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Study on mushroom flour and it's potential for bread making

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Abstract

The present investigation entitled "Study on mushroom flour and it's potential for bakery product" was carried out at the Research laboratory, ITM University, Gwalior (M.P.). Mushrooms of *Pleurotus* genus are commonly known as "oyster mushroom" and popularly consumed all over the world. Oyster mushrooms are the second most widely cultivated mushrooms in the world and Turkey. Mushrooms are rich in proteins, minerals, vitamins, nonstarchy carbohydrates, and dietary fibers, and they have quite low cholesterol, calories, and fat content. The highly perishable nature of fresh mushrooms is attributed to their high moisture content (85%–95%) which favors microbial activities, high respiration rate, delicate texture, and high enzymatic activities. Mushrooms cannot be stored for more than 24 h at ambient temperature, while they can be stored for 1 to 2 weeks in refrigerated conditions. Low temperature storage of mushrooms decreases respiration and transpiration, delays aging, reduce the softening, enhance the textural firmness, prevents water loss, wilting and wrinkling, and, thus, extends the shelf life. Bread is one of the most widely consumed food product in the world and bread making technology is probably one of the oldest technology known. A lot of work is done on fortification of wheat flour with high protein materials from plant sources such as legumes to increase the protein and improve the essential amino acid balance of the resultant baked product such as bread has been recognized. Starch is an important ingredient in a range of formulated products, many of which are baked. The experiment was laid out in the Completely Randomized Design with three replications. Each replication was comprised of seven treatments consisting different concentration of wheat flour and mushroom flour in bakery product. Result concluded that the treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) was found the best treatment of wheat and mushroom flour for making bakery products among all the treatments and it was significantly influenced the different bio-chemical, minerals, physico-chemical and sensory parameters of bakery products. The maximum bio-chemical, minerals, physico-chemical and sensory parameters were recorded in treatment T_7 (85 % Wheat flour + 15 % Mushroom flour), whereas the maximum parameters were observed in treatment T_1 (100 % Wheat flour).

Introduction

Mushrooms of *Pleurotus* genus are commonly known as "oyster mushroom" and popularly consumed all over the world. Oyster mushrooms are the second most widely cultivated mushrooms in the world and Turkey. Mushrooms are rich in proteins, minerals, vitamins, nonstarchy carbohydrates, and dietary fibers, and they have quite low cholesterol, calories, and fat content. The highly perishable nature of fresh mushrooms is attributed to their high moisture content (85%–95%) which favors microbial activities, high respiration rate, delicate texture, and high enzymatic activities. Mushrooms cannot be stored for more than 24 h at ambient temperature, while they can be stored for 1 to 2 weeks in refrigerated conditions. Low temperature storage of mushrooms decreases respiration and transpiration, delays aging, reduce the softening, enhance the textural firmness, prevents water loss, wilting and wrinkling, and, thus, extends the shelf life. Bread is one of the most widely consumed food product in the world and bread making technology is probably one of the oldest technology known. A lot of work is done on fortification of wheat flour with high protein materials from plant sources such as legumes to increase the protein and improve the essential amino acid balance of the resultant baked product such as bread has been recognized. Starch is an important ingredient in a range of formulated products, many of which are baked.

Material and Methods

The experiment was laid out in the Completely Randomized Design with three replications. Each replication was comprised of seven treatments (viz., T_1 – 100 % Wheat flour, T_2 – 97.5 % Wheat flour + 2.5 % Mushroom flour, T_3 – 95 % Wheat flour + 5 % Mushroom flour, T_4 – 92.5 % Wheat flour + 7.5 % Mushroom flour, T_5 – 90 % Wheat flour + 10 % Mushroom flour, T_6 – 87.5 % Wheat flour + 12.5 % Mushroom flour and T_7 – 85 % Wheat flour + 15 % Mushroom flour) consisting different concentration of wheat flour and mushroom flour in bakery product.

