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Sensory and Consumer Acceptability of Mushroom Powder Incorporated Products

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ABSTRACT: The present study was conducted with the main objective to determine the sensory and consumer acceptance of two value added products *i.e.,* cake and toffee developed by incorporating the mushroom (*Pleurotus Hypsizygus ulmarius*) powder. Mushroom powder was incorporated in cake formulation by replacing refined wheat flour at various proportions (0-30%) *i.e.,* 10, 15, 20, 25 and 30% on dry weight basis. While, toffee formulations were prepared by replacing papaya pulp at various proportions (0-15%) *i.e.*, 3, 5, 10 and 15% on dry weight. Organoleptic evaluation was conducted to evaluate the sensory profile of the formulated products. Best accepted formulation from two products were subjected to consumer acceptability by untrained panelists (n=80). Sensory scores revealed that cake formulated by incorporating 20% mushroom powder and toffee formulated by incorporating 10% mushroom powder scored high for sensorial characteristics and were acceptable by all the consumers during consumer acceptability study. Nutritionally, mushroom incorporated food products can highly contribute to tackle protein malnutrition and other micronutrient deficiencies, as well as acting as a novel food fortification strategy.

Keywords: Mushroom powder, cake, toffee, sensory evaluation, consumer acceptability.

INTRODUCTION

The food habits of the world's population have changed dramatically due to alarming rates of non-communicable diseases over the past two decades. People prefer dietary management of such diseases to costly medicinal drugs with potential side effects. As a result, the demand for health-promoting or functional foods has increased rapidly in recent years. Edible mushrooms formerly known as "food of the gods," (Utpal *et al.,* 2015) are still used as a garnish or delicacy, can now be consumed on a regular basis as part of the human diet or as functional food. Historically, mushrooms have been valued for their flavour, economics, ecological value, and medicinal properties (Sanchez, 2010). On a dry basis, mushrooms contain almost 50% carbohydrate, 25% protein, and 3% crude fat (Kotwaliwale *et al.*, 2007).

The low calories, sodium, fat and cholesterol in mushrooms make them a healthy food. Additionally, it contains significant amounts of dietary fiber and β-glucan, vitamin D, vitamin B complex and many other nutrients that can be beneficial for the body (Dunkwal *et al.,* 2007). The modern science of nutrition has moved to understanding the physiological and genetic mechanisms by which the diet and individual food components influence health and diseases (Akinwunmi and Omotayo 2016). It is true that most processed foods do provide some nutritional value, developing a healthy processed foods provide acceptable nutritional composition and a great sensory experience to the consumers (Martins *et al.,* 2017). Therefore, the aim of the present study was to develop a novel variety of cake and toffee enriched with incorporation of mushroom powder and investigate sensory and consumer acceptance of mushroom powder incorporated products.

MATERIALS AND METHOD

The present study was conducted in the department of foods and nutrition, Post Graduate and Research

Centre, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad.

Preparation of mushroom powder: Fresh mushrooms were collected from the mushroom cultivation scheme, Department of Plant Pathology, College of Agriculture, PJTSAU, Rajendranagar. Mushroom powder was prepared according to the method developed by Kumar *et al*. (2019). In brief, collected mushrooms were cleaned, cut into slices, blanched for 3 minutes later dried in tray drier at 60° until constant moisture level was reached (10%). The dried mushrooms were ground into fine powder and stored in plastic containers further used for product development.

Product Development:

Preparation process for cakes: The cakes were prepared by partial replacement of refined wheat flour with mushroom powder at different proportions *i.e*., 0, 10, 15, 20 25 and 30%.

All weights of refined wheat flour, mushroom flour and other ingredients (sugar, milk powder, oil, baking soda, salt and essence) for all the formulations were taken accurately and mixed thoroughly. The mixture was poured into the mould and baked in the preheated oven at the temperature 140° for 30 minutes.

Preparation process for toffee: The toffees were formulated by partial replacement of papaya pulp with mushroom flour at different proportions *i.e.,* 0, 3, 5, 10 and 15%.

Briefly, Papaya pulp was heated until the raw smell goes off. Mushroom flour, sugar, glucose was added and allowed to cook until it reaches to 80˚ brix.

Sensory Evaluation of the formulated products: Sensory evaluation was conducted for selecting the best accepted formulation from the developed products (cake and toffee) using 9-points hedonic scale (Meilgaard *et al*., 1999) with the help of 25 semi trained panelists.

Consumer acceptability of the mushroom products: Both the accepted products were subjected to consumer acceptability. Consumer acceptance of the mushroom incorporated products were assessed by using structured questionnaire and sensory evaluation developed by Lawless and Heymann (2010) along with sensory evaluation. A total of 80 untrained members of different age groups (6-40 years) were selected randomly to determine the consumer acceptance and perceptions toward mushroom incorporated food products.

Statistical Analysis: Statistical analysis was carried out by one-way ANOVA method using INDOSTAT statistical software for finding out the best accepted formulations and for consumer acceptability of mushroom incorporated products.

