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Development, recovery and evaluation of fresh mushroom chips and mushroom fortified noodles

DB Desayi, LH Kukanoor, CP Patil, Mahantesh Shirur and BB Shivakumar

Department of Post Harvest Technology, Kittur Rani Chennamma College of Horticulture Arabhvi-591310, Karnataka

ABSTRACT

Among the different treatments fresh mushroom chips prepared by soaking in one per cent salt+ one per cent KMS+0.5 per cent citric acid for five minutes along with partial dehydration for two minutes recorded higher per cent recovery, lower oil uptake, higher scores for organoleptic characters like colour and appearance, flavour, crispness, taste and overall acceptability. Among the different treatments 15 per cent mushroom powder fortified with noodle flour recorded the highest scores for organoleptic parameters like colour and appearance, flavour, crispness, taste and overall acceptability. Fortification of 20 percent mushroom powder to the noodle flour was found better for mushroom fortified noodles.

Key words: Mushroom, value added products, mushroom chips, mushroom fortified noodles

In India, the fresh mushroom market is largely a contribution of marginal and small farmers, who have limited resources and, therefore are dependent on the local market for sale of their produce. The growers face consequences of over saturated market and distress sale at highly un-remunerative prices. The retention of fresh mushroom at the level of grower, whole seller, retailer and consumer further results in deterioration in its quality and economic loss. Presently, long-term preservation of mushrooms by canning and pickling are popular (Chandrasekar *et al*., 2002). But, in the peak periods of harvesting, gluts in the market can be checked by adopting appropriate post harvest technology to process surplus mushrooms into novel value added products rather going only for canning or pickling. These value added products will not only reduce the losses but will also enhance the income of farmers. The value addition of oyster mushrooms into chips could provide solution as short term storage of mushrooms upto three months (Armuganathan *et al.*, 2005). This study was undertaken to see the effect of different pretreatments on development and evaluation of fresh mushroom chips from the oyster mushrooms.

Fresh oyster mushroom (*Pleurotus florida*) was procured from the Department of Agricultural Microbiology, washed thoroughly with clean tap water. The chips were made by partial dehydration of mushrooms with the help of potato chips dehydrator. Before partial dehydration, mushrooms were pre-treated with salt, citric acid, KMS and their combinations for preparation of mushroom chips.

In treatment one (T_1), mushrooms were soaked in 1% salt solution for 5 minutes, followed by partial dehydration for 2 minutes. In treatment two (T_2) mushrooms were soaked in 1% salt and 0.5 % citric acid solution for 5 minutes, followed by partial dehydration for 2 minutes. In treatment three (T_3), soaking was done in 1% KMS solution for 5 minutes,

followed by partial dehydration for 2 minutes. In treatment four (T_4), mushrooms were soaked in solution of 1% salt, 1% KMS and 0.5% citric acid for 5 minutes, followed by partial dehydration for 2 minutes. In treatment five (T_5) soaking was done in solution of 1% salt, 1% KMS and 0.5 % citric acid for 5 minutes, followed by partial dehydration for 2 minutes. Treatment six (T_6) was a control, where the mushrooms were subjected for partial dehydration only for 2 minutes.

The pretreated mushrooms were partially dehydrated to remove excess moisture and they were fried in refined oil. The excess oil was removed with the help of tissue paper, while the required quantity of salt and chilli powder was added to enhance the taste of the mushroom chips. The chips were packed in 200 gauge polyethylene bags and kept at room temperature for further analysis.

Fresh weight of the mushrooms and weight of chips obtained at the end of frying from each treatment was noted down and the percentage recovery of fresh mushroom chips was calculated.

$$\text{Recovery percentage} = \frac{\text{Weight of fried mushroom}}{\text{Weight of fresh mushroom}} \times 100$$

The availabity of oil before and after frying of chips was weighed to calculate oil uptake. It was the difference in weight before frying and weight after frying in preparation of mushroom chips.

Organoleptic evaluation of fresh mushroom chips were carried out by a panel of 10 semi trained judges. Organoleptic characters *viz.*, colour, appearance, crispiness, taste and overall acceptability of fresh mushroom chips, were evaluated on five point hedonic scale (Ranganna, 1986). The mean scores given by ten judges were used for statistical analysis.

