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Quality Evaluation of Mushroom Powder Enriched Sesame Snack (Nutri Gajak)

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ABSTRACT

Protein energy malnutrition is a widely recognized health problem in Madhya Pradesh State of India. The incorporation of snacks made up of protein and energy rich sources, like mushroom and sesame in the diet of preschool children may be a possible solution to overcome the malnutrition problem. Therefore, the present study was undertaken with the objective of developing mushroom powder enriched snacks and assessment of its nutritional, organoleptic, quality along with shelf life. Mushroom powder was prepared by oven dry method. Proximate nutrient analysis was done by standard methods. Sensory evaluation of developed products was done on the basis of 9 point hedonic scale. Three products namely wheat flour sweet balls (T_1), sesame dry sweet enriched with mushroom powder (Nutri Gajak) (T_2) and wheat sesame sweet balls (T_3) were developed. These products were evaluated at the beginning and at interval of 15, 30, 45, 60, 75, 90 days in order to study the storage stability of the products. The value of protein, energy, fat, fiber, ash and carbohydrate for product T_2 were highest among all the three. For overall acceptability, product T_2 had highest mean score of 8.4, followed by product T_3 (7.99) and product T_1 (7.3). The difference among all the products was found to be significant ($p<0.05$). It revealed that the product T_2 was most preferred for different sensory attributes when compared with the other treatments. The T_1 product had least acceptability for all attributes. These products were devoid of off flavour and possessed acceptable characteristics. All the snacks could be stored safely and up to an acceptable period of three months at ambient temperature (28±5°). This study indicates that mushroom powder could be incorporated in various local recipes as an excellent functional and nutritional food for preschool children.

Keywords Sesame, Mushroom, Snack, Sensory quality, Shelf life.

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INTRODUTION

Children between one to five years of age remain at significant risk of under nutrition. Sometimes growth failure may occur even in the presence of normal meal patterns because the energy density of the diet is inadequate. The nutritional problems which manifest as a result of malnutrition prior to and during the infancy and early childhood have an impact on health, general growth and development of children (Sarada and Mrudula 2016). The World Health Organization defines malnutrition as deficiency, excess or imbalance in a person's intake of energy and/or nutrients.

Almost 11% of the world's population is considered undernourished, they lack adequate nutrients needed to thrive (Schneyder 2014).

Worldwide malnutrition is very dreadful issue, commonly observed in children due to protein- energy malnutrition. Protein energy malnutrition is a widely recognized health problem in Madhya Pradesh State of India. Nutrition supplements are a useful adjunct to increase protein, energy and other nutrients intake. Sweet balls commonly known as ladoo are a traditional sweet in Morena district of Madhya Pradesh. The basic ingredient of this ball is wheat flour.

Nutritional quality of traditional sweet or snacks can be enhanced by supplementing cereals with other nutritious food products. The incorporation of snacks made up of protein and energy rich sources, like mushroom and sesame in the diet of preschool children may be a possible solution to overcome the malnutrition problem.

Mushrooms present a balanced nutritional composition (Rashidi and Yang 2016) and are considered to be an attractive and alternative source of high quality protein with essential and nonessential amino acids. In addition, they are an excellent source of carbohydrates, dietary fiber, unsaturated fatty acids, vitamins and minerals (Deepalakshmi and Mirunalini 2014, Kadnikova *et al*. 2015, Rosli *et al.*2015, Teklit 2015). Wan Rosli and Aishah (2012) reported that *Pleurotus sajorcaju* improves the nutritional profile/ characteristics contents and maintains sensory properties of carbohydrate-based products. Mushrooms are rich sources of nutraceuticals that are responsible for their antioxidant, antitumor and antimicrobial properties (Aida *et al*. 2009, Islam *et al.* 2016, Reis *et al.* 2017).

Processing of mushrooms and its fortification into ready to eat products can serve the dual purpose of prevention of post-harvest losses as well as utilization of mushrooms for the improvement of nutritional status of society (Arora and Mridula 2014). Pleurotus sajor-caju (PSC) improves nutrient contents and maintains sensory properties of carbohydrate-based products (Rosli and Aishah, 2012).

Sesame seeds are used extensively in India. The seed is rich in protein with good nutritional value similar to soybean (NAERLS 2010). The chemical composition of sesame shows that the seed is an important source of oil (44-58%), protein (18-25%), carbohydrate (~13.5%) and ash (~5%) (Borchani *et al.* 2011). Dry sweet made of sesame seeds and jaggery is a quite famous Indian recipe of winter season. It is commonly name as Gajak. The Gajaks of Morena are very well-known.