Result and Discussion

pH

The results clearly indicate that the different treatments of wheat flour and mushroom flour were significantly affecting the pH in bakery product. It was observed that the maximum pH was recorded in treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) and it was found the best treatment among all the treatments, whereas the minimum

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pH was found in treatment T_1 (100 % Wheat flour). Similar results for most of the characters were also reported by Adeoye *et al.* (2019) and Dhankar *et al.* (2019).

Total sugar (%)

Result revealed that the different treatments of wheat flour and mushroom flour were significantly influenced the total sugar percent in bakery product. It was recorded that the maximum total sugar was recorded in treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) and it was found the best treatment among all the treatments. However, the maximum total sugar was noted in treatment T_1 (100 % Wheat flour). These results are supported by the findings of Alemu *et al.* (2017), Adeoye *et al.* (2019) and Jahan *et al.* (2019).

TSS (^{0}Brix)

It is evident from the data that the maximum TSS was recorded in treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) and it was found the best treatment of wheat and mushroom flour for making bakery products as compared to all the treatments. However, the minimum TSS was noted in treatment T_1 (100 % Wheat flour). Findings are in agreement with those of Mishra *et al.* (2018) and Dhankar *et al.* (2019).

Moisture (%)

Results revealed that the treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) was found the best treatment of wheat and mushroom flour for making bakery products among all the treatments and it gave the minimum moisture content. However, the maximum moisture content was recorded in treatment T_1 (100 % Wheat flour). The high moisture contents of the bread samples may be attributed to the water added during the baking process. The results are in confirmation with the results achieved by Verma *et al.* (2017), Adeoye *et al.* (2019), Jahan *et al.* (2019) and Samsudin *et al.* (2019).

Crude protein (%)

It was recorded that the maximum protein content was found in treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) and it was found the best treatment of wheat and mushroom flour for making bakery products as compared to all the treatments and the minimum protein content was observed in treatment T_1 (100 % Wheat flour). This may be due to wheat flour is a poor source of the protein and good source of carbohydrate. In contrast, as the mushroom powder concentration increased the protein concentration of the whole wheat

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flour bread samples increased. Similar results for most of the characters were also reported by Dhankar *et al.* (2019), Samsudin *et al.* (2019) and Irakiza *et al*. (2021).

Crude Fat

The results indicated that the different treatments of wheat flour and mushroom flour were significantly influenced the fat percent in bakery product. It was recorded that the minimum crude fat percent was found in treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) and it was found the best treatment among all the treatments. However, the maximum crude fat percent was recorded in treatment T_1 (100 % Wheat flour). Mushroom powder concentration increased the fat content also decreased. The high fat contents of the bakery products may be attributed to the refined oil added during the baking process. These results are supported by the findings of Alemu *et al.* (2017), Singh (2017), Adeoye *et al.* (2019) and Jahan *et al.* (2019).

Crude Fibre

The investigation revealed that the treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) was found the best treatment of wheat and mushroom flour for making bakery products among all the treatments and it gave the maximum crude fibre, whereas the minimum crude fibre was recorded in treatment T_1 (100 % Wheat flour). The fiber content percent of the bakery products also increased as the substitution of mushroom powder was increased in the prepared whole wheat flour bread samples. The results are in confirmation with the results achieved by Mishra *et al.* (2018), Dhankar *et al.* (2019) and Farzana *et al.* (2019).

Ash

The result revealed that the maximum ash was recorded in treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) and it was found the best treatment of wheat and mushroom flour for making bakery products as compared to all the treatments and the minimum ash percent was noted in treatment T_1 (100 % Wheat flour). Ash contents directly represents the mineral contents of certain foods, mushroom powder concentration increases, the ash content of making bakery products was also increased. Similar results for most of the characters were also reported by Makinde *et al.* (2014), Dhankar *et al*. (2019) and Jahan *et al.* (2019).