Pre-treated oyster mushrooms with one per cent KMS, along with 0.5 per cent citric acid were dried for 10 h and grounded into powdered form. The grounded mushroom powder was used for fortification in noodle flour.

Noodle flour was mixed with different proportions of mushroom powder to prepare the mushroom fortified noodles. Mushroom powder @ 5 %, 10 %, 15 % and 20 % (w/w), respectively was used with noodle flour in treatment one to four (T_1 - T_4). Treatment five (T_5) with only the noodle flour was kept as control.

In mushroom fortified noodles preparation process, all the ingredients were dry mixed and kneaded with water (78%) into dough. The dough was covered with wet muslin cloth and kept at 28 to 30°C for 30 minutes for seasoning. The dough was then passed through manual vermicelli machine (200 g capacity with hole size 3 mm), sun dried and packed in a HDPE polythene bags (400 gauges). The dried and cooked noodles were kept for organoleptic evaluation. The cooked noodles were prepared by taking 100 g of dried noodles for each treatment, followed by boiling with 2 tea spoonful of noodle masala (Kwality), 2 tea spoonful of refined oil, a pinch of salt, chilli powder and sufficient quantity of water. Organoleptic evaluation of mushroom fortified noodles was carried out by following the same protocol as for mushroom crops.

The data (Table 1) (pertaining to the recovery and oil uptake of fresh mushrooms chips) revealed that there were significant differences among the treatments. Recovery percentage was significantly higher in pretreatment of mushrooms with one per cent salt + one per cent KMS + 0.5 per cent citric acid for five minutes along with partial dehydration for two minutes (21.77 %), whereas the lowest was in partial dehydration for two minutes (14.51%). The lowest oil uptake was recorded in pretreatment with one per cent

Table 1. Effect of different treatments on recovery and oil uptake of fresh mushroom chips

Treatment	Recovery (%) of chips	Oil uptake (ml/ 400 g)
T_1: Soaking in 1 % salt (5 min) + partial dehydration (2 min)	20.52	49.0
T_2: Soaking in 1 % salt + 0.5 % citric acid (5 min) + partial dehydration (2 min)	20.01	41.00
T_3: Soaking in 1 % KMS (5 min) + partial dehydration (2 min)	19.51	42.00
T_4: Soaking in 1 % KMS + 0.5 % citric acid (5 min) + partial dehydration (2 min)	20.27	38.00
T_5: Soaking in 1 % salt +1 % KMS + 0.5 % citric acid (5 min) + partial dehydration (2 min)	21.77	32.00
T_6: Partial dehydration 2 minutes (Control).	14.51	58.04
Mean	19.43	43.36
S.Em±	0.37	1.40
CD 1%	1.62	6.30

salt + one per cent KMS + 0.5 per cent citric acid for five minutes along with partial dehydration of two minutes (32 ml/ 400 g), whereas the highest was in partial dehydration for two minutes (58.04 ml/ 400 gm).

In the present investigation, the per cent recovery, oil uptake and organoleptic evaluation of mushroom chips, (Table 1) were influenced by different treatments. Higher per cent recovery (21.77%) and lower oil uptake (32 ml/400g) were recorded in the treatment imposed by soaking fresh mushrooms in one per cent salt + one per cent KMS + 0.5 per cent citric acid for five minutes along with partial dehydration for two minutes. Higher recovery and lesser oil uptake of chips could be attributed to the action of pretreatments that might have helped to maintains cell integrity and prevented damage of mushroom cells during frying.

The organoleptic evaluation of fresh mushroom chips was influenced by different pretreatments (Table 2). Higher scores for colour and appearance (4.50), flavour (4.30), crispiness (4.30), taste (4.34) and overall acceptability(4.4) was recorded in the treatment received soaking of fresh mushrooms in one per cent salt + one per cent KMS+ + 0.5 per cent citric acid for five minutes along with partial dehydration for two minutes. This was due to the effect of salt and citric acid, which enhances the taste and flavour and potassium metabisulphite helped in better retention of colour and appearance. The results on preparation and organoleptic evaluation of fresh mushroom chips are in conformity with Armuganathan *et al*. (2005) in *Agaricus bisporus.*

The data on colour and appearance of mushroom fortified noodles reveal that there were significant differences among the treatments. Significantly higher score for colour and appearance was recorded in noodle flour alone (4.50), which was on par with noodle flour along with fortification with 5 per cent mushroom powder (3.80), whereas least score were recorded in noodle flour along with 20 per cent mushroom powder fortification (3.20).