Culturally-competent cookies were also developed with protein (18.58%, fat (20.09%), fiber (1.67 percent), ash (2.53%), lysine (585.2 mg), calcium (97.2 mg), iron (4.9 mg) and zinc (0.88 mg) which can be effectively targeted for meeting the nutritional needs of the disaster hit population and address the food insecurity issues that arise aftermath any emergency especially when the donated food conflicts with the cultural/religious beliefs of the affected region (Dhami *et.al.* 2020).

So, local recipies could be a good target. If we enrich our locally made sweet or snack for preschool children by introducing mushroom production techniques and its utilization as fortifying agent, then the problem of protein energy malnutrition may be alleviated. Therefore, the objectives of the present study were to develop mushroom powder, to develop high protein and energy enriched snacks and to assess its nutritional, organoleptic and shelf life facts to gain a better insight into this concern.

MATERIALS AND METHODS

The present study was carried out in Krishi Vigyan Kendra, Morena, Madhya Pradesh, India.

Preparation of mushroom powder

Freshly harvested oyster mushroom (*Pleurotus sajor-caju*) was obtained from mushroom demonstration unit of Krishi Vigyan Kendra, Morena, Madhya Pradesh, India. The mushrooms were cleaned from extraneous matter to remove dirt, straw and other undesirable material from it. These mushrooms were blanched and chopped coarsely until the uniform size ranged from 7-8 mm thickness is obtained. The chopped mushrooms were then oven dried (Labtech

Table 1. Yield percentage of mushroom powder.

Weight of fresh mushrooms	Yield percentage of mushroom powder
5 kg	10.5%

Instrument) at 50-55°C until constant weight was achieved. The dried mushroom slices were cooled, then ground into powder form and sifted into fine powder through a 40 mesh sieve. The collected mushroom powder was then kept in air tight container at cool place until further use (Fig. 1, Table 1).

Development of products

Three products namely wheat flour sweet balls (T_1), sesame dry sweet enriched with mushroom powder (Nutri Gajak) (T_2) and wheat sesame sweet balls (T_3) were developed. Sesame dry sweet fortified with mushroom powder (nutri gajak) was prepared with sesame seeds, jaggery and mushroom powder. Sesame seeds and jaggery were procured from local market. Mushroom powder was made from fresh mushroom obtained from mushroom demonstration unit of KVK, Morena, Madhya Pradesh, India.

The sesame seeds were cleaned of all dirt and other adhering materials by winnowing. Firstly, cleaned sesame seeds were roasted in a large bowl-shaped heavy bottomed frying pan on low heat till they turned light brown in colour. These roasted sesame seeds were kept aside. In another bottomed pan, jaggery was cooked on medium heat till it turns thick and syrupy. The pan was took off from the heat and mixed with the previously roasted sesame seeds. The nutritional quality of this dry sweet was enhanced through incorporation of mushroom powder. Now, this prepared dough was hammered until all the sesame seeds broke down and released their oils into the dough. This was quickly transferred into a previously greased rectangular tray and levelled it with a large flat spatula. While it was slight warm, cuts were made on it. After cooling down, the pieces were separated and stored in an air tight container.

Proximate analysis for shelf life of snacks

Nutritional composition of food is an important criterion in determining quality of the product. The nutrient contents of developed products were estimated according to the standard methods.

