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Incorporation of Button Mushrooms in Pakistani Dishes

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Abstract. Button mushrooms (*Agaricus bisporus*) were incorporated into six table delicacies and six traditional Pakistani dishes. Protein content of the mushroom-fortified dishes increased from 8.44% to 67.50%. Organoleptic evaluations showed that all the mushroom-fortified table delicacies and traditional dishes showed significant improvement in their acceptability.

Keywords: button mushrooms, anti-nutritive factors, toxins and allergents, *Agaricus bisporus*, table delicacies, Pakistani dishes

Introduction

The widening gap between supply and demand of protein can be bridged by supplementing the existing sources with unconventional sources of protein, such as plant leaves, oilseed cakes and edible mushrooms. Unlike plant leaves and oilseed cakes, edible mushrooms are free from anti-nutritive factors, toxins and allergents (Falanghe, 1976). The production of mushrooms as a source of fungal proteins, or as flavouring agents, has the most attractive prospect. A breakthrough for cultivation of mushrooms in Pakistan has already been achieved by researchers of Agricultural University, Faisalabad, and PCSIR Laboratories Complex, Lahore, by optimization of conditions for the cultivation of oyster and button mushrooms (Kausar *et al*., 2003; Kausar and Zafar, 2002; 1999; Khan and Siddique, 1987).

Mushrooms are regarded highly both as nutritious foods and delicacies. They are gaining popularity in over-populated areas of the world as they can provide adequate amount of texture protein in the diet. Mushrooms contain 35-45% protein on a dry matter basis, with the amino acid profile that is better than many vegetables and fruits (Jaindak and Kapoor, 1976; Bano and Srivastava, 1962). They are also a rich source of minerals and vitamins, and their digestibility is better than meat (Anonymous, 1999; Garcha, 1976). The Food Development Authority in 1994 awarded mushrooms the status of 'Healthy Foods' (Ananymous, 1999). Mushrooms are not a staple food by themselves but can be regarded as important diet supplements. Vegetable proteins, such as leaf protein and mustard protein concentrates have been incorporated in normal dishes of India, Nigeria, Jamaica, and Pakistan (Shah, 1984; Olatubosum *et al*., 1972).

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The present study reports the incorporation of button mushrooms (*Agaricus bisporus*) in some traditional Pakistani dishes and table food delicacies so that the protein contents and acceptability of the so fortified commonly consumed food dishes is improved significantly.

Materials and Methods

Fresh mushrooms (*Agaricus bisporus*) were washed with water to remove any sticking soil. Excessive moisture was reduced by pressing them gently between folds of filter paper sheets. Mushrooms were chopped into slices and added to different table delicacies and traditional Pakistani dishes with the objective of improving their culinary values, such as taste, flavour, and acceptability (Table1).

The recipes and procedures for the preparation of different mushroom-fortified table delicacies and traditional Pakistani dishes are detailed below; ts = tablespoon, whenever referred.

Mushroom delicacies

(i) Mushroom soup

Fresh mushrooms (0.5 x 0.5 cm pieces)	=	100 g
Onions	=	50 g
Beef (dry, crushed)	=	2 ts
Cornflour	=	1 ts
Salt	=	¼ ts
Black pepper	=	¼ ts

Finely chopped onions were fried in butter to which were added sliced mushrooms, sprinkled with 25 ml water, and cooked at relatively low heat for 10 min. The remaining ingredients were then mixed to the mushroom and onion slurry and boiled for 2-3 min before serving.

ii) Mushroom mayonnaise

Egg yolk	=	1
Oil	=	150 ml
Mustard powder	=	1 ts
Vinegar	=	1 ts
Sugar	=	1 ts
Sodium bicarbonate	=	0.2 g
Salt	=	1 ts
Mushrooms (0.5 x 0.5 cm pieces)	=	300 g

In the first step, egg yolk was well beaten and all other ingredients, except oil, mushrooms and sodium bicarbonate, were added and stirred well. Oil was then added in small portions, bit by bit, with continuous beating of the mixture till it thickened, within 5 min. Small slices of mushrooms, along with sodium bicarbonate (used as the preservative), were then added to the mayonnaise preparation made in the first step.

(iii) Mushroom ketchup

Mushrooms (0.5 x 0.5 cm pieces)	=	300 g
Onions (peeled and chopped)	=	100 g
Garlic (chopped)	=	2 cloves
Ginger (crushed)	=	1 ts
Salt	=	1 ts
Chillies	=	1 ts
Sugar	=	1 ts

Chopped mushrooms were placed in a mixing bowl, sprinkled with salt and set aside for 24 h, stirred occasionally. Mushrooms were then drained and washed with cold water. The washed mushrooms were placed in a saucepan with onions and garlic. Vinegar and other spices were added to it and the mixture was brought to boil. Heat was then reduced, the pan covered with lid, and allowed to simmer for 35-40 min, till the mushrooms were soft. The slurry was later pushed through a fine muslin cloth. The puree so obtained was again boiled. After slight cooling, the ketchup was poured into sterilized bottles.

