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RESEARCH ARTICLE

DEVELOPMENT AND EVALUATION OF VALUE ADDED BISCUITS FROM DEHYDRATED SHIITAKE (*LENTINUS EDODES*) MUSHROOM

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ABSTRACT

Shiitake is the common name for the mushroom *Lentinus edodes*. The Shiitake, meaning "mushroom of the shii (oak tree)" in Japanese, is highly prized in Asia for its flavor and reputed medicinal value. The present study aimed at development, sensory evaluation, nutrient composition and shelf life evaluation of value added biscuits. A good quality of Shiitake mushroom biscuits comparable with refined flour biscuits in terms of sensory attribute were successfully prepared. Value addition was done using treated or untreated dehydrated shiitake mushroom powder. Crude protein content in value added Biscuits (10.55% and 9.61%) was significantly ($p \leq 0.05$) higher as compared to that without value addition (5.74%). HCl extractability for iron, zinc, phosphorus and calcium (70.53, 72.21, 85.83, 53.69 %) were also significantly ($p > 0.05$) higher in treated mushroom biscuits. The developed products could be successfully stored for a period of 30 days. In conclusion, the value addition with mushroom powder can be recommended for the purpose of improved nutrient content.

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INTRODUCTION

Edible fungi are food with high nutritional values. Mushrooms have been used for traditional foods and medicines in Asia (Chang, 1996). Mushroom is an exotic and nutritious source of vegetarian food. It is a major horticulture product all over the world and is also becoming popular in India. Production and consumption of mushrooms have tremendously increased in India mainly due to increase in awareness of the commercial value and nutritional significance of this commodity. Shiitake (*Lentinula edodes*) mushroom is the second most cultivated edible mushroom in the world, accounting for about 25% of worldwide production. It is a major agricultural commodity in Japan, where about half the world's supply of Shiitake mush-rooms is produced. Its production has increased faster than of any other mushroom species (Boa, 2004), reaching a production of 7.5 million ton in 2000 (Royse, 2005). These mushrooms are acknowledged as "the queen of mushrooms" and have great market potential both at home and abroad. Demand for Shiitakes as food and as health promoting products has also increased.

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Dried Shiitake mushrooms (*Lentinus edodes*) are consumed after rehydrating and give a unique and pleasant flavor and texture to meals. Therefore, they are very popular in Asian dishes. Fresh mushrooms cannot be stored for more than two to three days due to its perishable nature. This is a limiting factor for mushroom marketing. Quality deterioration starts just after harvesting. Therefore, producers are not able to hold it as fresh for more days to market. Processing into value added products is one option producer can adopt to save the product from spoilage as well as to earn more money. The value-added products are the need of the hour for the mushroom growers not only to reduce the losses but also to enhance the income by value-addition to boost the consumption of mushroom (Lakshmipathy *et al*., 2013). The present study reports development, sensory evaluation, nutrient composition and shelf life evaluation of value added biscuits.

MATERIALS AND METHODS

Procurement of materials

The present study was carried out in the Department of Foods and Nutrition, I.C. College of Home Science, CCS Haryana Agricultural University, Hisar. All the ingredients required for

development of products were procured from open market in a single lot and stored in air tight food grade container. For the purpose of study, the Shiitake mushrooms were solar dried (with or without pretreatment with 5g/L citric acid). Biscuit II was developed using untreated solar dried mushroom whereas citric acid treated solar dried mushroom was used for development of Biscuit III. Biscuit I contained no mushroom and was used as control.

Development of mushroom biscuits

Micro method III of Finney *et al.* (1950) was used with minor modifications for biscuit preparation (Fig. 1). The ingredients for biscuits were as follows:

Ingredients	Biscuit I	Biscuit II	Biscuit III
Refined wheat flour	100	90 g	90 g
Sugar	55 g	55 g	55 g
Mushroom powder	-	10 g	10 g
Ghee	40 g	40 g	40 g
Milk	20 ml	20 ml	20 ml
Ammonia	¼ tsp	¼ tsp	¼ tsp
Baking powder	¼ tsp	¼ tsp	¼ tsp

Sensory Evaluation

Sensory evaluation of developed mushroom biscuits was carried out by a panel of ten semi-trained judges using 9-point Hedonic Rating scale (Ranganna, 1986).

