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Formulation, organoleptic and nutritional evaluation of value added baked product incorporating Oyster mushrooms (Pleurotus *ostearus*) powder

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Abstract
Mushroom has been relished as a source of food and medicine throughout the world. *Pleurotus* mushrooms are very highly perishable and therefore, it has been very necessary to develop a value added product. The fresh mushroom and mushroom powder was analyzed for their nutritional composition. Mushroom powder has been incorporated in the formulations of cake at 0, 5, 10, 15 and 20% by weight. The effect of various levels of mushroom powder on the physico-chemical properties and nutritional quality of cakes had been observed. The cakes containing mushroom powder in different concentrations were evaluated for their sensory attributes by a panel at 9 pointer hedonic scale. The results revealed that the colour and flavour of cake containing mushroom powder was significantly different from the control cake. Mushroom powder at 15% addition level significantly improved colour, flavour and texture of cake. The texture of the cakes with mushroom powder was equally acceptable to the control cake. The overall acceptability of the cakes with mushroom powder was equally acceptable to the control cake.

Keywords: *Pleurotus ostearus*, mushroom powder, value added products, sensory evaluation

1. Introduction
Edible mushrooms have been widely utilized as human foods for centuries and have been appreciated for texture, flavor as well as some nutritional and medicinal attributes (Manzi *et al.*, 2001) [12]. However, the awareness of mushrooms as a healthy food and as an important source of biological active substances with medicinal value has recently emerged (Chang, 1999; Lakhanpal and Rana, 2005; Lakhanpal *et al.*, 2010; Thakur, 2012; Lakhanpal *et al.*, 2016) [3, 8, 9, 10, 21]. Now a day, mushroom is being relished throughout the world as food and medicine. Researcher reports revealed that mushrooms being a complete food source are rich in proteins, vitamins, fats, carbohydrates, dietary fibers, and minerals (Alam and Raza, 2001) [1].

Among several species of cultivated mushroom, *Pleurotus ostearus*, has been popularly consumed by people all over the world due to their taste, flavor, high nutritional and medicinal values (Deepalaskshmi and Mirunalini, 2014) [5]. Oyster mushrooms (*Pleurotus* spp) also called as 'dhingri' or 'abalone'; ranks second among the important cultivated mushrooms in the world (Chang and Miles, 2004) [4]. This group got the common name 'oyster mushrooms' because of the tounge shaped pileus with an eccentric lateral stripe. It possesses a very pleasant flavour, taste and is a highly perishable commodity. In view of their high perishable nature, the fresh mushrooms have to be processed to extend their shelf life. The off seasonal use of the mushroom can be achieved by adopting appropriate post-harvest technology to process the fruiting bodies into novel value added products. The production of value-added products are the need of the hour for the mushroom growers not only to reduce the losses but also to enhance their income by value-addition and boost the consumption of this important horticultural crop.

Kulshreshtha *et al.* (2009) [6] discussed various common processing procedures include canning, freezing and drying but among all canning has been widely used on a commercial scale, but it is quite expensive. Various value added products have been developed from *Pleurotus* mushroom. Kumar *et al.* (2006) [7] developed mushroom mathri (a deep fried snack). Rai and Arumuganathan (2008) [16] studied the value added products from the mushrooms. They have prepared various mushroom powder value added producst as: biscuits, soup powder, nuggets, noodles, papads, candies, pickles, ketch-up, murraba etc. Wakchaure *et al.* (2010) [22] studies the development and evaluation of quality value added mushrooms. Shiek *et al.* (2010) studied the effect of mushroom powder on the quality of cake and have specified that 15% addition level has best acceptability. Nalwade *et al.* (2011) [13] worked on value addition of selected bakery products like: *nankhatai, Fresh coconut biscuits, Sweet salty biscuits, Melting moment, coconut castles*. Rosli and Aishah (2012) [18, 19] studied that *Pleurotus sajor-caju* (PSC) improves nutrient contents and maintains sensory properties of carbohydrate-based products. Rosli *et al.*, (2012) [18, 19] worked on the improvement of nutrient contents and sensory properties of Carbohydrate-based Products. Okafor *et al.* (2012) [14] studies the quality characteristics of Bread made from Wheat and Nigerian Oyster mushroom (*Pleurotus pulmonarius*). Lakshmipathy *et al.* (2013) [11] studied different drying, canning and value addition techniques for *Calocybe indica*. Paul (2016) [15] studied on the standardization and preparation of various products form mushroom powder.