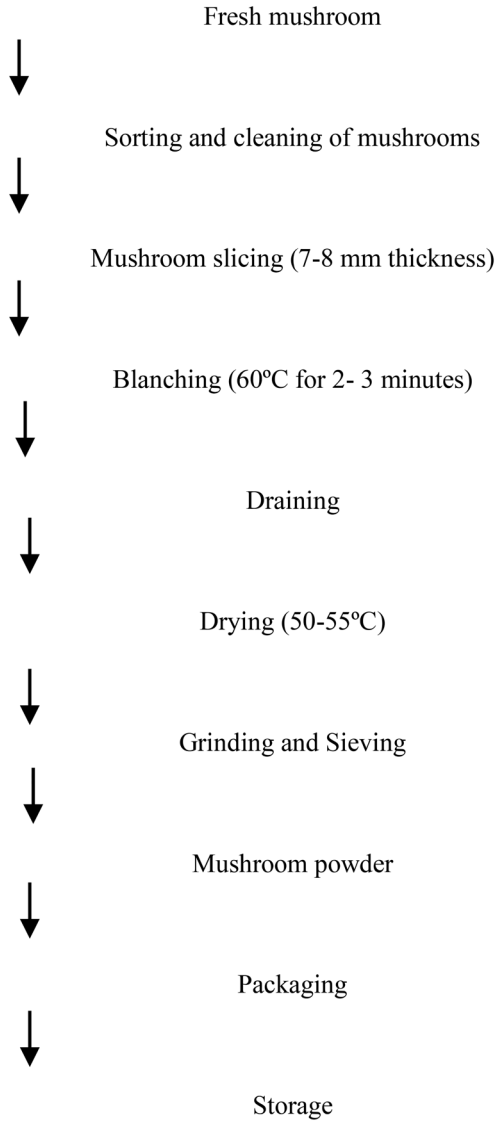

Fig. 1. The process flow chart for preparation of mushroom powder.

Sensory evaluation of snacks

Mushroom powder enriched sesame dry sweet (Nutri Gajak) was evaluated organoleptically for color, texture, flavor, taste and overall acceptability. 1 -9

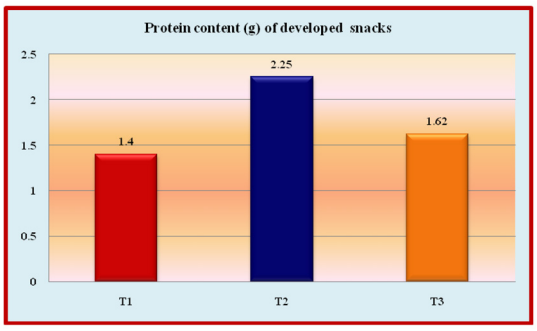

Fig. 2. Protein content (g) of one serving (20 g) of developed snacks.

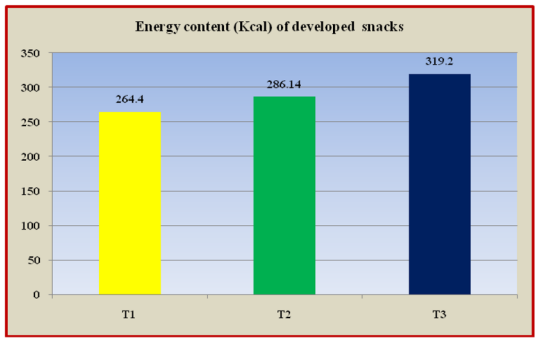

Fig. 3. Energy content (Kcal) of one serving (20 g) of developed snacks.

point hedonic rating test (Lim 2011) was performed to assess the degree of acceptability of nutri gajak containing mushroom powder where 9=Like extremely; 8=Like very much; 7= Like moderately; 6=Like slightly; 5= Neither like nor dislike; 4=Dislike slightly; 3= Dislike moderately; 2= Dislike very much; 1=Dislike extremely.

Storability analysis of moisture content of snacks

The moisture content of developed products was estimated according to the standard analytical method. These products were evaluated at the beginning and at interval of 15, 30, 45, 60, 75, 90 days in order to study the storage stability of the products.

Statistical analysis

All the experiments were carried out in triplicate. The data obtained in the present investigation were calculated statistically.

RESULTS AND DISCUSSION

Nutritional evaluation of snacks

The value of protein, energy, fat, fiber, ash and carbohydrate for product T_2 were highest among all the three. Product T_2 exhibited highest protein content (2.25 g) per serving among all the three (Fig. 2). The energy values for product T_1, T_2 and T_3 were 264.4, 319.2 and 286.14 kcal per serving, respectively (Fig. 3).The mushroom powder incorporated cookies showed enhanced protein content. The cookies supplemented with mushroom would be a good source of protein and other nutrients, which can be helpful in reducing malnutrition (Dhalagade *et al.* 2020).

Table 2. Sensory parameters of developed snacks.