Nutritional evaluation

Proximate composition was determined according to AOAC method (2000). Dietary fibre constituents were assayed according to (Furda, 1981). Total carbohydrate (by addition), Total soluble sugars (Yemm and Willis, 1954), Reducing sugars (Somogyi, 1945), Non –reducing sugars (by difference), Starch (Clegg, 1956) were assayed. *In vitro* protein digestibility were determined by (Mertz *et al*., 1983). Total iron and zinc calcium, phosphorus, in acid digested samples were determined by the atomic absorption spectrophotometer according to the method of Lindsey and Norwell (1969) and HCl extractability by (Peterson *et al*., 1943). Polyphenols were assayed by (Singh and Jambunathan, 1981).

Shelf Life Studies

Sensory and Fat acidity

The developed products were stored in food grade plastic containers and studied for Sensory evaluation(Ranganna, 1986) and fat acidity (AOAC, 2000) at intervals of 15 and 30 days of storage

Total Bacterial Count

The biscuits were powdered and 1g was measured and dissolved into 9.0 ml of sterilized distilled water blank and shaken thoroughly. One ml of 10^{-1} dilution was taken and dissolved into 9.0 ml sterilized water blank. This was 10^{-2} dilution. Similarly 10^{-3} dilution was made. 0.1ml of 10^{-1}, 10^{-2} and 10^{-3} dilutions were poured in petri plates containing PCA media. Plates were incubated at 30±2˚C for 24 - 48 hours. Numbers of colonies were counted and colony forming unit (cfu) was calculated by using formula:

No. of colonies × dilution factor × 10 = cfu /g of sample

Statistical analysis

Results were expressed as mean±standard deviations. Suitable standard statistical methods were used for analysis of data (Sheoran and Pannu, 1999). Statistical significance was set at ($p < 0.05$).

RESULTS

Sensory evaluation

All the developed biscuit were acceptable and adjudged as 'liked very much' in terms of overall acceptability (Table1). Score of different sensory characteristics for treated mushroom biscuits (Biscuits III) ranged from 7.25 for appearance to 7.90 for colour. It had an overall acceptability score of 7.67 and was therefore rated as 'liked very much' on 9 point hedonic scale. Different sensory characteristics of untreated mushroom biscuits (Biscuit II) ranged from 7.20 for taste to 7.70 for aroma. Biscuit I scored from 7.85 (colour) to 8.45 (aroma). Biscuit I scored 8.25 for appearance and 8.23 for overall acceptability, both of which were significantly ($p \leq 0.05$) higher than the corresponding scores of biscuit III (7.25 for appearance; 7.67 for overall acceptability). There were no significant ($P \leq 0.05$) difference among any of sensory attributes of biscuit II and biscuits III.

Nutritional evaluation

Moisture content of Biscuit I was 2.28 per cent. It was significantly ($p \leq 0.05$) lower than that of value added biscuits prepared from untreated (Biscuit II) and treated mushroom powder (Biscuit III). The respective moisture content of biscuit II and biscuits III was 6.54 and 6.60 per cent (Table2). Crude protein content in Biscuit II (10.55%) and biscuits III (9.61%) was significantly ($P \leq 0.05$) higher as compared to that of biscuit I (5.74%). The biscuit supplemented with untreated Shiitake mushroom (Biscuit II) had significantly ($p \leq 0.05$) higher crude protein than those supplemented with treated Shiitake mushroom (Biscuit III). Crude fat content was 21.50, 20.16 and 19.16 per cent for Biscuit I, II and III respectively. Supplementation of biscuits with Shiitake mushroom significantly ($P \leq 0.05$) increased the ash and crude fibre as compared to non supplemented one (Biscuit I). Total carbohydrate and starch content were significantly ($P \leq 0.05$) higher in biscuits I (71.10 and 30.00 % respectively) as compared to Biscuit II (66.06 and 28.33 %) and Biscuit III (67.93 and 27.33% respectively). No significant ($P \leq 0.05$) differences were observed in reducing or non reducing sugars of three developed biscuits. The developed supplemented biscuits (Biscuit II and III) had significantly ($P \leq 0.05$) higher total fibre (13.04) and (12.72 g/100g) and insoluble dietary fibre contents (8.68 and 8.31 g/100g respectively) as compared to unsupplemented biscuit I.

