mushrooms, which are considered both as nutritious food and delicacy, are gaining popularity in over-populated areas of the world as they can provide adequate amounts of textured protein in the diet. The per acre yield is 10 times that of animal protein [5]. Mushrooms contain 35-45% protein on dry matter basis [6] with an amino-acid profile better than that of many vegetables and fruits [7]. Mushrooms also contain vitamins and minerals.

Vegetable proteins i.e. leaf protein concentrate, mustard protein concentrate, obtained from leaves, grasses and mustard seed, have been incorporated in the normal cuisines of India [8], Nigeria [9], Jamaica [10] and Pakistan [11-12]. The present study involves incorporation of the oyster mushrooms into Pakistani dishes to increase their nutritive value.

MATERIALS AND METHODS

The oyster mushroom (*Pleurotus ostreatus*) was grown on pasteurized rice straw at the Mushroom Pilot Plant, PCSIR Laboratories, Lahore, under controlled conditions i.e. temperature 25 ± 1^{o} at the vegetative stage and 20 ± 3^{o} at the fruiting stage. The relative humidity was maintained between 65-85% with the help of a humidifier (Defensor AG Zurich Model 505; Switzerland). The full sized mushrooms were harvested by cutting with a sharp knife after 35 days.

The conditions for maintenance of the strain, preparation of the inocculum and pasteurization of the rice straw have been reported elsewhere [13].

Incorporation of mushroom in food stuffs. Freshly harvested mushrooms were washed with tap water, sliced and added to traditional Pakistani foods as detailed in Table 1. The food products fortified with fresh oyster mushrooms included: 'Allu Kabab' (potato cutlets); Lamb Liver hen egg omellete; 'Pakoray' (fried gram flour balls); green pea; and 'Samosa' (stuffed patent flour dough). The control as well as mushroom fortified food products were analysed for protein, crude fibre, fat and ash contents by A.O.A.C. methods [14]. Organoleptic evaluation of the prepared food products was carried out following the sensory evaluation method of Krum [15]. The products were served to a panel of eight judges. The acceptability i.e. average score of five parameter-colour, flavour, taste, palatability and mouthfeel, of the dishes was calculated as follows:

$$\text{Acceptability (\%)} = \frac{\text{Average of five parameters}}{50} \times 100$$

Statistical analysis. The data collected was statistically evaluated using analysis of variance based on completely randomised design and difference in mean values were tested by Duncan's multiple range test [16].

RESULTS AND DISCUSSION

The oyster mushrooms (*P. ostreatus*) contained 36.35% protein, 1.95% fat, 10.65% crude fibre and 9.53% ash on dry matter basis. The results are comparable with those

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Table 1. Food products fortified with mushrooms.

Ingredients	Units	Omellette	Allu kabab	Pakoray	Samosa	Liver	Pea
Gram flour	"	–	–	250	–	–	–
Patent flour	"	–	–	–	300	–	–
Green peas	"	–	–	–	–	–	250
Liver	"	–	–	–	–	250	–
Potatoes boiled	"	–	150	125	250	–	–
Onions chopped	"	50	–	–	–	75	75
Ginger fresh	"	–	40	–	–	5	–
Mushrooms chopped (½" x ½")	"	–	125	125	125	250	–
Mushrooms slices (½" x 1")	"	100	–	–	–	–	250
Garlic fresh	"	–	–	–	–	10	10
Fat	"	*	+	*	*	125	125
Red chillies	T.S.	–	1.0	1.0	–	0.75	0.75
Coriander powder	"	–	0.75	–	–	0.50	0.25
Cumin seeds	"	–	–	–	–	–	–
Spices	"	0.25	–	–	4	0.25	–
Common salt	"	0.25	1.5	0.5	–	1.00	1.00
Pomegranate seeds (dried)	"	–	1.5	0.5	4	–	–
Eggs	No.	2	2	–	–	–	–
Green chillies slices (.25" x .25")	"	2	–	2	4	–	–

* Fried in simmering oil T.S. – Tea spoon + Roasted in oil on hot pan

reported by other researchers [17-18]. The slight variation in different components were mainly due to the varietal difference of *Pleurotus* spp. The amino acid profiles of oyster mushrooms (*P. ostreatus*), button mushrooms (*Agaricus bisporous*) and egg albumin showed that amounts of total, essential and sulphur containing amino acids of oyster mushrooms were higher than button mushrooms but lower than egg albumin (Table 2). The results are in accordance with the findings of Jandaik and Kapoor [7], Kalberer and Kunsch [19]. Thus oyster mushrooms protein are intermediate in quality between vegetable and animal protein and the supplementary valuè of mushrooms protein in vegetarian diets is of considerable significance.

Oyster mushrooms (*P. ostreatus*) were incorporated into traditional Pakistani dishes which are popular in local dietaries (Table 1). A standard recipe of each dish without oyster mushrooms was used for the purpose of comparison. The dishes fortified with oyster mushrooms could be divided into two groups on the basis of the increase in protein content (Table 3). 'Allu Kabab' and 'Samosa' came in the first group. The increase in the protein content of 'Allu kabab' and 'Samosa' supplemented with oyster mushrooms was 93.33% and 62.24% respectively. The second group included pea, 'Pakoray' liver and omellete dishes fortified with mushrooms. The increase in the

Table 2. Amino acid composition of *Pleurotus ostreatus* protein (% of protein g/100 g).