Texture data reveal that there were significant differences among the treatments. Significantly higher score for texture was recorded in noodle flour along with fortification with 15 per cent mushroom powder (4.10), which was at par with noodle flour along with fortification with 20 per cent mushroom (3.95), whereas lowest score were recorded in control (2.90). Significantly higher score for taste was recorded in noodle flour along with fortification with 15 per cent mushroom (4.30), which was at par with noodle flour along with fortification

Table 2. Organoleptic evaluation of fresh mushroom chips for colour, flavour, crispiness, taste and overall acceptability (Score out of 5)

Treatments	Colour and appearance	Flavour	Crispiness	Taste	Overall acceptability
T_1: Soaking in 1 % salt (5 min) + partial dehydration (2 min)	3.90	3.65	3.60	3.30	3.69
T_2: Soaking in 1 % salt + 0.5 % citric acid (5 min) + partial dehydration (2 min)	3.85	3.75	3.70	3.22	3.79
T_3: Soaking in 1 % KMS (5 min) + partial dehydration (2 min)	3.40	3.50	3.60	3.60	3.60
T_4: Soaking in 1 % KMS + 0.5 % citric acid (5 min) + Partial dehydration (2 min)	3.95	3.70	3.75	3.75	3.80
T_5: Soaking in 1 % salt + 1 % KMS + 0.5 % citric acid (5 min) + partial dehydration (2 min)	4.50	4.30	4.30	4.34	4.40
T_6: Partial dehydration 2 minutes (Control).	3.20	3.40	2.80	3.20	3.40
Mean	3.80	3.72	3.63	3.56	3.78
S.Em±	0.12	0.12	0.12	0.11	0.12
CD @1%	0.55	0.53	0.52	0.51	0.54

with 20 per cent mushroom (4.10), whereas lowest score were recorded in control (3.00).

The data on overall acceptability of mushroom fortified noodles reveal that there were significant differences among the treatments. Significantly higher score for overall acceptability was recorded in noodle flour along with fortification with 15 per cent mushroom (4.15), which were at par with noodle flour along with fortification with 20 per cent mushroom (4.05), whereas lowest score were recorded in control (2.90).

Organoleptic evaluation of mushroom fortified noodles was influenced by different levels of fortification of oyster mushroom powder (Table 3). Higher score for colour and appearance (4.50) was obtained in control prepared by noodle flour alone. Whereas,

Table 3. Organoleptic evaluation of mushroom fortified noodles for colour, flavour, crispiness, taste and overall acceptability (scores out of 5)

Treatments	Colour and appearance	Texture	Taste	Overall acceptability
T_1 - Noodle flour + 5 % mushroom powder	3.80	3.40	3.40	3.45
T_2 - Noodle flour + 10 % mushroom powder	3.70	3.60	3.65	3.60
T_3 - Noodle flour + 15 % mushroom powder	3.60	4.10	4.30	4.15
T_4 - Noodle flour + 20 % mushroom powder	3.20	3.95	4.10	4.05
T_5 – Noodle flour (control).	4.50	2.90	3.00	2.90
Mean	3.76	0.38	0.39	0.38
S.Em±	0.12	0.12	0.12	0.12
CD @1%	0.56	0.54	0.55	0.54

higher score for texture (4.10), taste (4.30) and overall acceptability (4.15) was observed in treatment containing noodle flour along with 15 per cent mushroom powder, followed by noodle flour along with 20 per cent mushroom powder. Higher concentration of mushroom powder which gave bitter taste exhibited lower score for colour, while lower concentrations did not show any difference in organoleptic evaluation. These results are in agreement with the results of Devina *et al.* (2008) that mushroom noodles of good organoleptic qualities were obtained in the treatment containing 20 g mushroom powder, 38 g wheat flour, 20 g of potato flour, 0.2 g of baking powder and two ml of edible oil in the preparation of button mushroom noodles. The present study emphasizes the possibility of using mushroom powder in various post harvest processed foods. Post harvest processing to prepare such food products with mushrooms will help to overcome the problem of short shelf life of mushrooms and also to increase per capita consumption of mushrooms in India.

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