Fig. 1. Biscuit I = No mushroom added, II = Untreated mushroom, III = Treated mushroom

Table 1. Sensory characterstics of Shiitake mushroom Biscuits

Product	Colour	Appearance	Aroma	Texture	Taste	Overall acceptability
Biscuit I	7.85±0.25	8.25±0.25^{a}	8.45±0.21	8.30±0.26	8.30±0.21^{a}	8.23±0.10^{a}
Biscuit II	7.65±0.31	7.55±0.26^{ab}	7.70±0.30	7.55±0.26	7.20±0.41^{b}	7.53±0.08^{b}
Biscuit III	7.90±0.26	7.25±0.29^{b}	7.80±0.24	7.75±0.22	7.65±0.15^{ab}	7.67±0.11^{b}
CD(P≤ 0.05	NS	0.78	NS	NS	0.82	0.31

Values are mean ± SE of three independent determinations
Biscuit I = No mushroom added, Biscuit II = Untreated mushroom, Biscuit III = Treated mushroom; Values with different superscripts differ significantly (P≤0.05) for respective treatment (column wise)

Table 2. Chemical composition of Shiitake mushroom Biscuits

Component	Content			
	Biscuit I	Biscuit II	Biscuit III	CD(P≤0.05)
Proximate composition (%)				
Moisture	2.28±0.12^{a}	6.54 ±0.12^{b}	6.60 ±0.07^{b}	0.39
Crude protein	5.74±0.07^{a}	10.55±0.29^{b}	9.61±0.31^{c}	0.88
Crude Fat	21.50±1.25	20.16±0.44	19.16±1.87	NS
Total Ash	1.31±0.03^{a}	1.52±0.02^{b}	1.49 ± 0.03^{b}	0.09
Crude Fibre	0.35 ± 0.02^{a}	1.71 ± 0.04^{b}	1.81± 0.01^{c}	0.10
Carbohydrate composition (%)				
Total Carbohydrate	71.10±0.04^{a}	66.06±1.17^{b}	67.93±0.35^{b}	2.50
Total Soluble sugars	26.76±0.72	28.80±0.90	26.77±0.80	NS
Reducing sugar	0.66 ±0.14	0.67±0.12	0.65±0.08	NS
Non-Reducing Sugars	26.09±0.84	28.13±0.82	26.12±0.82	NS
Starch	30.00±0.57^{a}	28.33±0.32^{b}	27.33±0.33^{b}	1.51
Dietary fibre constituents(g/100g)				
Total fibre	10.68±0.40^{a}	13.04±0.43^{b}	12.72±0.30^{b}	1.35
soluble fibre	4.23±0.25	4.36±0.18	4.40±0.11	NS
Insoluble fibre	6.45 ±0.51^{a}	8.68±0.28^{b}	8.31 ±0.21^{b}	1.27
Antinutritional factor and *In vitro* protein digestibility				
Polyphenol(mg/100g)	297.03±0.98^{a}	290.68±0.65^{b}	285.34±0.87^{c}	3.00
In vitro protein digestibility (%)	80.07±0.22^{a}	82.21±0.50^{b}	84.78±0.14^{a}	1.16
Mineral content (mg/100g)				
Iron	12.52±0.26^{a}	12.94±0.08^{b}	13.46±0.06^{b}	0.55
Zinc	5.81±0.36	6.65±0.23	6.70±0.02	NS
Phosphorus	90.81±0.09^{a}	269.9±0.15^{b}	270.27±0.03^{b}	0.37
Calcium	53.53±1.30^{a}	61.45±0.19^{b}	63.09 ±0.65^{b}	2.99
HCl extractability (%)				
Iron	60.49±0.62^{a}	69.68±0.16^{b}	70.53±0.23^{c}	0.66
Zinc	67.00±0.57^{a}	69.40±0.30^{b}	72.21±0.48^{c}	1.65
Phosphorus	54.90±0.05^{a}	74.51±0.32^{b}	85.83±0.18^{c}	0.76
Calcium	50.81±0.28^{a}	52.57±0.29^{b}	53.69±0.37^{c}	1.12

