

## Utilization of dried mushroom powder for development of mushroom fortified biscuits

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### ABSTRACT

A study was conducted to develop the mushroom fortified biscuits as influenced by fortification of different levels of mushroom powder and artificial flavours. Mushroom fortified biscuits were prepared by adding mushroom powder to the biscuit recipe at 5, 10 and 15 per cent concentrations along with addition of strawberry and vanilla flavours at each level, whereas biscuits prepared only with bakery recipe were kept as control. Among different treatments, 10 per cent mushroom powder along with 0.2 per cent vanilla flavour recorded highest scores for organoleptic parameters like colour and appearance, flavour, crispness, taste and overall acceptability even upto 30 days of storage. Whereas, it was at par with fortification of 10 per cent mushroom powder along with 0.2 per cent strawberry flavour. Fortification with 10 per cent mushroom powder along with 0.2 per cent vanilla or strawberry flavour in bakery recipe was better for preparation of mushroom fortified biscuits.

**Key words:** Mushroom powder, Fortification, Biscuits, Organoleptic evaluation, Recipe

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Mushrooms are highly delicious and contain 86.5 to 94.5 per cent moisture. They are rich in all the essential amino acids, phenols, and enzymes such as polyphenol oxidase, peroxidase, catalase and protease. They lack protective coating of suberin, unlike most of fresh fruits and vegetables. Thus they are prone to fast deterioration due to loss of moisture at room temperature. The rate of deterioration is further activated by their fast rate of respiration leading to shriveling, loss of texture, discoloration, development of off-flavor, loss in marketable quality and thus leading to consumers unacceptability with advancement in time.

Bakery biscuits are ready to eat, convenient and inexpensive food product. They contain

digestive and dietary principles of vital importance. The baked products have about 6-7 per cent protein and have long shelf life. Mushroom biscuits have been considered useful for nutritional enrichment in feeding programs (Agrawal, 1990). In recent years consumption of biscuits has increased in most of the countries as they are important source of nutrients (Ranhotra, 1980). Mushrooms have a great potential due to having high and good quality proteins (20 to 40% on dry weight basis), vitamins (Vitamin B- complex) and minerals (Singh *et al.*, 1995). Mushrooms can be dried and converted into powdered form, which can be used for fortification in baked products like bread, biscuits, etc. The study was undertaken to see the effect of fortification of mushroom powder on sensory quality of biscuits.

## MATERIALS AND METHODS

Mushroom fortified biscuits were prepared from dehydrated oyster mushroom. Fresh mushrooms (*Pleurotus florida*) were dried by pretreating with 0.1 per cent potassium metabisulphate and 0.5 per cent citric acid and were dried under tray drier. The tray-dried mushrooms were grinded into fine powder in a mixer grinder. The mushroom powder so obtained was used for fortification in biscuits in different proportions as explained in the treatment details Table 1.

The commonly used standard bakery recipe contains 100 grams of fine wheat flour, 60 grams baker's oil (dalda) and 60 grams of sugar. The mushroom fortified biscuits were prepared by fortifying the mushroom powder in the bakery recipe along with artificial flavor.

The sweet mushroom fortified biscuits were prepared by the method of Whitely (1970). The biscuits were immediately packed in 300 gauge thick (76.2 microns) high-density polyethylene (HDPE) bags and stored under ambient conditions (21-30°C and 62-85% RH).

The biscuits were analyzed for various organoleptic characters like color and appearance, flavor, crispiness and overall acceptability of the product by a semi trained panel of 10-15 panelists and were expressed as scores on a 5 point hedonic rating scale

(Ranganna, 1986). The samples were analyzed at an interval of 15 days. The study was carried out until the products became unacceptable for human consumption.

## RESULTS AND DISCUSSION

The table 2 shows the scoring of organoleptic evaluation of mushroom fortified biscuits as influenced by different treatments. Significantly higher scores for colour and appearance were recorded in bakery recipe along with fortification @ 10 per cent mushroom powder + 0.2 per cent vanilla flavour 4.50, 4.25 and 3.30 after 0, 15 and 30 days of storage, respectively, at par with 10 per cent mushroom powder fortification along with 0.2 per cent strawberry flavour. The highest scores for flavour was recorded in bakery recipe along with fortification of 10 per cent mushroom powder + 0.2 per cent vanilla flavour was 4.60, 4.25 and 3.90 after 0, 15 and 30 days of storage, respectively, which were at par with 10 per cent mushroom powder fortification along with 0.2 per cent strawberry flavour when compared to control. Highest scores for crispiness were recorded with 10 per cent mushroom powder fortification in bakery recipe along with 0.2 per cent vanilla flavour. The scores were 4.54, 4.20 and 3.10 after 0, 15 and 30 days of storage, respectively closely followed by biscuits with 10 per cent mushroom powder fortification and 0.2 per cent strawberry flavour.

