Development of Mushroom Cake By Incorporation of Button Mushroom (*Agricus Bisporus*) Powder

Mohammed I. Talib* [1] , Miss Chaitanya S. Rathod[2], Vishal R. Parate[3]

Department of Food Technology, University Institute of Chemical Technology, North Maharashtra University, Jalgaon-425001, India
drmtalib@gmail.com , chaitanyarathod99@gmail.com, vishal_parate@yahoo.com

Abstract

Mushroom is fleshly fungus, spore bearing fruit, with more than 2000 species of mushroom existing in nature that include 25 species of edible mushroom. It is rich source of protein, minerals, crude fiber and polyphenolics. Mushrooms are reported to cater therapeutic benefits, including its role in alleviating diabetic, cancer and heart diseases by way of their consumption. In present study an attempt is made to develope mushroom cake by incorporating button mushroom powder, by replacing refined wheat flour at 5 g%, 10g %, 15 g% and 20 g% level : and were marked as C5, C10, C15 and C20 respectively.Four cake samples so prepared were compared with sole refined wheat flour cake (C0). Among four mushroom cake samples, 15% incorporated mushroom cake (C15) was reported to be sensory acceptable and palatable. Mushroom cake (C15) is reported to contain about 60 g% higher protein, while increase in minerals in terms of calcium, potassium and sodium were about 80 mg %, 20 mg % and 90 mg % respectively. Sensory acceptable mushroom cake showed 1.6 fold increase in fiber content , and mushroom cake was also enriched with gallic acid (4.25 mg %) and quercetin (15 mg %).In view of substantial increase in dietary fibre and health benefiting polyphenolic, essential minerals, and nutritive protein , mushroom cake may herald an interesting promise to provide health benefits like that of functional food.

Keywords *Cakes, Mushroom Powder, Protein, Fiber, Minerals, Polyphenolic Compounds, Incorporation*

---

1. Introduction

Mushroom is rich in nutritive values like protein, minerals, crude fiber and polyphenolic compounds (Nasiri, 2011). Besides mushrooms as source of nutrients, it has been reported as therapeutic foods: useful in preventing diabetic, cancer and heart diseases (Okafor et al., 2012). β-glucan of mushroom impart beneficial health effects like anti-tumor, immunomodulatory and hypocholesterolaemic activities. Mushrooms are generally consumed fresh as a palatable culinary recipe ingredient (Kim and Lee, 2011). It is highly perishable in nature, after harvesting they keep respiring and undergo browning, loss of texture and nutrients. To minimize post harvest wastage it can be converted into powder form to increase its shelf life (Kumar, 2015). Most species of mushroom contain abundant essential amino acid, that can complement well with wheat flour in making nutritionally balanced high quality products (Okafor et al., 2012). Exploitation of mushroom is still undermined in processed food products (Kim and Lee, 2011). The performance of the white button mushroom powder in cake was evaluated as a high nutritive substitute for wheat flour. Mushroom powder play complementary in terms of protein and other nutrients (Abdellatief et al., 2017). *corresponding

2. Materials and Methods

The mushrooms were procured from local market of Jalgaon. Standard laboratory methods were adopted for proximate analysis of mushroom powder. Moisture, fat and ash was analyzed as per procedures of S. Ranganna (1986) , protein by IS-7291(1973), crude fiber by AACC (1969). Minerals content of the samples were determined by using flame photometer and polyphenolics were determined by HPLC Method. All the experiment was carried out in triplicates.

Preparation of mushroom powder (Verma et al., 2016**)**

Fresh mushrooms were grinded and sieved to pass through a 60 mesh sieve and oven dried at 110ºC for 10hrs. Mushroom powder was packaged in polyethylene bag, sealed, stored in the ambient temperature until required.

Production of Wheat Flour and Mushroom Powder cake

The cake was prepared using the method described by J Kim et al., (2011). The preparation of the cake involves the replacement of part of the Wheat Flour with 5 g %, 10 g%, 15 g% and 20 g% % Mushroom Powder. Cake prepared with sole refined flour was treated as control cake. Cakes were prepared by creaming method. Cake batter was mixed for 0.5 min. Again mixed it for 2 min. The batter was poured into baking pan and baked at 170˚c for 30 min.