RESULTS AND DISCUSSION

Sensory scores for the developed products: Sensory quality of any developed food product depends on its appearance, colour, flavour, taste, texture and overall acceptability (Sheikh *et al.,* 2010). Cakes formulated by incorporating 0,10, 15, 20, 25 and 30% mushroom powder on dry weight basis and toffees formulated by incorporating 0, 3, 5, 10 and 15% mushroom powder were subjected to sensory evaluation. The mean sensory scores of mushroom incorporated cakes and toffees were tabulated in the Table 2 and Table 3.

Cake: Table 2 revealed that, statistically significant difference ($P<0.01$) in texture and overall acceptability was observed statistically between the cake samples. Among all the five formulated cakes, 20% mushroom incorporated cake was found higher for overall acceptability and was selected as the best accepted formulation for carrying out the consumer acceptability study.

A similar study conducted by Arora *et al*. (2017) reported that cake with 20% wheat flour replacement with mushroom powder was closely related in sensorial attributes with control sample.

Toffee: Table 3 revealed that, statistically significant difference ($P<0.01$) was found in colour, taste, texture and overall acceptability between the formulated toffees. Toffee with 10% mushroom powder incorporated had the highest overall acceptability score compared to other formulations. Hence, toffee with 10% mushroom powder incorporated was selected as the best accepted formulation for carrying out the consumer studies.

Consumer acceptance of mushroom incorporated products: Many factors influence consumer acceptance of food products, including the characteristics of the offered product, consumer characteristics, and social conditions. Price, convenience, taste, general appearance, and health-promoting properties of a food product all play a role in its acceptance by consumers. Furthermore, consumer characteristics such as approach to innovation, preferences for specific food groups, or nutritional neophobia heavily influence food acceptance. Food preferences differ across age groups in terms of food knowledge, views on the health benefits of specific food groups, and attitudes toward food. Social conditions, such as the country's economy, political conditions, or generally accepted social norms, also influence consumer acceptance.

However, consumer acceptance of the mushroom incorporated products was assessed through structured questionnaire and sensory evaluation. The respondents were asked about the snacking pattern, frequency of consumption and selection of snacks etc. The detailed were presented in Table 1.

Table 1: Consumers attitude towards snacking.

Description	Yes (%)	No (%)
Consumption of snack between meals	66	34
Is it hard to find healthy snack option	95	5
Awareness on health benefits that mushroom offers	85.1	14.9
Ever tried mushroom incorporated products	89.5	10.5

Table 2: Sensory Scores of cake formulations.

Sample	Appearance	Colour	Flavour	Taste	Texture	Overall Acceptability
Control	8.30±0.20^{cb}	8.30±0.23^{b}	8.15±0.31^{a}	8.35±0.22^{a}	8.55±0.18^{a}	8.60±0.18^{a}
MC1	8.45±0.18^{a}	8.45±0.18^{a}	7.85±0.39^{c}	7.95±0.38^{b}	8.15±0.25^{c}	8.35±0.20^{c}
MC2	8.30±0.21^{ca}	8.20±0.21^{ca}	7.65±0.31^{e}	7.60±0.34^{da}	7.60±0.31^{d}	7.80±0.26^{d}
MC3	8.40±0.18^{b}	8.20±0.20^{cb}	7.90±0.17^{b}	7.90±0.19^{c}	8.50±0.18^{b}	8.38±0.20^{b}
MC4	8.15±0.22^{d}	8.05±0.19^{d}	7.75±0.23^{d}	7.60±0.18^{db}	7.25±0.27^{e}	7.55±0.23^{e}
MC5	7.90±0.20^{e}	7.75±0.20^{e}	7.35±0.28^{f}	7.25±0.17^{e}	7.10±0.26^{f}	7.30±0.24^{f}
CD	0.57	0.57	0.82	0.73	0.69	0.62
CV%	11.03	11.26	17.03	15.17	14.45	12.65
P- Value	0.44^{NS}	0.24^{NS}	0.56^{NS}	0.07^{NS}	0.00**	0.00**

Note: Values are expressed as mean ± standard deviation of three determinations. Values with similar superscripts within columns are statistically similar at 0.05% level. *(P<0.05); **(P<0.01); NS- Non-Significant

Table 3: Sensory Scores of toffee formulations.

Sample	Appearance	Colour	Flavour	Taste	Texture	Overall Acceptability
Control (CT)	8.50 ±0.15^{a}	8.80±0.09^{a}	8.25±0.23^{b}	8.55±0.17^{a}	8.40±0.16^{b}	8.40±0.23^{b}
MT1	8.10±0.16^{c}	8.20±0.15^{c}	8.05±0.11^{c}	8.10±0.12^{c}	8.05±0.11^{cb}	8.00±0.10^{c}
MT2	8.05±0.15^{da}	8.10±0.19^{da}	7.80±0.15^{e}	7.75±0.19^{e}	8.05±0.13^{ca}	7.85±0.10^{d}
MT3	8.35±0.13^{b}	8.55±0.13^{b}	8.30±0.17^{a}	8.50±0.11^{b}	8.50±0.11^{a}	8.60±0.11^{a}
MT4	8.05±0.11^{db}	8.10±0.12^{db}	7.85± 0.15^{d}	7.80±0.17^{d}	7.60±0.15^{d}	7.40±0.18^{e}
CD	0.40	0.40	0.48	0.44	0.38	0.44
CV%	7.82	7.66	9.59	8.61	7.63	8.73
P- Value	0.09^{NS}	0.00**	0.15^{NS}	0.00**	0.00**	0.00**

Note: Values are expressed as mean ± standard deviation of three determinations. Values with similar superscripts within columns are statistically similar at 0.05% level. *(P<0.05); **(P<0.01); NS- Non-Significant

Consumer preference towards the mushroom incorporated (Cake and Toffee) were illustrated in the Fig. 1, 2.