**Table 1. Treatments and their recipes used in the study**

Treatments	Recipes
T <sub>1</sub>	Bakery recipe + 5% mushroom powder + 0.2 % strawberry flavor
T <sub>2</sub>	Bakery recipe + 10% mushroom powder + 0.2 % strawberry flavour
T <sub>3</sub>	Bakery recipe + 15% mushroom powder + 0.2 % strawberry flavour
T <sub>4</sub>	Bakery recipe + 5% mushroom powder + 0.2 % vanilla flavor
T <sub>5</sub>	Bakery recipe+10% mushroom powder + 0.2 % vanilla flavour
T <sub>6</sub>	Bakery recipe + 15% mushroom powder + 0.2 % vanilla flavour
T <sub>7</sub> (Control)	Bakery recipe

**Table 2.** Organoleptic evaluation of mushroom fortified biscuits during storage (Scores out of 5)

Treatments	Colour and appearance						Flavour						Crispiness						Taste						Overall acceptability					
	Initial		15		30		Initial		15		30		Initial		15		30		Initial		15		30		Initial		15		30	
	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	
T <sub>1</sub> - Bakery recipe + 5% Mushroom powder + 0.2 % strawberry flavour	3.84	3.40	2.40	3.95	3.60	2.60	3.80	3.20	2.20	3.97	3.68	2.60	3.92	3.51	2.45															
T <sub>2</sub> - Bakery recipe+10% Mushroom powder + 0.2 % strawberry flavour	4.20	4.00	3.00	4.40	4.10	3.20	4.25	4.00	3.00	4.35	4.10	3.10	4.34	4.06	3.08															
T <sub>3</sub> - Bakery recipe + 15% Mushroom powder + 0.2 % strawberry flavour	3.40	3.10	2.20	3.85	3.72	2.70	3.90	3.60	2.40	3.80	3.50	2.50	3.90	3.51	2.45															
T <sub>4</sub> - Bakery recipe + 5% Mushroom powder + 0.2 % vanilla flavour	3.90	3.65	2.90	4.00	3.60	3.70	3.87	3.40	2.40	3.94	3.70	2.60	3.93	3.65	2.90															
T <sub>5</sub> - Bakery recipe+10% Mushroom powder + 0.2 % vanilla flavour	4.50	4.25	3.30	4.60	4.25	3.90	4.54	4.20	3.10	4.55	4.20	3.20	4.53	4.19	3.30															
T <sub>6</sub> - Bakery recipe + 15% Mushroom powder + 0.2 % vanilla flavour	3.20	3.20	2.10	3.70	3.65	2.25	3.98	3.68	2.30	3.90	3.60	2.50	3.81	3.58	2.70															
T <sub>7</sub> - Bakery recipe (Control).	3.80	3.25	1.80	3.40	2.70	1.70	3.50	2.80	1.80	3.60	3.10	1.90	3.56	3.03	1.80															
Mean	3.84	3.55	2.53	3.99	3.66	2.87	3.98	3.56	2.46	4.02	3.70	2.63	4.00	3.65	2.67															
S.Em±	0.12	0.11	0.08	0.13	0.12	0.09	0.13	0.11	0.08	0.13	0.12	0.08	0.13	0.12	0.09															
CD @1%	0.54	0.50	0.36	0.56	0.51	0.41	0.56	0.50	0.35	0.56	0.52	0.37	0.56	0.51	0.38															

DAS= Days after storage

## DEVELOPMENT OF MUSHROOM FORTIFIED BISCUITS

Significantly higher scores of mushroom fortified biscuits for taste and overall acceptability were recorded in bakery recipe along with fortification of 10 per cent mushroom powder + 0.2 per cent vanilla flavour. The scores were 4.55 & 4.53, 4.20 & 4.19, 3.20 and 3.30 after 0, 15 and 30 days of storage, respectively, which were at par with 10 per cent mushroom powder fortification along with 0.2 per cent strawberry flavour.

The treatment containing bakery recipe along with 10 per cent mushroom powder and 0.2 per cent vanilla flavour, recorded higher score for colour and appearance (4.5 to 3.3), flavour (4.6 to 3.9), crispiness (4.54 to 3.10), taste (4.55 to 3.20) and overall acceptability (4.53 to 3.30) during storage of 30 days. There was gradual decrease in the organoleptic scores for colour and appearance, flavour, crispiness, taste and overall acceptability as the storage period increased (Table 2). Similar results were obtained in by Awasthi and Yadav (1998) and

Rao *et al.* (1995) in liquid dairy bi-products incorporated by soy fortified biscuits and whole egg powder incorporated biscuits, respectively.