Values are mean ± SE of three independent determinations
Biscuits I = No mushroom, Biscuits II = Untreated mushroom, Biscuits III = Treated mushroom powder; Values with different superscripts differ significantly (P≤0.05) in respective row

The total and insoluble fibre content of biscuits I was 10.68 and 6.45 g/100g respectively (Table 2). The polyphenol content and *in vitro* protein digestibility varied significantly (P≤0.05) among the developed biscuits (Table 2). Polyphenol content was highest for biscuit I (297.03 mg/100g) and significantly (P≤0.05) lowest for biscuit III (285.34 mg/100g).

On the contrary *in vitro* protein digestibility was significantly (P≤0.05) highest for biscuit III (84.78%) and lowest for biscuit I (80.07%). It was observed that the biscuits I contained 12.52, 5.81, 90.81, 53.53 mg/100g for iron, zinc, phosphorus and calcium, respectively (Table 2). Biscuits II had iron (12.94 mg/100g), zinc (6.65 mg/100g), phosphorus (269.90 mg/100g)

and calcium (61.45 mg/100g). Similarly Biscuits III had iron (13.46 mg/100g), zinc (6.70 mg/100g), phosphorus (270.27 mg/100g) and calcium (63.09 mg/100g). HCl extractability of iron, zinc, phosphorus and calcium of Biscuits I were 60.49, 67.00, 54.90, 50.81 per cent, respectively. HCl extractability of all minerals were significantly (P≤0.05) higher in Biscuits II (69.68, 69.40, 74.51 and 52.57%) and Biscuits III (70.53, 72.21, 85.83 and 53.69%) respectively (Table 2).

Shelf life studies

Mean organoleptic score for "colour" in three developed biscuits ranged from 7.65 to 7.90 on day 0 and from 6.90 to 7.80 on day 30 of storage (Table 3). No significant (P≤0.05) changes were observed in acceptability of colour in any of biscuits after 30 days of storage. Similarly scores of appearance and aroma also did not exhibit any significant (P≤0.05) changes after storage period. The acceptability scores for appearance were 7.45, 7.50 and 7.25 on day 30. Aroma was also adjudged as "liked very much" after 30 days of storage period for all the three developed biscuits. The texture of biscuit I was significantly (P≤0.05) reduced from 8.30 (day 0 and 15) to 7.00 (day 30). No such significant (P≤0.05) change was observed in scores for texture after storage period in biscuit II and III. Taste and overall acceptability were adjudged as "liked very much" by judges for all three type of developed biscuits after the storage period. During storage period, the fat acidity of biscuit I changed non- significantly (P≤0.05) from 41.85 (0 day) to 45.68 (30 days) mg KOH/100g. The fat acidity of value added biscuits developed from untreated mushroom (biscuit II) and treated mushroom powder (biscuit III) ranged from 39.32 to 43.23 and 37.36 to 41.14 mg KOH/100g, respectively during 0 to 30 days of storage.

Table 3. Sensory characteristics of Shiitake mushroom biscuits after storage

Treatment	Storage period (days)			
	0	15	30	CD(P≤0.05)
		Colour		
Biscuits I	7.85±0.25	7.80±0.21	7.80±0.21	NS
Biscuits II	7.65±0.31	7.50±0.16	6.95±0.36	NS
Biscuits III	7.90±0.26	7.20±0.29	6.90±0.30	NS
		Appearance		
Biscuits I	8.25±0.16	7.90±0.22	7.45 ±0.36	NS
Biscuits II	7.55 ±0.26	7.50±0.16	7.50 ±0.16	NS
Biscuits III	7.25±0.29	7.25 ±0.31	7.25±0.31	NS
		Aroma		
Biscuits I	8.45 ±0.16	8.45±0.22	8.30±0.16	NS
Biscuits II	7.70±0.28	7.80±0.16	7.70±0.16	NS
Biscuits III	7.80 ±0.16	7.70±0.31	7.75±0.31	NS
		Texture		
Biscuits I	8.30±0.25[a]	8.30±0.21[a]	7.00±0.21[b]	0.74
Biscuits II	7.75±0.28	7.75±0.16	7.65±0.16	NS
Biscuits III	7.55±0.21	7.55±0.29	7.25±0.30	NS
		Taste		
Biscuits I	8.30±0.23	8.30±0.25	7.70 ±0.34	NS
Biscuits II	7.65±0.16	7.65±0.16	7.55±0.22	NS
Biscuits III	7.65±0.20	7.55±0.12	7.55±0.21	NS
		Overall Acceptability		
Biscuits I	8.23±0.22	8.15±0.28	8.10 ±0.22	NS
Biscuits II	7.53±0.08	7.60±0.20	7.60±0.24	NS
Biscuits III	7.67±0.11	7.67±0.23	7.60±0.33	NS