Products	Color	Texture	Flavor	Taste	Overall acceptability
T_1	7.3±0.63	7.05±0.55	7.4±0.66	7.2±0.59	7.3±0.68
T_2	8.45±0.69	7.65±0.53	8.5±0.58	8.6±0.58	8.4±0.62
T_3	8.05±0.55	7.2±0.68	8.1±0.52	7.9±0.68	7.99±0.61

The mineral content of T_1, T_2 and T_3 products per serving for iron and calcium were in the range of 0.76 to 1.51 and 10.32 to 88.63 mg, respectively. The iron value of product T_2 was significantly higher than T_2 and T_1 ($p<0.05$) (Fig. 4). It is a rich source of energy and nutrients. It also helps new mothers in improving lactation while boosting their health and immunity (Sharif Hossain 2015). The nutrient analysis of laddoos revealed that the nutritive value of product can be increased with fortification of mushroom at different increasing levels (Verma and Singh 2014).

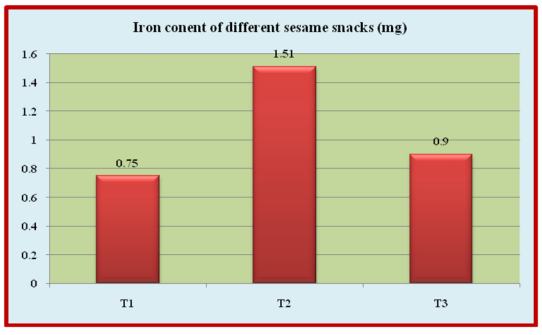

Fig. 4. Iron content (mg) of one serving (20 g) of developed snacks.

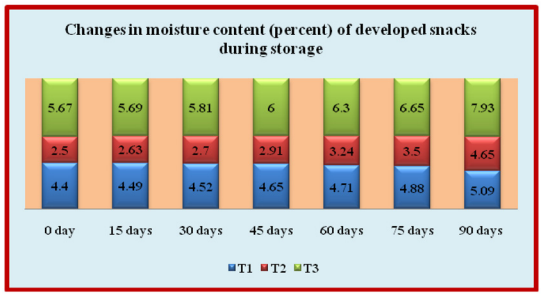

Fig. 5. Changes in moisture content (percent) of developed snacks during storage.

Sensory evaluation of snacks

The mean sensory scores of T_1, T_2 and T_3 groups for color, texture, flavour, taste and overall acceptability ranged are presented in Table 2, which revealed the range of scores from 7.3 to 8.45, 7.05 to 7.65, 7.4 to 8.5, 7.2 to 8.6 and 7.3 to 8.4, respectively. Nine-point hedonic scale was used to evaluate the acceptability of these products. It shows that for overall acceptability, product T_2 had highest mean score of 8.4, followed by product T_3 (7.99) and product T_1 (7.3). The difference among all the products was found to be significant ($p<0.05$). It revealed that the product T_2 was most preferred for different sensory attributes when compared with the other treatments. The T_1 product had least acceptability for all attributes. These products were devoid of off flavor and possessed acceptable characteristics. Mushroom fortified laddoos had better sensory characteristics than other fortified samples (Verma and Singh 2014).

Introducing mushroom into daily diet of rural farm families not only increased its nutritional quality but also increased sensory attributes. Addition of mushroom either in fresh or dry form has improved especially the nutritional content of daily food items (Mishra *et al.* 2018).

Effect of storability on the moisture content of snacks

The results in Fig. 5 showed that the results were observed to be the same during storage. This figure showed that the moisture content slightly increased with increasing the storage period in all formulated snacks for preschool children. Maximum moisture content was found in T_1 sample, whereas minimum was found in T_2 formulated snack after 90 days of storage. Moisture content increased with increase in the storage time. All the snacks could be stored safely and up to an acceptable period of three months at ambient temperature (28±5°). The reason for increase in moisture content with increase storage interval may be attributed to the effect of hygroscopic nature of products. Moisture content increased with increase in storage duration irrespective of packaging materials and storage conditions (Ramya *et al.* 2016).

CONCLUSION

Sweets are relatively more popular among preschool children as snacks, but locally made sweet of only wheat flour are a poor source of protein, energy and other important nutrients. Therefore, it can be overcome by fortifying the sweet or snack with sesame and mushroom. Sesame dry sweet (Nutri Gajak) made by incorporating mushroom powder was good source of nutrients. Based on the organoleptic evaluation, this developed dry sweet (Nutri Gajak) was acceptable, and it was found to be superior (nutritionally) compared to locally available other snacks. The storage capacity of all snacks was also calculated and it was observed that these snacks can last for three months. This study indicates that mushroom powder could be incorporated in various local recipes as an excellent functional and nutritional food for preschool children. Mushroom and sesame provide health benefits. Hence it can be used as a weapon against malnutrition

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