Table 3 indicates the microbial load of mushroom fortified biscuits as influenced by different treatments at 15 and 30 days after storage. Least bacterial population of  $0.7 \times 10^2$  and  $1.1 \times 10^2$  CFU per gram was recorded in bakery recipe along with fortification of 10 per cent mushroom powder + 0.2 per cent vanilla flavour at 15 and 30 days after storage, respectively. The highest bacterial population of  $2.0 \times 10^2$  and  $2.4 \times 10^2$  CFU per gram was recorded in control ( $T_7$ ) at 15 and 30 days after storage, respectively. Least fungal population of zero and  $0.4 \times 10^2$  CFU per gram was recorded in bakery recipe along with fortification of 10 per cent mushroom powder + 0.2 per cent vanilla flavour at 15 and 30 days, respectively. Maximum fungal population of  $0.5 \times 10^2$  and  $0.9 \times 10^2$  CFU per gram was recorded in bakery recipe + five per cent mushroom powder + 0.2

**Table 3.** Microbial load (count  $\times 10^2$  CFU/g) on mushroom fortified biscuits during storage

Treatments	Bacteria (count $\times 10^2$ CFU/g)		Fungi (count $\times 10^2$ CFU/g)		Yeast (count $\times 10^2$ CFU/g)	
	15	30	15	30	15	30
	DAS	DAS	DAS	DAS	DAS	DAS
T <sub>1</sub> - Bakery recipe + 5% mushroom powder + 0.2 % strawberry flavour	1.2	1.7	0.3	0.6	1.9	2.5
T <sub>2</sub> - Bakery recipe+10% mushroom powder + 0.2 % strawberry flavour	0.9	1.4	0.1	0.4	1.8	2.4
T <sub>3</sub> - Bakery recipe + 15% mushroom powder + 0.2 % strawberry flavour	1.6	2.1	0.4	0.7	2.1	2.7
T <sub>4</sub> - Bakery recipe + 5% mushroom powder + 0.2 % vanilla flavour	1.8	2.2	0.5	0.9	2.3	2.8
T <sub>5</sub> - Bakery recipe+10% mushroom powder + 0.2 % vanilla flavour	0.7	1.1	0	0.4	1.0	1.5
T <sub>6</sub> - Bakery recipe + 15% mushroom powder + 0.2 % vanilla flavour	1.9	2.3	0.1	0.5	2.2	2.8
T <sub>7</sub> - Bakery recipe (Control).	2.0	2.4	0.2	0.6	2.0	2.6

DAS= Days after storage CFU= Colony forming unit

per cent vanilla flavour at 15 and 30 days after storage. Similarly, least yeast population of  $1.0 \times 10^2$  and  $1.5 \times 10^2$  CFU per gram was recorded in bakery recipe along with fortification of 10 per cent mushroom powder + 0.2 per cent vanilla flavour and maximum yeast population was observed in five per cent mushroom powder fortification + 0.2 per cent vanilla flavour with population of  $2.3 \times 10^2$  and  $2.8 \times 10^2$  CFU per gram after 15 and 30 days after storage.

There was significant increase in the total plate count of biscuits during storage of 30 days (Table 3). The bacterial count of  $0.7 \times 10^2$ ,  $1.1 \times 10^2$  CFU per gram, fungal count of zero and  $0.4 \times 10^2$  CFU per gram and yeast count of  $1.0 \times 10^2$  and  $1.5 \times 10^2$  CFU per gram at 15 days and 30 days after storage, respectively were least in bakery recipe fortified with 10 per cent mushroom powder and 0.2 per cent vanilla flavour.

The bakery biscuits with less moisture content and hygroscopic in nature absorb moisture gradually. The available moisture and sugar lead to the growth of micro-organisms, This might had been due to the absorption of external moisture by the biscuits leading to increase in water activity of biscuits, which favors the entry of microorganisms. The results of the microbial count are in conformity with Krishan and Aradhita (2007) in storage of button mushroom powder fortified biscuits.

Finally it is concluded that Mushroom fortified biscuit prepared by fortifying 10 per cent mushroom powder in bakery recipe along with 0.2 per cent vanilla flavour recorded highest scores for organoleptic parameters like colour and appearance, flavour, crispness, taste and overall acceptability for upto 30 days of storage.

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