Mushrooms contribute significantly in overcoming protein deficiency in developing countries like India, because of their low calorific value, very high proteins content, vitamins and minerals. Among alternate or other novel sources of proteins to bridge the protein gap in the food articles, mushroom offers themselves as a potent source of protein. Mushroom are said to possess many unsubstantiated nutritional properties but documen and adequate scientific validation and measures for their sustainable utilization is still to be explored. Since they contain a high quality protein so they can be very easily replaces with other animal proteins like milk and meat. The present study

was undertaken to incorporate mushroom powder in bakery product (cake). The further assessment was carried out to assess the effect of value addition of mushroom powder on sensory and nutritional availability of the prepared value added baked product (cake).

2. Material and Methods

Fresh mushroom

Fresh oyster mushrooms were collected from INA market, New Delhi, India. The mushrooms were cleaned from extraneous matter to remove dirt, sand and other undesirable material from it.

Wheat flour

Commercial refined wheat flour (maida) of 'Shakti Bogh' brand was used for cake preparation.

Chemicals, Solvents and ingredients

Chemicals and solvents used were of analytical grade.

Commercial refined Wheat flour (12-13% moisture and 8-9% protein) sugar powder, butter/vegetable oil, milk powder, baking powder, vanilla essence, mushroom powder, salt, were procured from the local market. High density polyethylene bags were used for packaging and storage of samples.

Preparation of Mushroom Powder

Fresh oyster mushrooms were cleaned and chopped into small pieces of 7 mm thickness. 5kg fresh mushroom pieces were pre-treated by blanching in water at 60°C for approx 2 minutes. The pretreated slices were dehydrated in the tray dryer (S. M. Sientech, Kolkata) at 70°C. The velocity of the drying air was kept constant. The samples were dried to a moisture content of 5-10% approximately. The dried mushroom slices were cooled powdered and sieved at BS 30 and stored in air tight container for further use (Fig 3).

Fig 1: Cabinet Tray drier

Fig 2: Cabinet air-dried oyster mushroom

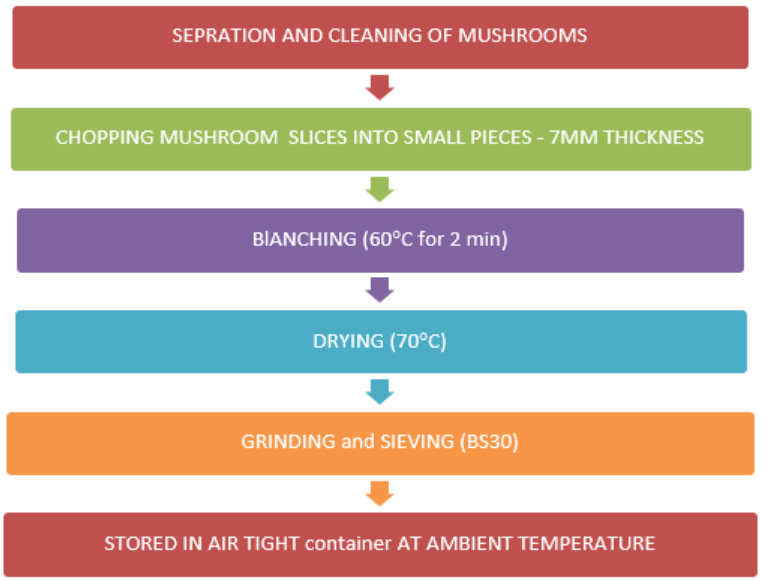

Fig 3: The process flow chart for mushroom powder

Preparation of Value Added Bakery Product (Cake)

Formulation of cake incorporating mushroom powder

The cake was prepared using multi stage mixing method (Atkins, 1971). The value addition was done by mushroom powder with the addition to the wheat flour at a concentration of 5, 10, 15, and 20% respectively.