Carbohydrate

The results indicated that the different treatments of wheat flour and mushroom flour were significantly influenced the carbohydrate percent in bakery product. It was

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recorded that the minimum carbohydrate was observed in treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) and it was found the best treatment among all the treatments. However, the maximum carbohydrate was found in treatment T_1 (100 % Wheat flour). Carbohydrates are the major composition of the many plant based foods, and they are the immediate energy sources in the metabolism. The carbohydrate contents of the breads decreased significantly as mushroom powder concentration was increased. The decrease in carbohydrate might be due to increase in crude protein, crude fat and ash content. Findings are in agreement with those of Alemu *et al.* (2017) and Irakiza *et al*. (2021).

Calcium, Sodium, Potassium and Magnesium

Result reported that the maximum calcium, sodium, potassium and magnesium content was recorded in treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) and it was found the best treatment of wheat and mushroom flour for making bakery products as compared to all the treatments. However, the minimum calcium, sodium, potassium and magnesium content was noted in treatment T_1 (100 % Wheat flour). These results are supported by the findings of Verma *et al.* (2017), Chitra *et al.* (2018), Mishra *et al*. (2018), Farzana *et al.* (2019) and Samsudin *et al.* (2019).

Vitamin-D_2

It is evident from the above data that the treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) was found the best treatment of wheat and mushroom flour for making bakery products among all the treatments and it gave the maximum vitamin-D_2, whereas the minimum vitamin-D_2 was observed in treatment T_1 (100 % Wheat flour). These results are supported by the findings of Verma *et al.* (2017) and Samsudin *et al.* (2019).

Protein digestibility (%)

Results revealed that the maximum protein digestibility (%) was recorded in treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) and it was found the best treatment of wheat and mushroom flour for making bakery products as compared to all the treatments and the minimum protein digestibility (%) was noted in treatment T_1 (100 % Wheat flour). Similar results for most of the characters were also reported by Yuan Biao *et al.* (2019) and Irakiza *et al*. (2021).

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Energy (Kcal/100g)

The maximum energy (Kcal /100g) was recorded in treatment T_4 (92.5 % Wheat flour + 7.5 % Mushroom flour) and the minimum energy (Kcal /100g) was noted in treatment T_7 (85 % Wheat flour + 15 % Mushroom flour). Similar results for most of the characters were also reported by Adeoye *et al.* (2019).

Conclusion

Result concluded that the treatment T_7 (85 % Wheat flour + 15 % Mushroom flour) was found the best treatment of wheat and mushroom flour for making bakery products among all the treatments and it was significantly influenced the different bio-chemical, minerals and physico-chemical of bakery products. The maximum bio-chemical, minerals and physico-chemical were recorded in treatment T_7 (85 % Wheat flour + 15 % Mushroom flour), whereas the minimum parameters were observed in treatment T_1 (100 % Wheat flour).

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Table no. 1: Effect of mushroom flour and potential of mushroom flour on bio-chemical, minerals and physico-chemical in bakery product

