Formulation and quality evaluation of mushroom (Oyster mushroom) powder fortified potato pudding

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ABSTRACT

Mushrooms are basically fungi, which have a fleshy and spore-bearing fruiting body. They have been in use not only for consumption purposes but also for medicinal purposes since ages. Today mushrooms are eaten by people for their flavor, texture as well as for the health benefits. Addition or fortification of mushrooms in traditional food of India may enhance their acceptance among common people because these are rich in nutrients and provide health benefits. They have a profound ability to boost immune system, fight cancers and improve functioning of important organs, as they are full of proteins, vitamins, minerals, amino acids, antibiotics and antioxidants. Mushrooms can therefore be used as a weapon against malnutrition and starvation because of its high protein and vitamin content. Hence, an attempt was made to develop mushroom powder and fortified potato pudding with mushroom powder and the developed products were evaluated for sensory parameters and nutritive value. Nutritional analysis of powder revealed that mushroom powder retained high amount of protein (22.10g), fibre (15.70g), low amount of fat (1.90g) and good amount of carbohydrate (43.70g) while nutritional analysis of developed potato pudding revealed that 5% (T, sample) fortification of mushroom powder in potato pudding retained high amount of protein (2.28g) and fibre (0.26g) and good amount of fat (1.36g) and carbohydrate (18.93g) than control sample. The organoleptic acceptability of developed potato pudding revealed that 5% (T, sample) fortification of mushroom powder in potato pudding was liked extremely.

Key words: Fortification, Fungi, Health benefits, Organoleptic acceptability, Oyster mushroom, Quality evaluation.

INTRODUCTION

Mushroom is also called white vegetables or “boneless vegetarian meat”. They fall between the best vegetables and animal protein source (Manjunathan et al., 2011). It is a good source of very good quality protein especially rich in lysine and thus supplements well the cereal based Indian diet. Mushroom as the right source of protein to fight protein malnutrition in the cereal-dependent developing countries like India (FAO 1996). 100 to 200 g of mushrooms (dry weight) is required to maintain an optimal nutritional balance in a man weighing 70 kg. Protein value of mushrooms is twice as that of asparagus and potatoes, four times as that of tomatoes and carrots, and six times as that of oranges (Kakon et al., 2012). Mushrooms have been used as human food for centuries, being valued particularly for the variety of flavours and textures. Mushrooms are rich in protein, minerals, vitamins, fibres and they contain an abundance of essential amino acid (Sadler 2003). Modern pharmacological research confirms large parts of traditional knowledge regarding the medicinal effects of mushrooms due to their antifungal, antibacterial, antioxidant and antiviral properties, besides being used as functional foods. Being rich in fibre, protein and Vitamin B, mushrooms help maintain a healthy metabolism. The objective of the study are:

Objectives

1. To develop mushroom powder and determine its nutritive value.
2. To develop product by fortification of mushroom powder.
3. To assess the organoleptic acceptability and nutritive value of developed product.

MATERIALS AND METHODS

The present research was carried out in the Department of Food Science and Nutrition laboratory, College of Home Science, C. S. A. University of Agriculture and Technology, Kanpur.

Procurement of raw materials and development of products: Fresh oyster mushroom was purchased from C. S. A. University of Agriculture and Technology, Kanpur from the section of mushroom research. Mushroom powder was prepared by oven drying method from fresh mushroom (Flow chart 1 and Figure 1). Fortified potato pudding was prepared in which potato was replaced by mushroom powder.
Flow chart 1: Preparation of mushroom powder:

Fresh mushroom
↓
Sorting, washing, trimming
↓
Blanching for 3 minutes
↓
Draining
Oven drying (110°C for 10 hours)/Sun drying
↓
Grinding (3 times) and sieving (2 times)
↓
Making powder
↓
Packed in air tight container

Flow chart 2: Preparation of potato pudding fortified with mushroom Powder

Fresh grated Potato
↓
Fried slightly grated Potato and mushroom powder (@ 5%, 10%, 15% and 20%) separately at medium flame in melted ghee until appearance of light brown color
↓
Remove from gas and allowed to cool, then add pre-boiled milk and avoid lump formation
↓
cook for 5 minutes
Remove from flame
↓
Add sugar and chopped dry fruits
↓
mix well
Cook for 1 minute

Organoleptic evaluation: The developed products were evaluated for organoleptic quality attributes using nine point Hedonic scale by a panel of 10 semi trained judges.

Nutritive value: The developed products were analyzed for the proximate principles namely moisture, crude protein, crude fat, carbohydrate, total ash and crude fibre using standardized procedure of AOAC (1980).