Table 1: Basic Recipe for cake formulation:

Ingredients	Quantity
Wheat flour (refined)	100 gm
Sugar powder	82 gm
Baking powder	5 gm
Butter/vegetable oil	65 ml
Milk (powder)	12 ml
Vanilla essence	1ml
Salt	1gm

Cake making procedures

Cakes were prepared by wheat flour with different concentration as 5, 10, 15, and 20% of different mushroom powder samples in the basic formulation of cake as per method of Rajchel *et al.* (1975) [17]. The flour, mushroom powder and other ingredients for each cake were weighed accurately. After that the sugar and shortening were mixed in a mixing machine for 20 minutes to produce a cream. In later stages, half of the milk, other ingredients, and finally the flour were mixed using low speed (145 rpm) for 10 minutes to ensure even distribution of all the components. The bowl was scrapped and butter was mixed for additional two minutes at medium speed (250 rpm). The remaining milk was added and the butter mixed at low speed for two minutes. After the bowl was scrapped, the batter was mixed for additional two minutes at medium speed. Portion of butter weighing 150 gm was scaled into pre-greased cake pan. All cakes were baked in convection oven for 40 minutes at 170°C.

Physical evaluation

The height, length and width of the rectangular shaped cakes were measured with vernier caliper. Weight was determined with digital weighing balance. Volume of cake was calculated as length × width × height. Density was calculated as weight / volume.

Organoleptic evaluation

Cakes were evaluated organoleptically for colour, flavour, texture, and overall acceptability. 1-9 point hedonic rating test was performed to assess the degree of acceptability of cakes containing mushroom powders in different level. One slice from each lot of cake was presented to 10 panelists as randomly coded samples. The taste panelists were asked to rate the sample for colour, flavour, texture, and overall acceptability on a 1-9 point scale, where 9=Like extremely; 8=Like very much; 7= Like moderately; 6=Like slightly; 5= Neither like nor dislike; 4=Dislike slightly; 3= Dislike moderately; 2= Dislike very much; 1=Dislike extremely.

Chemical evaluation of cake containing mushroom powder:

The cake containing 5, 10, 15, and 20% mushroom powders were analyzed for moisture content, protein, ash and crude fat as per the methods of AOAC (2010). Carbohydrate content of the cake samples was determined as total carbohydrate by difference method. All of the measurements were performed in triplicates. The data is given either as mean + SD or mean + SEM.

3. Results and Discussion

Preparation of mushroom powder

The moisture content of the fresh mushroom was found to be in the range of 88 - 89%, which was reduced to 8 - 10 % after tray drying at 70°C for 6 hours.

Table 2: Yield percentage of Mushroom powder

Weight of fresh mushrooms	Yield Percentage of mushroom powder
5 Kg	10.5%

Composition of fresh and dried mushrooms

The fresh and dried oyster mushroom powder was analyzed for moisture, protein fat ash and total carbohydrates contents. Table 3 explains the composition of fresh and dried mushrooms as: Fresh Mushroom contain 88.80% moisture, 4.82% protein, 0.74% fat, 1.06% ash and 5.58% Total carbohydrate by difference. Dried mushroom powder contains 9.04% moisture, 13.02% protein 2.39% fat, 6.95% ash and 68.06% total carbohydrate by difference.