Values are mean ± SE of ten independent determinations
Biscuit I = No mushroom added, Biscuit II = Untreated mushroom, Biscuit III = Treated mushroom; Values with different superscripts differ significantly (P≤0.05) in respective raw

No significant (p≤0.05) changes were observed in fat acidity in any of biscuits during 30 days of storage period (Table4). The total bacterial count of biscuits varied from 0 to 5×10^2 (cfu/g) of biscuits during 0 to 30th day of storage (Table5). The total bacterial count of Biscuits I and biscuits II varied from 0 to 5×10^2 and 0 to 4×10^2 cfu /g of biscuits, respectively while that of biscuits III ranged from 0 to 2×10^2 cfu/g of biscuits. These were within the acceptable range upto 30th days of storage.

Table 4. Effect of storage period on fat acidity (mg KOH/100gm) of Shiitake mushroom biscuits (on dry weight basis)

Treatment	Storage (days)			
	0	15	30	CD(P≤0.05)
Biscuits I	41.85±1.33	43.08±1.30	45.68±1.26	5.95
Biscuits II	39.32±0.88	41.13±0.77	43.23±0.88	4.50
Biscuits III	37.36±0.55	39.66±0.95	41.14±0.70	5.69

Values are mean ± SE of three independent determinations
Biscuits I = No mushroom, Biscuits II = Untreated mushroom, Biscuits III = Treated mushroom

Table 5. Total bacterial count (cfu/g) at different storage periods

Treatment	Storage period (days)		
	Total bacterial count (cfu/g)		
	0	15	30
Biscuits I	0	4×10^1	5×10^2
Biscuits II	0	2×10^1	4×10^2
Biscuits III	0	1×10^1	2×10^2

Biscuits I= No mushroom, Biscuits II= Untreated mushroom, Biscuits III= Treated mushroom

DISCUSSION

All the products developed incorporating treated/untreated mushroom were acceptable to the panel of judges and had good nutritional quality and shelf life. Similar work on evaluation (Bora and Kawatra, 2014; Usha and Suguna, 2014) and product development has been reported by various other authors. Wakchaure *et al*. (2010) developed some novel value added products from the dried oyster mushrooms. A good quality of crunchy oyster mushroom biscuits, comparable with commercially available biscuits in terms of appearance and taste were successfully prepared. Dunkwal *et al.* (2009) also prepared mushroom biscuits. Chandrasekher *et al.* (2001), Shah *et al*. (2005), Rai and Arumuganathan, (2008), and Singh *et al*, (2016) have also reported development of acceptable mushroom products.

Conclusion

It may be concluded that the dehydrated Shiitake mushroom can be successfully employed for product development. The changing food habits and increasing health consciousness have led to a gradual increase in demand of processed mushrooms among urban and rural consumers. However such products must suit the taste and choice of common buyers.

REFERENCES

AOAC, 2000. Official Methods of Analysis, 17th edition. Association of the Official Analytical Chemists, Washington D.C, USA.

Boa, E. 2004. Wild edible fungi: A global overview of their use and importance to people. Non- wood forest products series no. 17. Rome: FAO.

Bora, P. and Kawatra, A. 2014. Study on nutritional evaluation and composition of oyster mushrooms (*Pleurotus florida*) . Food Sci. Res. J., **5**(1): 56-58.