Statistical analysis: Tested analysis of variance (ANOVA) were used to analyzed the obtained data on the basis of completely randomized design in order to study the effect of mushroom powder fortification at different levels (5%, 10%, 15% and 20%) on sensory qualities and nutrient content of prepared products.

Table 1: Recipe for mushroom powder fortified potato pudding:

<table>
<thead>
<tr>
<th>Ingredients (g)</th>
<th>Control</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato</td>
<td>100</td>
<td>95</td>
<td>90</td>
<td>85</td>
<td>80</td>
</tr>
<tr>
<td>Mushroom powder</td>
<td>-</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Skim milk</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Hydrogenated fat</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Sugar</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Chopped dry fruits</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 2: Nutritive value of developed mushroom powder:

<table>
<thead>
<tr>
<th>Parameters (g/100g)</th>
<th>Mean score of Nutrient content of Mushroom(Oyster mushroom) powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>12.80</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>22.10</td>
</tr>
<tr>
<td>Crude Fat</td>
<td>1.90</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>43.70</td>
</tr>
<tr>
<td>Crude Fibre</td>
<td>15.70</td>
</tr>
<tr>
<td>Total ash</td>
<td>3.80</td>
</tr>
</tbody>
</table>

Note: A - 5 per cent, B - 10 per cent, C- 15 per cent and D- 20 per cent of mushroom powder fortification
RESULTS AND DISCUSSION

Nutritive value of developed mushroom powder: The nutrient components not only determine shelf-life and nutritional quality but also determine end uses in development of designer foods for specific purposes. The sample (Mushroom Powder) was analyzed for proximate and results were presented in Table 2. Moisture content of flour is very important for its shelf life, lower the moisture content, the better its storage stability (Butt et al., 2004). Table shows that the moisture content of mushroom powder was 12.80 which are almost similar to most of the cereal and millets. The mean score of crude protein was 22.10 in mushroom powder. Stamets (2005) also reported approximate similar values for protein content 19.23 in mushroom on the dry weight basis (g/100g). The mean score of crude fat was 1.90 in mushroom powder. Approximate similar values for fat 2.70 content in mushroom on the dry weight basis (g/100g) was reported (Stamets, 2005). Being low in fat, but desirable fat devoid of cholesterol, these make an ideal diet for the heart patients. The mean value of carbohydrate was 43.70 in mushroom powder. Stamets (2005) also reported values for carbohydrate 56.61 content in mushroom on the dry weight basis (g/100g) which is slightly higher than tabulated data. The mean score of crude fibre was 15.70 in mushroom powder. Manzi et al., (2004) reported that Mushroom contain good quality fibre. The mean value of total ash was 3.80 in mushroom powder.

The result revealed that mushroom contains high protein, low fat, low calories, low carbohydrates, high fibre and no cholesterol.

Organoleptic evaluation mushroom powder fortified potato pudding

Color and appearance: Table 3 shows the mean score of control sample was 8.00 whereas value obtained by T1 (5%), T2 (10%), T3 (15%) and T4 (20%) mushroom fortified potato puddings were 8.20, 8.20, 7.40 and 7.00 respectively. The result shows that T1 (5%) and T2 (10%) fortified samples had better color and appearance than control and other fortified products.

Taste and flavor: Table 3 shows that mean score of control sample was 9.00 while the mean value of T1 (5%), T2 (10%), T3 (15%) and T4 (20%) mushroom fortified potato pudding were 8.80, 8.20, 7.20 and 6.60 respectively in taste and flavor. The results show that, the mean score value of control sample was higher than fortified products at different level. But the T1 (5%) fortified product shows better taste and flavor than other fortified products.

Texture: It is evident from the Table 3 that the mean score of control sample was 8.00 whereas for T1 (5%), T2 (10%), T3 (15%) and T4 (20%) mushroom fortified potato pudding were 8.60, 8.20, 8.00 and 7.20 respectively. The results from Table 3 show that control and fortified products were significant at the level of 5 per cent. The result shows that T1 (5%) fortified sample had better texture than other fortified products.

Overall acceptability: Table 3 shows that the mean score of overall acceptability of control sample was 8.30, while the mean value of T1 (5%), T2 (10%), T3 (15%) and T4 (20%) mushroom fortified potato pudding were 8.50, 8.20, 7.50 and 6.90 respectively. The result shows that overall acceptability of T1 (5%) fortified sample had higher than control and other fortified products.