Table 1. Standard Cake Recipe

Ingredients (%)	C_0	C_5	C_{10}	C_{15}	C_{20}
Wheat flour	22.5	17.5	12.5	7.5	2.5
Mushroom powder	-	5	10	15	20
Sugar	27.08	27.08	27.08	27.08	27.08
Shortening	11.28	11.28	11.28	11.28	11.28
Non fat dry milk	2.7	2.7	2.7	2.7	2.7
Baking powder	0.90	0.90	0.90	0.90	0.90
Distilled water	32.73	32.73	32.73	32.73	32.73

Sensory Analysis

The cake samples were evaluated on nine point hedonic scale. The samples were served in clean plates at room temperature (28±2°C) to the panelist. The panelist were served the samples and taste score of each sample were recorded on 9-point Hedonic scale (Larmond, 1977). Score sheet of panelist was analyzed on Analysis of Variance (ANOVA), while the means were separated using Duncan multiple range test (Duncan, 1955).

3. Results and Discussion

Table 2 shows that the result of the sensory evaluation indicated significant difference between 100% wheat flour cake (control) and those fortified with 5, 10, 15 and 20% mushroom powder. Cake with 5% and 10% mushroom powder did not differ significantly from plain cake in mouth feel, appearance, colour, flavor and overall acceptability. Cake with 20% mushroom powder addition had dark color and pronounced mushroom taste and flavor. While 15% MP fortified cake was acceptable to

the panelist. Fifteen g % mushroom powder fortified mushroom cake offered uniqueness in taste and texture.

Table 3 shows composition mushroom cakes and plain cake. There was increase in fat content from 13.58 to 20.3%. The protein content is reported to increase in the range from 11.96 to 14.06%. The crude fibre and ash contents were reported to increase in the range; from 0.88 to 1.9% and from 1.18 to 2.18% respectively.

Table 2 Sensory evaluation of mushroom cakes and plain cake

Parameter	C_0	C_5	C_{10}	C_{15}	C_{20}
Flavour	5.66±0.57	6.33±1.15	6±1.73	7.66±0.57	5.33±1.15
Colour	6.33±1.15	6±0	5.66±0.57	7±1	4.33±1.15
Texture	6.33±0.57	5.33±1.5	5.66±1.52	7.66±1.52	5.33±2.08
Taste	6.66±0.57	5.66±0.57	6±1	8±1	5.66±1.52
Appearance	6±1.73	5.66±0.57	5.66±0.57	7.33±1.15	5.33±0.57
Mouth feel	6.66±0.57	6±1.73	6±1.73	8±1	5±1
Overall acceptability	6.66±0.57	6±1	5.66±0.57	7.66±0.57	5.66±1.52

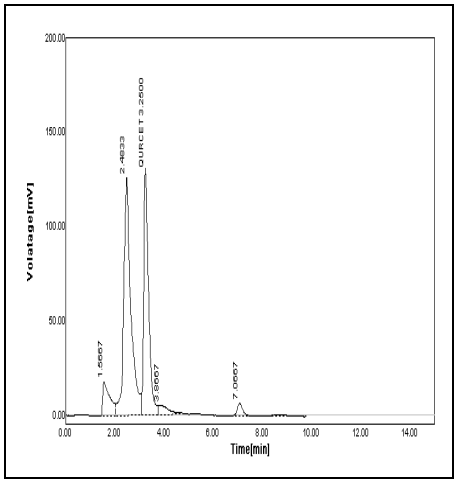
Table 3 Proximate analysis of mushroom cakes and plain cake

Parameters	C_0	C_5	C_{10}	C_{15}	C_{20}
Moisture (%)	16.4±0.2	15.46±0.50	20.53±0.41	19.66±0.28	20.26±0.30
Fat (%)	16.82±0.39	13.67±0.40	20.3±0.25	13.58±0.28	6.12±0.28
Protein (%)	7.96±0.05	12.20±0.02	11.96±0.02	12.98±0.02	14.06±0.21
Crude fiber (%)	0.60±0.01	0.88±0.12	1.166±0.18	1.57±0.03	1.9±0.17
Ash (%)	1.11±0.01	1.18±0.05	1.78±0.02	2.05±0.05	2.18±0.07
Carbohydrate (%)	57.69±0.69	59.89±0.34	45.42±0.45	51.71±0.38	57.43±0.23