Chandrasekar, V., Rai, R.D., Srimivasa Gopal, T.K. and Verma, R.N. 2001. Preparation and storage of mushroom curry in retort pouches. *Mushroom Research,* 10 (2): 103-107.

Chang, R. 1996. Functional properties of edible mushrooms. Nutr. Rev., 54, S91-S93.

Clegg, K.M. 1956. The application of anthrone reagent to the estimation of starch in cereals. *J. Sci. Food Chem. Agric.,* 7: 40-44.

Dunkwal, V. and Jood, S. 2009. Effect of substrate on nutrient composition of oyster mushroom (*Pleurotus sajor caju*). J. Dairying, *Food and Home Science.,* 26 (2):132-136.

Finney, F.F., Morris, V.H. and Yamazaki, W.T. 1950. Micro versus Macro cookies baking procedure for evaluating the cookie quality of wheat varieties. *Cereal chem.,* 25:42-49.

Furda, I. 1981. Simultaneous analysis of soluble and insoluble dietary fibre. In W.P.T. James, and O. Theander (Eds.). The Analysis of Dietary Fibre in Food. Marcel Dekker, New York. pp. 163-172

Lakshmipathy, G., Arunkumar J., abhilash, M., and Shantha, P.R. 2013. Studies on different drying,canning and value addition techniques for mushrooms (*Calocybe Indica*). *African Journal*

Lindsey, W.L. and Norwell, M.A. 1969. A new DPTA-TEA soil test for zinc and iron. Agron. Abst., 61: 84.

Mertz, E.T., Kirleis, A.W. and Sxtell, J.D. 1983. *In vitro* digestibility of protein in major food cereals. Fed. Proc., 32 (5): 6026.

Miles, P.G. and Chang, S.T. 1997. Mushroom Biology-Concise Basics and Current Developments. Singapore: World Scientific, 144.

Peterson, W.H. 1943. Elements of Food Biochemistry. Prentice Hall, Inc. New York, p. 73.

Rai, R.D., and Arumuganathan, T. 2008. Postharvest Technology of Mushrooms. National Research Centre for Mushroom. Chambagat, Solan-173 213, HP India. Pp1-10.

Ranganna, S. 1986. Manual of analysis of fruits & vegetable products. Tata Mc Graw Hills Publishing Company LTD., New Delhi.

Royse, D.J. 2005. Cultivation of Shiitake on natural and synthetic logs. http://pubs.cas.psu.edu/FreePubs/pdfs/ul203.pdf.

Shah, N.S., Rakhi. and Singh, D. 2005. Development of instant mushroom soup mix. Ind. J. Food Packer., 59 (1-6):172-177.

Sheoran, O.P. and Pannu, R.S. 1999. Statistical software package for agricultural research workers *In* Recent advances in information theory, Statistics and Computer application. Eds. Hooda DS and Hasija RC., pp. 139-143

Singh, J., Sindhu, S.C. and Sindhu, A. 2016.Development and evaluation of value added pickle from dehydrated shiitake (*Lentinus edodes)*Mushroom**.** *International Journal of Food Science and Nutrition,* 1(1):24-26.

Singh, U. and Jambunathanan, R. 1981. Studies on *desi* and *kabuli* chickpea cultivars, levels of protease inhibitors, polyphenolic compounds and *in vitro* protein digestibility. *J. Fd. Sci.,* 46: 1364-1367.

Somogyi, M. 1945. A new reagent for the determination of sugar. *J. Biol. Chem.,* 160: 60-61.

Usha, S. and Suguna V. 2014. Investigation on the nutritional value of edible mushrooms viz., *auricularia polytricha* and *pleurotus ostreatus*. *Asian Journal of Science and Technology,* 5(8): 497-500.

Wakchaure, G.C., Mahantesh, S., Manikandan, K. and Lekhraj, R. 2010. Development and evaluation of Oyster mushroom value added products. *Mushroom Research,* 19(1): 40-44.

Yemm, E.W. and Willis, A.J. 1954. The estimation of carbohydrates in plant extracts by anthrone. *Biochem. J.,* 57: 508-514.

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