(iv) Mushroom pickle

Mushrooms (2 x 2 cm pieces)	=	300 g
Oil	=	100 ml
Foeniculum (fennel,'vern. saunf')	=	1 ts
Trigonella- Foenum graceum (fenugreek seeds,'vern. methrey')	=	1ts
Nigella sativa ('vern. kalonje')	=	¼ ts
Black pepper	=	¼ ts
Red chilies	=	¼ ts

Oil was heated for 30 min. Fresh and clean mushrooms were mixed with other ingredients and then poured into sterilized glass jar. The jar was sealed with screw-type lids and kept for one month before use.

(v) Mushroom beef steaks

Tenderized meat	=	100 g
Salt	=	1 ts
Pepper	=	¼ ts
Monosodium glutamate	=	¼ ts
Cornflour	=	¼ ts
Tomatoes (medium size)	=	1
Mushrooms (2 x 2 cm pieces)	=	250 g
Onions	=	100 g

Meat was cooked with salt and pepper, and tenderizer (0.5 g) was added to it. After the meat was cooked, it was strained to separate the stock from meat. All other ingredients were mixed with the stock and boiled for ten min. To the pieces of meat were added sliced and fried mushrooms, all of which were then added to the above prepared broth. Before serving, one teaspoon of cornflour was added for making the gravy.

(vi) Fried mushrooms

Mushrooms (2 x 2 cm pieces)	=	250 g
Oil	=	3 ts
Pepper	=	1 ts
Salt	=	½ ts

Slices of mushrooms were fried with constant stirring till light brown in colour. Pepper and salt were sprinkled on the fried mushrooms and served while hot.

Mushroom-fortified dishes. Six traditional Pakistani dishes, namely, egg omelet, potato 'bhujia', 'pakoray', 'samosa', pea, and 'chapatti' (bread) were fortified with mushrooms in accordance with the recipe ingredients given in Table 1. All the dishes were cooked according to the local methods of preparation, and served when fresh.

Analysis. Proximate composition (moisture, crude protein, fat, ash, crude fibre, nitrogen free extract) of mushrooms and protein contents of various dishes were determined according to the standard methods (AOAC, 2000).

Organoleptic evaluation. Sensory evaluation of six table delicacies and six traditional Pakistani food dishes, fortified with mushrooms, was carried out according to the method of Krum (1955). All the samples, in triplicate, were served to the panel of eight judges. The samples were graded for colour, taste, flavour, palatability and mouthfeel. Grading was done on a numbering scale (0-10), from lower value to the higher value for each parameter. Acceptability for each sample was calculated as:

$$\text{acceptability (\%)} = \frac{\text{total score of five parameters}}{50} \times 100$$

Statistical analysis. The data of each control and the mushroom-fortified samples were statistically evaluated and difference in the mean values was tested by Duncan's multiple range test (Steel *et al*., 1996).

Results and Discussion

Button mushrooms (*Agaricus bisporus*) contained 37.52% crude protein, 6.58% fat, 13.55% ash, 19.05% crude fibre, and 16.18% nitrogen free extract on dry matter basis. The results are comparable with those of Kausar *et al*. (2003). Crude protein contents of button mushrooms are 2 to 5 times greater as compared with other vegetables, such as eggplant-brinjal (15.1%), cabbage (18.1%), cauliflower (28.8%), green peas (26.1%), and potatoes (7.6%). Mushrooms, however, cannot substitute the animal protein sources like egg, meat and fish, because of their inferior amino acid profile (Garcha, 1976). Thus, button mushrooms are not a staple food by themselves, but may be regarded as good food supplements.

The liking for table delicacies has developed many-fold during the last ten to fifteen years in Pakistan. The effect of supplementing button mushrooms on the overall acceptability, particularly taste and flavour of six prominent table food delicacies is given in Table 2. The overall acceptability varied from 78.0 to 91.6%. Mushroom-supplemented soup, mayonnaise and pickles showed 91.6%, 90.7% and 90.6% acceptability (excellent), respectively, followed by ketchup (83.8%), beef steaks (83.0%), and fried mushrooms (78.0%). However, the overall acceptability rating was observed to be very good, and being table food delicacies the main stress was on their acceptability and not on the nutritional value related with changes in protein contents upon mushroom supplementation.

Change in protein contents of the button mushroom-fortified traditional and popular Pakistani dishes, namely, egg omelet, potato 'bhujia', 'pakoray', 'samosa' and 'chapatti', are given in Table 3. The increase in protein contents varied from 8.44 to 67.50%, being minimum in egg omelet and maximum in potato 'bhujia', respectively, followed by 'samosa' (57.30%), 'chapatti'- the traditional Pakistani bread (40.44%), 'pakoray' (33.48%), and pea (28.10%). The dishes containing egg and vegetables, having higher protein contents, showed lesser increase in their respective protein contents than those having lower protein values, such as potatoes, wheat/gram flour. The results obtained in the present studies are comparable with the findings of Shah (1984) and Shah *et al*. (1984), who supplemented some Pakistani dishes with leaf protein concentrate and low fibre detoxified mustard meal. Moreover, incorporation of button mushrooms in dishes significantly improved their acceptability.