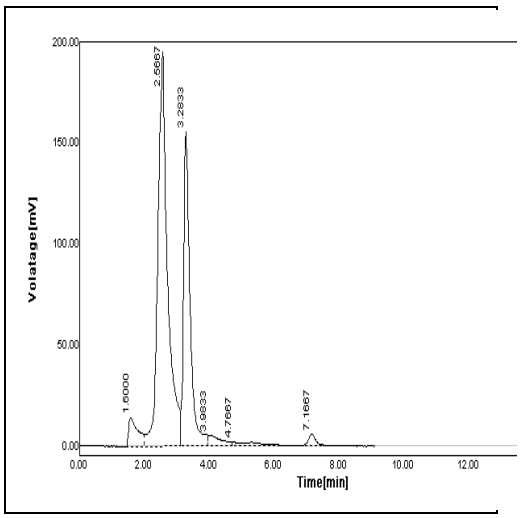
Table 4 Comparative Composition of sensory acceptable cake and plain cake

Parameters (%)	C_0	C_{15}	(%)changes
Moisture (g %)	16.4±0.2	19.66±0.28	19.87%
Fat (g %)	16.82±0.39	13.58±0.28	-19.26%
Protein (g %)	7.96±0.05	12.98±0.02	63.06%
Crude fiber (g %)	0.60±0.01	1.57±0.03	1.6 fold increase
Ash (g %)	1.11±0.01	2.05±0.05	84.68%

Carbohydrate (g %)	57.69±0.69	51.71±0.38	-10.36%
Sodium (mg/ml)	0.034	0.065	91.17%
Potassium (mg/ml)	1.27	1.56	22.83%
Calcium (mg/ml)	0.032	0.060	87.5%
Gallic acid mg %	1.41	1.47	4.25%
Quercetin mg %	93.21	110.74	15.82%

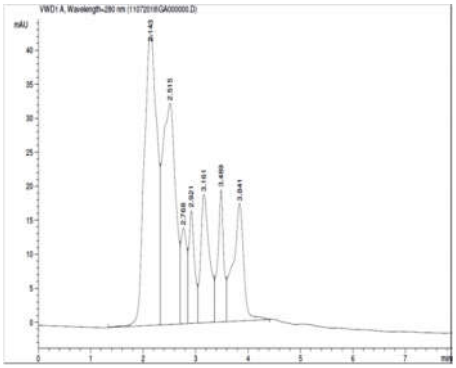


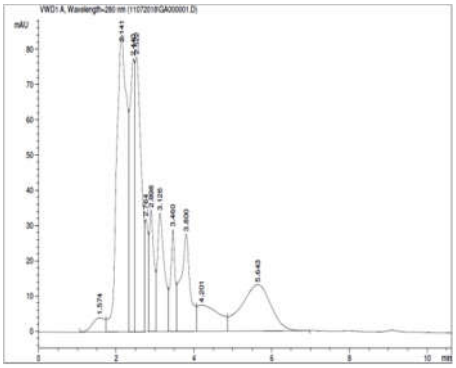
Plain cake



Mushroom Cake

Figure 1. Quercetin concentration in Plain Cake and Accepted mushroom cake





Plain cake Mushroom Cake

Figure 2. Gallic Acid concentration in control cake and accepted mushroom cake

Table 4 shows comparative Composition of sensory acceptable cake and plain cake. Results showed that as level of mushroom powder is increased, protein content, minerals and crude fibre was reported to be progressively increased. The increase in these proximate parameters could be probably due to their high quantities in mushroom power. Wwheat flour is comparatively deficient in protein and lysine but rich in sulphur containing amino acid, while mushroom is higher in lysine containing to the extent of 36% protein and substantial balance of other essential amino acids (J. N. C. Okafor, 2012). Mushroom incorporated cake can enhance good quality protein content of baked cake(J. Kim, et.al.; 2011).

In Figure 1a shows standard peaks of Quercetin appeared at retention time of 1.56, 2.48 and 3.86 min. respectively and quercetin content of plain cake (C0) shown to be 93.21 mg %

In Figure 1b showing peaks of Quercetin appeared at retention time of 1.60, 2.56 and 3.98 min. respectively; quercetin content of mushroom cake (C15) is shown to be is 110.7 mg %.