Table 3: Composition of fresh and dried mushroom powder

Components	Fresh mushroom (g/100gm)	Dried mushroom (g/100gm)
Moisture (%)	88.80	9.04
Protein (%)	4.82	13.02
Fat (%)	0.74	2.39
Ash (%)	1.06	6.95
Total carbohydrates (%) by difference	4.58	68.06

Physical properties of the cake

The physical properties of cakes prepared by incorporating different percentages of mushroom powders as: 5, 10, 15, and 20% against control have been showed in Table 4. Cake was assessed for volume, weight and density. The physical properties of cakes prepared by incorporating mushroom powder in different mentioned concentrations against control showed that the weight of all the cake samples were higher than the control cakes. The cakes containing 20% mushroom powder had the higher weight and less density than those with 0, 5, 10 and 15% mushroom powder. The volume of the cakes increased with the increasing levels of mushroom powder and the control cakes had the lowest volume. The density of cake decreases with increase in mushroom concentration. This shows that there is more trapping of air in the cake with increase in concentration of mushroom.

Table 4: Physical properties of cake incorporating mushroom powder against control

Cake	Physical Properties		
Parameters	Volume (cm^3)	Weight(S) gm	Density (gm /cm^3)
Control	80.73	150	1.85
5%	81.53	151	1.85
10%	83.00	152	1.83
15%	85.25	153	1.79
20%	87.75	154	1.75

Organoleptic evaluation of cake

The mean scores for colour, flavour, texture, taste and overall acceptability of the cakes are presented in Table 5, which revealed that the cakes containing 15% mushroom powder were most preferred for colour and texture was higher than the cake containing various levels of mushroom powder and control. The 20% mushroom powder cake had least acceptability for all attributes. Result showed that increasing percentage of mushroom powder gave higher scores for color till 15% overall acceptability.

Table 5: Mean sensory attributes of cake incorporating mushroom powder against control

Sensory attributes	(5%)	(10%)	(15%)	(20%)	Control (Cake (refined flour only)
Mean score on sensory attributes	**Mean ± S.D**	**Mean ± S.D**	**Mean ± S.D**	**Mean ± S.D**	**Mean ± S.D**
Color	8.25±0.597	8.16±0.746	8.34±0.898	6.02±0.126	8.0±0.5
Taste	8.08±0.702	7.94±1.019	7.08±1.351	5.17±0.063	8.10±0.624
Flavor	8.12±0.881	7.68±1.190	7.25±1.541	5.81±0.772	8.05 ±0.687
Texture	7.6±1.190	7.51±1.497	7.72±1.686	5.84±0.461	7.36±1.52
Overall acceptance	7.92±0.953	7.45±0.890	7.18±1.298	5.02±0.192	7.13±0.751

Chemical Composition of the cake

Cakes prepared with incorporation of mushroom powder with varying concentrations were analyzed for fat, protein, ash, moisture and total carbohydrate by difference (Table 6). Mushroom powder incorporation increased the protein content and reduces the carbohydrate content in samples, whereas, the fat percentages increases in the samples as the mushroom powder incorporation increases.

Table 6: Chemical composition of cake incorporating mushroom powder against control

Parameters	5%	10%	15%	20%	Control
Fat (%)	17.8	18.9	19.5	19.98	17.0
Protein (%)	8.57	9.49	10.91	11.42	7.1
Carbohydrates (%) by difference	57.28	54.93	50.4	48.68	57.95
Moisture (%)	15.37	16.19	18.51	19.06	17.43
Ash (%)	0.98	0.49	0.68	0.86	0.52

4. Conclusion

The investigation showed that the mushroom powder incorporation could be used to improve the significant improvement in the bread protein content and nutritional quality on addition of mushroom powder. Fresh Mushrooms were tray dried up to 8 to 10 % moisture level and grounded into powder. Mushroom powder at different concentration was incorporated into cake and the organoleptic properties of cakes were evaluated and they revealed that colour, flavour, texture and overall acceptability of cakes varied significantly (0.05). The colour, flavour, texture and overall acceptability of cake containing 15% mushroom powder was significantly better than those of others concentration. This was also evident that the mushroom incorporation in cake will increase the protein content, but will reduce the carbohydrate content. Therefore, mushroom value addition could be used to improve the nutritional quality of cake which could help in reduction of protein-energy malnutrition prevalent in various developing countries.

