

**Research Article**

## **DEVELOPMENT, SENSORY EVALUATION AND MICROBIAL ANALYSIS OF MUSHROOM FORTIFIED BISCUITS**

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### **ABSTRACT**

The present study was conducted to prepare the mushroom fortified biscuits as influenced by different levels of mushroom powder and artificial flavours. Mushroom fortified biscuits were prepared by fortifying mushroom powder to the biscuit recipe at 5, 10 and 15 per cent concentrations along with strawberry flavour and vanilla flavour is added to each level, whereas biscuits prepared out of bakery recipe were kept as control. Among the different treatments 10 per cent mushroom powder along with 0.2 percent 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 is on par with fortification of 10 percent mushroom powder along with 0.2 percent strawberry flavour. 10 percent mushroom powder along with 0.2 percent vanilla or strawberry flavour was better for fortification in preparation of mushroom fortified biscuits.

### **INTRODUCTION**

Bakery biscuits are ready to eat, convenient and inexpensive food products containing digestive and dietary principles of vital importance. These biscuits become popular both in rural and urban population in India. These baked products have about 6-7% proteins. Biscuits owing to their long shelf life are considered useful for nutritional enrichment in feeding programs (Agrawal., 1990). In recent years, consumption of biscuits has increased in most of countries as they served as important source of nutrients (Ranhotra., 1980), Mushroom have a great potential due its high and good quality proteins (20 to 40% on dry weight basis), Vitamins (Vitamin B- complex) and minerals (Singh *et al.*, 1995), so 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 incorporation of mushroom powder on sensory quality of biscuits.

### **MATERIALS AND METHODS**

Productions of mushroom fortified biscuits were prepared from dehydrated mushroom powder. Mushrooms were dried under the tray drier with pre-treatment of 0.1 per cent potassium metabisulphite (KMS) along with 0.5 per cent citric acid. The dried mushrooms were converted into mushroom powder. This powder was used for fortification in biscuits. The ingredients for preparation of mushroom biscuits in bakery were as follows,

#### **Bakery Recipe**

Maida	- 100 g
Special bakery dalda	- 60 g
Sugar	- 60 g

#### **Treatment Details**

- T<sub>1</sub> - Bakery recipe + 5% mushroom powder + 0.2 % strawberry flavour
- 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 flavour
- T<sub>5</sub> - Bakery recipe+10% mushroom powder + 0.2 % vanilla flavour

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T<sub>6</sub> - Bakery recipe + 15% mushroom powder + 0.2 % vanilla flavour

T<sub>7</sub> - Bakery recipe (control)

The sweet mushroom fortified biscuits were prepared by using traditional creamery method as described by Whitely (1970). The biscuits were packed in high density poly ethylene bags and stored under ambient conditions (21-30°C and 62-85% RH).

Biscuits were analyzed for various organoleptic characters. Color, appearance, flavor, crispiness and overall acceptability of the product were evaluated by a semi trained panel of 10-15 panelists including teachers and students for sensory evaluation and expressed as scores on a 5 point hedonic rating scale (Ranganna, 1986). The samples were drawn at an interval of 15 days and analyzed for their sensory properties. The study was carried out until the products became unacceptable.

### **RESULTS AND DISCUSSION**

The data pertaining to the organoleptic evaluation of mushroom fortified biscuits was influenced by different treatments were presented in Table 1.

The data on colour and appearance reveals that there were significant differences among the treatments. Significantly highest score for colour and appearance was recorded in bakery recipe along with fortification of 10 per cent mushroom powder + 0.2 per cent vanilla flavour 4.50, 4.25 and 3.30 at initial, 15 days and 30 days after storage respectively, which was on par with 10 per cent mushroom powder fortification along with 0.2 per cent strawberry flavour when compared to control (T<sub>7</sub>). Significantly highest score for flavour was recorded in bakery recipe along with fortification of 10 per cent mushroom powder + 0.2 per cent vanilla flavour 4.60, 4.25 and 3.90 at initial, 15 days and 30 days after storage respectively, which was on par with 10 per cent mushroom powder fortification along with 0.2 per cent strawberry flavour when compared to control (3.60, 3.10 and 1.90), with respect to crispiness of mushroom fortified biscuits revealed that there were significant differences among the treatments, Significantly highest score for crispiness was recorded in bakery recipe along with fortification of 10 per cent mushroom powder + 0.2 per cent vanilla flavour 4.54, 4.20 and 3.10 at initial, 15 days and 30 days after storage respectively, which was on par with 10 per cent mushroom powder fortification along with 0.2 per cent strawberry flavour when compared to control (T<sub>7</sub>).