Significant difference (p<0.05) was found for all sensory attributes between control and fortified potato puddings. The overall organoleptic acceptability of different samples of potato pudding shows that 5 per cent mushroom fortified sample had better sensory characteristic than control and other fortified samples and 10 per cent fortified sample had also good sensory characteristic. 5 per cent mushroom fortified potato pudding is liked by all age group peoples because of its good sensory quality and nutritional value. Therefore, T1 (5% fortification of mushroom powder) and control of potato pudding were selected for further study (Nutritive value). Wakchaure et al., (2010) studied on development of some novel value-added products from the fresh/dried oyster mushrooms. A good quality of crunchy oyster mushrooms biscuits comparable with commercially available biscuits in terms of appearance and taste were successfully prepared. In a similar study, Piemolini-Barreto et al., (2012) developed white chocolate with addition of dehydrated mushroom powder. White chocolate mushroom added showed an increase of protein and fiber, compared to white chocolate. Through the sensory analysis it was verified that the addition of mushrooms in the proportions tested did not affect the sensory attributes (color, aroma, texture and flavor) of chocolate. The results show that the addition of

Table 3: Organoleptic evaluation of mushroom powder fortified potato pudding:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>SE</th>
<th>CD5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taste and Flavor</td>
<td>9.00</td>
<td>8.80</td>
<td>8.20</td>
<td>7.20</td>
<td>6.60</td>
<td>0.3346</td>
<td>0.69*</td>
</tr>
<tr>
<td>Texture</td>
<td>8.00</td>
<td>8.60</td>
<td>8.20</td>
<td>8.00</td>
<td>7.20</td>
<td>0.3794</td>
<td>0.79*</td>
</tr>
<tr>
<td>Color and Appearance</td>
<td>8.00</td>
<td>8.20</td>
<td>8.20</td>
<td>7.40</td>
<td>7.00</td>
<td>0.3687</td>
<td>0.76*</td>
</tr>
<tr>
<td>Overall Acceptability</td>
<td>8.30</td>
<td>8.50</td>
<td>8.20</td>
<td>7.50</td>
<td>6.90</td>
<td>0.3224</td>
<td>0.67*</td>
</tr>
</tbody>
</table>

T1 - 5 per cent, T2 - 10 per cent, T3 - 15 per cent and T4 - 20 per cent of mushroom powder fortification
SE- Standard Error, *- Significant at 5 per cent level
white chocolate mushroom can provide significant amounts of nutritional and functional compounds in the diet.

**Nutritive value of mushroom powder fortified potato pudding:** Table 4 shows that mean score of protein, crude fat, carbohydrate, crude fibre and total ash content in control sample of potato pudding were 1.90, 1.35, 18.70, 0.03 and 0.61 respectively. While the mean value of protein, crude fat, carbohydrate, crude fibre and total ash content for T1(5%) were 2.28, 1.36, 18.93, 0.26 and 0.63 respectively. Significant difference (p<0.05) was found for all nutrients content between control and fortified potato pudding. So, Table 4 revealed that nutrient content of 5% fortified product was higher than control.

It is concluded from the Table 4 that mushroom powder fortified potato pudding are considered as a nutritious calories-dense food because they are rich in carbohydrate, fat and dietary fibres but high in protein value.

Okafor et al., (2012) revealed that Bread containing graded levels of Mushroom Powder (MP) was produced by replacement of Wheat Flour (WF) with 0, 5, 10, 15, 20 and 25% MP. Effect of MP supplementation on the bread making properties, proximate composition and sensory qualities were evaluated. Supplementation of WF with MP from 0-25% increased the crude protein content significantly from 7.96-14.62%, ash from 0.90-2.64% and crude fiber 0.51-2.48%.

**CONCLUSION**

This study indicates that mushroom powder can be easily prepared under optimized process condition. Organoleptic acceptability of mushroom fortified potato pudding revealed that 5% fortification of mushroom powder in potato pudding was liked extremely and also nutritious. Mushroom fortified products are suggested for Children in growing age, pregnant and lactating women, and old persons who require high protein diet.

### Table 4: Nutritive value of mushroom powder fortified potato pudding (per 100 g):

<table>
<thead>
<tr>
<th>Parameters (g/100g)</th>
<th>Mean Score of Study Group Products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>1.90</td>
</tr>
<tr>
<td>Crude Fat</td>
<td>1.35</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>18.70</td>
</tr>
<tr>
<td>Total ash</td>
<td>0.61</td>
</tr>
<tr>
<td>Crude Fibre</td>
<td>0.03</td>
</tr>
</tbody>
</table>

REFERENCES