5. References

1. Alam DSM, Raza MS. Importance of Mushrooms. NIA, Tando Jam, Pakistan. 2001.
2. Association of official analytical chemists (AOAC) official Methods of Analysis, 19th edn. Washington DC. 2010.
3. Chang ST. Global impact of edible medicinal mushrooms on human welfare in the 21st century: non green evolution. International Journal of Medicinal mushrooms. 1999; 1:1-7.
4. Chang ST, Miles PG. Mushroom cultivation, nutritional value, medicinal effects and environmental impact. CRC Press. 2004.
5. Deepalakshmi K. Mirunalini S. *Pleurotus ostreatus*: an oyster mushroom with nutritional and medicinal properties. Journal of Biochemical Technology. 2014; 5(2):718-726.
6. Kulshreshtha MA, Singh A, Vipul D. Effect of drying conditions on mushroom quality. Journal of Engineering Science and Technology. 2009; 4(1):90-98.
7. Kumar S, Nirankar N, Tyagi RK. Development and evaluation of *Pleurotus* mushroom mathri. Journal of Food Science and Technology. 2006; 43(5):501-504.
8. Lakhanpal TN, Rana M. Medicinal and nutraceutical genetic resources of mushrooms. Plant Genetic Resources: Characterization and Utilization. 2005; 3:288-303.
9. Lakhanpal TN, Shad O, Rana M. Biology of Indian Morels. I K International Publishing House. 2010; 1-266.
10. Lakhanpal TN, Sai I, Thakur M. Biodiversity of wild edible, Mycorrhizal and Nutraceutically important mushrooms. In: Mushrooms of India (eds. Sharma S, Singh M, Prasad S and Rathore H) I, IIT Delhi. 2016, 8-37.
11. Lakshmipathy G, Jayakumar A, Abhilash M, Raj SP. Studies on different drying, canning and value addition techniques for mushrooms (*Calocybe Indica*). African Journal of Food Science. 2013; 7(10):361-367.
12. Manzi P, Aguzzi A, Pizzoferrato L. Nutritional value of mushrooms widely consumed in Italy. Food Chemistry. 2001; 73:321-325.
13. Nalwade VM, Samekar S, Khan TN. Value addition of selected bakery products by incorporating mushrooms. Bionano Frontier. 2011; 4(1):115-119.
14. Okafor JNC, Okafor GI, Ozumba AU, Elemo GN. Quality characteristics of Bread made from Wheat and Nigerian Oyster mushroom (*Pleurotus pulmonarius*) powder. Pakistan Journal of Nutrition. 2012; 11(1):5-10.
15. Paul V. Mushroom products. In: Mushrooms of India (eds. Sharma S, Singh M, Prasad S and Rathore H) I, IIT Delhi. 2016; 1:254-262.
16. Rai RD, Arumuganathan T. Economics for pickling. Post-Harvest Technology. Technical Bulletin, NRCM, Solan. 2008, 68-69.
17. Rajchel CL, Zabik ME, Everson E. Wheat Bran and Middling: A source of dietary fibre in Bannana, Chocolate, Nut and Spices Cakes. Baker's Dig. 1975, 27-30.
18. Rosli WIW, Aishah MS. *Pleurotus sajor-caju* (PSC) Improves Nutrient Contents and Maintains Sensory Properties of Carbohydrate-based Products. World Academy of Science Engineering and Technology. 2012; 6:3-20.
19. Rosli WIW, Nurhanan AR, Aishah MS. Effect of partial replacement of wheat flour with oyster mushroom (*Pleurotus sajor-caju)* powder on Nutritional Composition and sensory properties of butter biscuit. Sains Malaysiana. 2012; 41(12):1565-1570.

20. Sheikh M, Kumar AMA, Islam A, Mahomud MM. The effects of mushroom powder on the quality of cake. Progress. Agriculure. 2010; 21(1-2):205-214.
21. Thakur M. Mushrooms a prominent source of nutraceuticals. Journal of Food Processing Technology 2012; 3(10):178.
22. Wakchaure GC, Mahantesh S, Manikandan K, Rana L. Development and evaluation of quality value added mushrooms. Mushroom Research. 2010; 19(1):40-44.