In Figure 2a showing peaks of Gallic acid appeared at retention time of 2.14, 2.51, 2.76, 2.92, 3.16 and 3.48 min. respectively; and gallic acid content of plain cake (C0) shown to be 1.41 mg%.

In Figure 2b showing peaks of Gallic acid appeared at retention time of 1.57, 2.14, 2.44, 2.52, 2.76, 2.89, 3.12, 3.46, 3.80 and 5.64 min. respectively; and gallic acid content of sensory acceptable cake mushroom cake (C15) is reported to be 1.47 mg %.

5. Conclusion

The sensory acceptable mushrrom cake can be prepared by replacing maximum 15% of refined wheat flour with mushroom powder in standard cake recipe. The mushroom cake so prepared can enhance protein by about 60 g % and; supplemented increase in calcium, potassium and sodium reported was 87 mg %, 22 mg % and 91 mg %,comparativelly with plain refined flour cake. Moreover the developed mushroom cake shown to contain 1.6 fold higher g % fibre than wheat flour cake. Mushroom cake was also comparatively enriched with gallic acid by 4.25 mg % and quercetin by 15 mg %.

Acknowledgement

Author is indebted to Director, University Institute of Technology, KBC-North Maharashtra University, for extending financial support under TEQIP-III, and rendering laboratory facility to carry out research project at Department of Food Technology, Jalgaon.

References

A.A.C.C. Approved Methods of American Cereal chemist. Cereal laboratory Methods, St. Paul Minneasota, U.S.A. ,(1967).

A.A.C.C.. Approved Methods of American Cereal Chemist. Cereal Laboratory methods, St, Paul minneasota ,U.S.A., (1969).

A.A.C.C. ,Approved Methods of American Cereal Chemist ,U.S.A. , (1976).

A.O.A.C., Official Methods of Analysis .14th ed. Association of Offical Agricultural Chemist .Inc Arlington ,V.A., (1984).

Abdellatief A. Sulieman, Ke-Xue Zhu, Wei Peng, Muhammad Shoaib, Hayat A. Hassan and Hui-Ming Zhou, "Compositional, functional and pasting properties of composite flour fortified with button mushroom *(Agaricus bisporus*) powder and insulin", Journal of food and nutrition research, Vol. 5, no. 8, (2017), pp. 614-621.

Dikeman cheryl, laura Bauer, elizabeth a. Flickinger, and george c. Fahey, "Effects of stage of maturity and cooking on the chemical composition of select mushroom varieties", J. Agric. Food chem, Vol. 53, (2005), pp. 1130-1138

Kim, J., Lee, S. M., Bae, I. Y., Park, H. G., Gyu Lee, H., & Lee, S. " (1-3)(1–6)□β□Glucan□enriched materials from Lentinus edodes mushroom as a high□fibre and low□calorie flour substitute for baked foods. Journal of the Science of Food and Agriculture", Vol. 91, no.10, (2011), pp. 1915-1919.

Kumar K., "Studies on development and shelf life evaluation of soup powder prepared by incorporation of white button mushroom *(Agaricus bisporus)"* , (2015).
Nasiri, F., Ghiassi, T. B., Bassiri, A. R., Hoseini, S. E., & Aminafshar, M. "Comparative study on the main chemical composition of button mushroom's *(Agaricus bisporus*) cap and stipe", Journal of Food Biosciences and Technology, Vol. 3, no. 3, (2013), pp. 41-48.
Okafor, J. N. C., Okafor, G. I., Ozumba, A. U., & Elemo, G. N., "Quality characteristics of bread made from wheat and Nigerian oyster mushroom (*Pleurotus plumonarius*) powder", Pakistan Journal of Nutrition, , Vol. 11, no.1, (2012), pp. 5-10.
Ranganna S., Handbook of analysis and quality control for fruit and vegetable products, 2nd ed. Tata Mcgraw hill publishing Co. Limited, New Delhi, (1986).
Verma, A., & Singh, V. "Formulation and quality evaluation of mushroom (Oyster mushroom) powder fortified potato pudding ", Asian J. Dairy & Food Res, Vol. 36,no. 1, (2017), pp. 72-75.