Treatment symbols	Treatment details	pH	Total sugar (%)	TSS (^{0}Brix)	Moisture content (%)	Crude protein (%)	Crude fat (g/100g)	Crude fibre (g/100g)	Ash (g/100g)
T_1	100 % Wheat flour	5.50 ± 0.087	4.30 ± 0.052	3.13 ± 0.046	34.02 ± 0.102	9.05 ± 0.080	1.70 ± 0.010	1.60 ± 0.043	1.47 ± 0.043
T_2	97.5 % Wheat flour + 2.5 % Mushroom flour	5.54 ± 0.050	4.36 ± 0.058	3.42 ± 0.055	33.98 ± 0.078	9.79 ± 0.138	1.65 ± 0.021	1.76 ± 0.049	1.59 ± 0.032
T_3	95 % Wheat flour + 5 % Mushroom flour	5.59 ± 0.017	4.42 ± 0.035	3.55 ± 0.068	33.73 ± 0.044	10.48 ± 0.134	1.64 ± 0.019	1.87 ± 0.044	1.65 ± 0.018
T_4	92.5 % Wheat flour + 7.5 % Mushroom flour	5.62 ± 0.006	4.53 ± 0.050	3.62 ± 0.038	33.55 ± 0.068	11.50 ± 0.156	1.62 ± 0.023	2.05 ± 0.051	1.71 ± 0.029
T_5	90 % Wheat flour + 10 % Mushroom flour	5.65 ± 0.051	4.61 ± 0.036	3.76 ± 0.045	33.02 ± 0.104	12.21 ± 0.182	1.57 ± 0.020	2.06 ± 0.049	1.93 ± 0.044
T_6	87.5 % Wheat flour + 12.5 % Mushroom flour	5.70 ± 0.009	4.65 ± 0.047	3.90 ± 0.026	32.92 ± 0.176	13.56 ± 0.154	1.55 ± 0.017	2.20 ± 0.026	2.01 ± 0.035
T_7	85 % Wheat flour + 15 % Mushroom flour	5.73 ± 0.044	4.70 ± 0.058	4.00 ± 0.069	32.06 ± 0.253	14.02 ± 0.104	1.52 ± 0.038	2.31 ± 0.030	2.10 ± 0.066
	SEm ±	**0.046**	**0.049**	**0.052**	**0.136**	**0.139**	**0.022**	**0.043**	**0.041**
	CD 5%	**0.140**	**0.148**	**0.157**	**0.412**	**0.422**	**0.068**	**0.130**	**0.124**

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Table no. 2: Effect of mushroom flour and potential of mushroom flour on bio-chemical, minerals and physico-chemical in bakery product

Treatment symbols	Treatment details	Carbohydrate (g/100g)	Calcium content (mg/100g)	Sodium content (mg/100g)	Potassium content (mg/100g)	Magnesium content (mg/100g)	Vitamin-D_2 (µg/100g)	Protein digestibility (%)	Energy (Kcal /100g)
T_1	100 % Wheat flour	86.17 ± 0.133	110.33 ± 0.997	700.68 ± 8.314	12.00 ± 0.161	28.02 ± 0.104	0.05 ± 0.012	0.965 ± 0.0015	396.18 ± 0.94
T_2	97.5 % Wheat flour + 2.5 % Mushroom flour	85.21 ± 0.193	113.33 ± 1.470	741.69 ± 8.592	12.62 ± 0.054	29.20 ± 0.175	0.06 ± 0.007	0.966 ± 0.0012	394.85 ± 1.51
T_3	95 % Wheat flour + 5 % Mushroom flour	84.35 ± 0.168	117.78 ± 1.255	781.77 ± 8.669	13.26 ± 0.156	30.17 ± 0.235	0.07 ± 0.009	0.966 ± 0.0007	394.08 ± 1.29
T_4	92.5 % Wheat flour + 7.5 % Mushroom flour	83.12 ± 0.185	121.31 ± 0.580	818.55 ± 8.754	14.02 ± 0.102	30.74 ± 0.160	0.08 ± 0.006	0.967 ± 0.0012	393.06 ± 1.57
T_5	90 % Wheat flour + 10 % Mushroom flour	82.23 ± 0.259	124.21 ± 0.580	848.69 ± 15.406	14.86 ± 0.144	31.14 ± 0.188	0.09 ± 0.003	0.968 ± 0.0006	391.89 ± 1.94
T_6	87.5 % Wheat flour + 12.5 % Mushroom flour	80.68 ± 0.157	128.52 ± 0.635	866.80 ± 5.474	15.65 ± 0.218	31.70 ± 0.168	0.09 ± 0.018	0.969 ± 0.0015	390.91 ± 1.39
T_7	85 % Wheat flour + 15 % Mushroom flour	80.06 ± 0.106	130.10 ± 0.872	890.59 ± 5.998	17.03 ± 0.111	32.07 ± 0.183	0.10 ± 0.009	0.970 ± 0.0017	390.00 ± 1.18
	SEm ±	**0.177**	**0.969**	**9.243**	**0.144**	**0.177**	**0.010**	**0.001**	

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	CD 5%	**0.538**	**2.938**	**28.038**	**0.435**	**0.537**	**0.030**	**0.004**	**-**

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