Fig. 1 clearly depicted that, in terms of cake`s appearance, 8.5 % consumers liked moderately, 55.3% liked very much and 36.2% liked extremely. 12.8% liked colour of the cake moderately, the majority of consumers (44.7%) liked the colour very much, and 42.6% liked cake`s colour extremely. In terms of taste, 10.6% liked it moderately, 38.3 % liked very much and 51.1 % liked extremely. 10.6% liked flavour of the cake moderately, majority of consumers (48.9%) liked the flavour of the cake very much and 40.4 % liked extremely. In terms of texture, 6.4% liked moderately, 55.3 % of consumers liked the cake's texture very much and 38.3% liked extremely. In terms of overall acceptability, only 2.1 % liked the cake slightly, 8.5% who liked moderately followed by 42.6 % who liked very much and majority of consumers (46.8%) liked cake extremely.

Fig. 2 clearly revealed that, toffee's colour was liked moderately by 2.1%, 36.2 % liked very much and 61.7% of consumers liked colour of the toffee extremely. In terms of toffee`s taste, 2.1% of consumers liked moderately, 38% liked very much and majority of the consumer 57.4% liked toffee`s taste extremely. Toffee's flavour, texture, and overall acceptability were liked moderately by 8.5%, 4.3% and 2.1%, very much by 36.2%, 36.2% and 44.7%, and extremely by 55.3%, 59.6% and 53.2% of consumers.

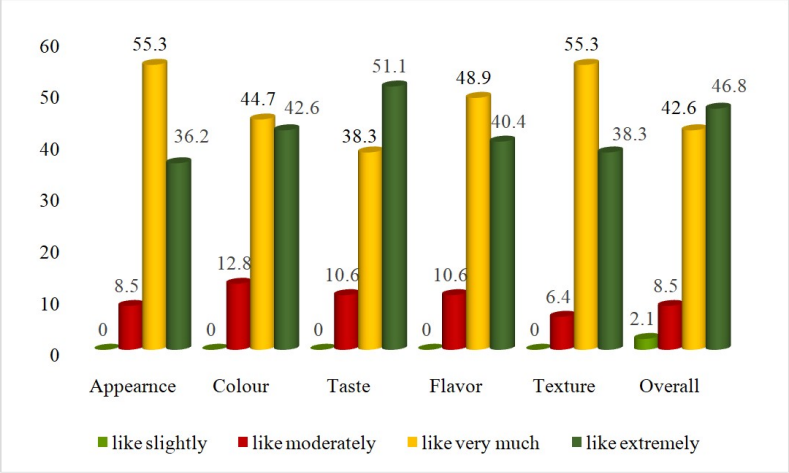

Fig. 1. Consumer preference toward mushroom incorporated cake.

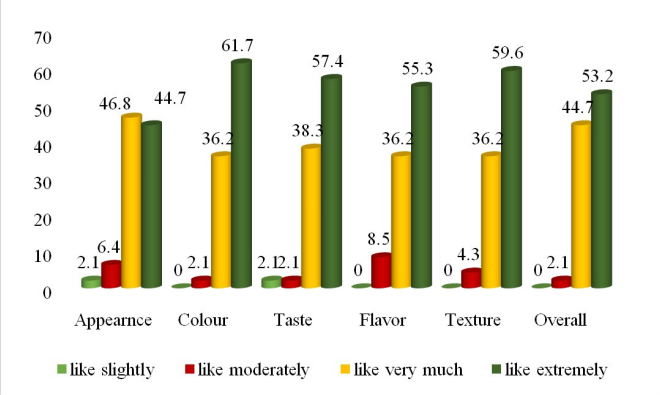

Fig. 2. Consumer perception toward mushroom incorporated toffee.

CONCLUSION

In this study, different levels of mushroom powder were incorporated for production of nutritionally enriched products and were investigated for sensory and consumer acceptability. From the results it was found that, cake formulated with 20% mushroom flour and toffee formulated with 10% mushroom flour scored high in overall acceptability compared to other formulations. It was also observed that most of the consumers prefer both the accepted products (Mushroom powder-incorporated cake and toffee). This study will encourage food industry to use mushroom powder for improving nutritional and sensory quality of the products, which in turn may pave way for improvement of the overall nutritional status of the vulnerable groups.

FUTURE SCOPE

Popularization and commercialization of these mushroom incorporated products will helps in establishing many micro enterprises which will reduce post-harvest losses, enhance the socioeconomic status along with nutritional security.

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Conflict of Interest. None.

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