The data on taste of mushroom fortified biscuits revealed that there were significant differences among the treatments, significantly higher score for taste was recorded in bakery recipe along with fortification of 10 per cent mushroom powder + 0.2 per cent vanilla flavour 4.55, 4.20 and 3.20 at initial, 15 days and 30 days after storage respectively, which was on par with 10 per cent mushroom powder fortification along with 0.2 per cent strawberry flavour when compared to control. Significantly highest score for overall acceptability was recorded in bakery recipe along with fortification of 10 per cent mushroom powder + 0.2 per cent vanilla flavour 4.53, 4.19 and 3.30 at initial, 15 days and 30 days after storage respectively, which was on par with 10 per cent mushroom powder fortification along with 0.2 per cent strawberry flavour when compared to control.

The data presented in Table 2, indicates that the microbial load of mushroom fortified biscuits as influenced by different treatments at 15 days and 30 days after storage. Least bacterial population  $0.7 \times 10^2$  and  $1.1 \times 10^2$  CFU per gram was observed in bakery recipe along with fortification of 10 per cent mushroom powder + 0.2 per cent vanilla flavour at 15 days and 30 days after storage, respectively. The highest bacterial population was observed in control (T<sub>7</sub>)  $2.0 \times 10^2$  and  $2.4 \times 10^2$  CFU per gram at 15 days and 30 days after storage, respectively. Least fungal population was observed in bakery recipe along with fortification of 10 per cent mushroom powder + 0.2 per cent vanilla flavour at 15 days and 30 days after storage was zero and  $0.4 \times 10^2$  CFU per gram, respectively. Maximum fungal population was observed in bakery recipe + five per cent mushroom powder + 0.2 per cent vanilla flavour at 15 days and 30 days after storage was  $0.5 \times 10^2$  and  $0.9 \times 10^2$  CFU per gram.

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**Table 1: Organoleptic evaluation of mushroom fortified biscuits during storage (Scores out of 5)**

Treatments	Colour and appearance			Flavour			Crispiness			Taste			Overall acceptability		
	Initial	15 DAS	30 DAS	Initial	15 DAS	30 DAS	Initial	15 DAS	30 DAS	Initial	15 DAS	30 DAS	Initial	15 DAS	30 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

**Table 2: Microbial load (count x 10<sup>2</sup> CFU/g) on mushroom fortified biscuits during storage**

Treatments	Bacteria (count x 10 <sup>2</sup> CFU/g)		Fungi (count x 10 <sup>2</sup> CFU/g)		Yeast (count x 10 <sup>2</sup> CFU/g)	
	15 DAS	30 DAS	15 DAS	30 DAS	15 DAS	30 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

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

The treatment contained 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). There was gradual decrease in the organoleptic scores for colour and appearance, flavour, crispiness, taste and overall acceptability as the storage period increases (Table 1). After 30 days of storage there was loss of crispiness, which leads to decrease in overall acceptability. 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.

There was significant increase in the total plate count of biscuits during storage of 30 days (Table 2). The bacterial count of  $0.7 \times 10^2$ ,  $1.1 \times 10^2$  CFU (Colony forming unit) 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 in bakery recipe fortified with 10 per cent mushroom powder and 0.2 per cent vanilla flavour. This might had been due to the absorption of external moisture by the biscuits leading to increase in water activity of biscuits as increase in water activity 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.

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