Amino acids	*P. ostreatus*	*Agaricus bisporus*	Egg albumin
Aspartic acid	6.60	4.48	9.3
Threonine*	3.38	2.72	4.0
Serine	3.73	2.72	8.2
Glutamic acid	15.29	7.04	16.5
Proline	3.77	5.12	3.8
Glycine	2.98	2.56	3.1
Analine	4.99	4.64	6.7
Cystine*+	1.57	0.52	2.8
Valine	3.34	2.56	8.8
Methionine*+	1.76	0.46	5.3
Isoleucine*	2.09	2.24	7.0
Leucine*	4.24	3.68	9.9
Tyrosine	3.38	1.92	3.7
Phenylalanine*	2.55	2.08	7.7
Histidine*	1.73	1.32	2.6
Lysine*	3.73	4.48	6.5
Arginine	5.89	5.92	5.9

(continued .....)

(Table 2, continued)

Total amino acid	71.02	54.46	111.8
* Essential amino acid	22.65	18.74	48.0
+ Sulphur containing amino acids	3.33	0.98	8.1

++ Through the courtesy of Nuclear Institute of Agriculture & Biology, Faisalabad.

protein content of this group ranged from 4.29 to 25.73%, maximum being in peas and the minimum in the omellete. The data regarding proximate composition when subjected to statistical analysis showed that increase in percent protein of mushroom fortified dishes i.e. 'Allu kabab' and 'Samosa' was significantly ($P < 0.01$) different from other food products. Other contents, i.e. fat, crude fibre and ash showed non significant difference within and between the

Table 3. Chemical compositon of unfortified and mushroom fortified dishes.

Food products		Protein*	Increase in protein (%)	Fat* (%)	Crude fibre* (%)	Ash* (%)	Calories/100g
Allu kabab	A	3.75	–	15.56	1.58	5.95	447.68
	B	7.25	93.33	16.72	2.12	5.74	452.16
Samosa	A	4.45	–	16.70	4.25	2.23	457.58
	B	7.22	62.24	18.35	4.64	2.65	462.59
Pea	A	22.15	–	14.42	1.82	3.32	451.54
	B	27.85	–	16.16	2.25	4.18	456.68
Pakoray	A	8.58	–	10.12	10.51	2.86	397.12
	B	11.35	15.42	11.98	11.05	3.22	402.82
Omellete	A	31.45	–	10.65	00.35	5.87	428.37
	B	33.68	7.09	12.25	0.62	6.25	431.27
Liver	A	33.58	–	15.15	0.35	4.55	456.15
	B	35.02	4.29	16.57	1.25	5.05	457.65
Products		H.S.	H.S.	–	–	–	–

*On dry wt. basis A : Control dish without mushrooms

H.S. – Highly significant at 1% level. B : Mushroom fortified dishes

Table 4. Organoleptic evaluation of mushrooms fortified dishes+

Food products	Colour* (0–10)	Flavour* (0–10)	Taste* (0–10)	Palatability* (0–10)	Mouth feel* (0–10)	Acceptibility** %	Remarks
Omellete	9.0	9.4	8.6	8.8	8.6	88.8	Excellent
Pakoray	8.5	9.0	8.4	8.6	8.3	85.6	Excellent
Samosa	7.6	8.0	7.8	8.0	8.2	79.2	Very good
Pea	7.6	7.8	7.4	7.2	7.8	75.6	Very good
Allu kabab	7.4	7.0	6.6	6.4	6.8	68.4	Good
Liver	7.5	6.8	6.4	6.2	6.5	66.8	Good
Products	–	–	–	–	–	H.S.	

* Average of 8 judges

** Average of five parameter i.e. colour, flavour, taste, palatibility and mouth feel.

\+ Fortified dishes compared with unfortified dishes (grade – 10) for each evaluation.

H.S. Highly significant at 1% level.

food products. The dishes containing protein rich ingredients, i.e. liver and omellete, showed comparatively lesser increases in protein than those which had a lower protein content. The results are in line with the observations of Shah [11] and Shah *et al.* [12] who reported similar increases in protein content of Pakistani dishes on fortification with leaf protein concentrate and low fibre detoxified mustard seed meal. 'Allu kabab', 'Samosa' and 'Pakoray' are popular foods relished by labourers, women and children. An increase in protein (15.42 to 93.33%) of these food-stuffs on fortification with oyster mushrooms would help in increasing the supply of protein to those who need it most.

On the basis of organoleptic evaluations, mushroom fortified dishes can be divided into three categories (Table 4). The first category, comprised of those dishes for which the over all acceptability was 85% or above (rated excellent) included mushroom supplemented omellete and 'Pakoray'. The second category, with 70 to 84% acceptability (rated very good), included 'Samosa', pea and 'Allu Kabab', whereas liver fortified with the mushroom fell into the third category with 50-60% acceptability and was rated good. The data regarding organoleptic evaluation of mushroom fortified dishes when subjected to statistical analysis showed that overall acceptability of omellete and 'Pakoray' was significantly ($P < 0.01$) different from all other dishes but these two dishes showed non-significant different with each other. Although an appropriate amount (selected during the preliminary studies) of oyster mushroom was added to different products, variation in the amount and number of spices and cooking techniques affected the overall acceptability of the final product. It is evident from the composition and organoleptic evaluation that fortification of traditional Pakisatani dishes with oyster mushrooms improved their nutritive value. All the dishes were acceptable because their overall acceptability score was more than 65%.

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