On the basis of consumer acceptability, the mushroom-fortified dishes can be grouped into two categories. Egg omelet

Table 1. Pakistani traditional dishes (vernacular names are given within inverted commas) fortified with button mushrooms (*Agaricus bisporus*)

Ingredients (g)	Egg omelet*	Potato 'bhujia'	'Pakoray*'	'Samosa+'	Pea	'Chapatti +' (bread)
Potato boiled (g)		100	125	200		
Gram flour (g)			250			40
Patent flour (g)				300		
Green peas (g)					250	
Wheat flour (g)						150
Onions chopped (g)	50	50	30	20	75	10
Ginger chopped (g)		8			10	
Mushrooms chopped (2 x 2 cm pieces)	100	100	125	125	250	50
Garlic powder (g)		8			10	
Coriander powder (g)			5	5	5	3
Common salt (g)	0.25	5	0.5	2.0	3.0	2
Spices (g)			0.5	4.0		
Tomatoes (number)		1			1	
Green chillies (0.5 x 0.5 cm pieces) (g)			5.0	4.0		
Eggs (number)	2					
Oil (ml)					120	25

*fried in simmering oil; +roasted in oil in hot pan

Table 2. Organoleptic evaluation of button mushroom (*Agaricus bisporus*)-fortified table delicacies

Table delicacies	Colour[+] (0-10)	Flavour[+] (0-10)	Taste[+] (0-10)	Palatability[+] (0-10)	Mouthfeel[+] (0-10)	Acceptability[++] (%)	Remarks
Soup A	7.5	7.8	8.2	8.1	8.3	79.8	very good
B	9.3	9.1	9.0	9.0	9.4	91.6	excellent
Mayonnaise A	7.2	7.6	7.5	7.4	7.4	74.2	very good
B	9.2	9.0	9.6	8.7	9.3	90.7**	excellent
Ketchup A	7.4	7.6	7.9	7.5	7.8	76.4	very good
B	8.7	8.3	8.5	8.0	8.4	83.8**	very good
Pickles A	7.2	7.3	7.8	7.5	7.7	75.0	very good
B	9.2	8.5	9.2	9.0	9.3	90.6**	excellent
Beef steaks A	7.5	7.2	7.1	7.2	7.3	72.6	good
B	9.2	8.4	8.0	7.8	8.1	83.0**	very good
Fried A	7.4	7.2	7.3	6.5	6.7	70.6	good
mushrooms B	8.6	8.2	8.4	7.0	7.2	78.0**	very good

A= control dishes; B = mushroom-fortified dishes; [+]average of 8 judges; [++]average of 5 parameters; **highly significant at 1% level

Table 3. Organoleptic evaluation of dishes fortified with button mushrooms (*Agaricus bisporus*)

Food products	Protein (%)	Increase in protein (%)	Colour[+] (0-10)	Flavour[+] (0-10)	Taste[+] (0-10)	Palatability[+] (0-10)	Mouthfeel[+] (0-10)	Acceptability[++] (%)	Remarks
Egg omelete	A 30.82		8.5	8.4	7.9	8.0	7.8	80.1	very good
	B 33.40	8.44	9.0	9.6	8.8	8.8	8.6	89.6**	excellent
Potato 'bhujia'	A 3.83		7.4	7.0	7.0	6.8	6.5	69.4	good
	B 5.75	67.50	7.6	7.8	7.5	7.2	7.0	74.2*	very good
'Pakoray'	A 8.84		8.1	8.3	8.2	7.8	8.1	80.1	very good
	B 1.80	33.48	8.5	8.8	9.0	8.5	8.6	86.8**	excellent
'Samosa'	A 5.20		7.8	7.6	7.8	7.6	7.8	76.8	good
	B 8.12	57.30	7.8	8.2	8.4	8.2	8.6	82.4**	very good
Pea	A 19.75		7.4	7.6	7.2	7.4	7.5	74.2	good
	B 25.30	28.10	7.8	8.2	8.0	7.6	7.8	78.8*	very good
'Chapatti'	A 8.90		7.2	7.4	7.4	7.4	7.6	74.0	good
	B 10.70	40.44	8.6	8.2	8.1	7.8	8.8	83.0**	very good

A = control dishes (comprising of all ingredients except button mushrooms); B = fortified dishes; [+]average of 8 judges; [++]average of 5 parameters; *significant at 5% level; **highly significant at 1% level

and 'pakoray' fall in the first category because of their excellent scores, which showed 89.6% and 86.8% acceptability, respectively, whereas potato 'bhujia', 'samosa', pea and 'chapatti' ranked in the second category, showing of 74.2%, 82.4%, 78.8% and 83.0% acceptability, respectively (Table 3). The variation in protein contents and acceptability of different dishes might be due to the differences in the various spices used as ingredients, cooking techniques, and the amount of mushrooms added to each dish. All the dishes were readily acceptable, nevertheless, irrespective of these variations.

The present study showed that incorporation of button mushrooms in table delicacies and traditional Pakistani dishes improved their overall acceptability score and nutritional level. Mushroom cultivation at the cottage industry level needs to be popularized so that this article of food, rich in proteins, minerals and vitamins may become accessible to the common man throughout the year.

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