IMPROVEMENT IN NUTRITIONAL PROPERTIES OF PRODUCT THROUGH FORTIFICATION WITH ALOEVERA, MUSHROOM AND PEARL MILLETS

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Abstract

The aim of the study was to determine nutritional quality of aloevera pulp, mushroom powder and bajra flour and to determine the organoleptic acceptability of aloevera pulp, mushroom powder and bajra flour fortified Indian recipes and its nutritional quality. For this purpose, mushroom powder was prepared by oven dried method. The powder was analyzed for its various physiochemical attributes *i.e.* moisture, ash, protein, fat, iron. After that product, biscuits were prepared using prepared aloevera pulp, mushroom powder and bajra flour. The products were analyzed for its nutritional value and organoleptic characteristics. Bio-chemical analysis of revealed that aloevera pulp, mushroom powder and bajra flour retained high amount of protein, iron and low amount of fat. Analysis of variance revealed that fortification of mushroom powder (30%, 20%, 10%) and fortification of aloevera pulp (10%, 10%, 10%) and fortification of bajra flour (30%, 40%, 50%) in biscuits and like very much. Therefore, these incorporated products should be introduced to all age group and pregnant, lactating women for their proper physical and mental development. This study shed light on the evaluation of organoleptic acceptability and nutritive value of aloevera pulp, mushroom powder and pearl millets as an important food supplement. It provides as an excellent functional food.

Key words : Nutritional value, aloevera, mushroom and pearl millets.

Introduction

"Mushroom – the magic ingredient", to promote the health, taste and versatility to the product. Mushrooms are a group of fungi endowed with ability to convert in edible waste into palatable food that is praised for characteristic texture and flavour. Mushroom is nutrient-rich with vitamins, minerals, proteins and essential amino acids. Trace minerals in the mushroom contribute to our good health. The mushroom is low sodium, low colorie, high fiber and high nutrient food. It is also cholesteral-free and contains very little or no fat. The little fat in the mushroom is also the good fat (unsaturated fat). Mushrooms have been recognized as '***Most Loved Vegetable Food***', rich in nutrition, particularly protein. With their flavour, texture, nutritional value, very high productivity per unit area and time, less dependence on land and ability to grow on a variety of residual agricultural wastes, mushroom have rightly been identified as a food source to fight malnutrition in developing countries (Dutta, 2007). Revealed that mushrooms had long been used for medicinal and food purposes since decades. It is now

increasingly recognized that correct diet, controls and modulates many functions of human body and consequently participates in the maintenance of state of good health, necessary to reduce the risk of many diseases. 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. Wani *et al.* (2010) revealed that mushroom is potent exemplary sources of natural medicines with anti-diabetic activity. The high protein, fiber and low fat / energy contentes of edible mushrooms mark them excellent food for the diabetics. Many investigators have endeavoured to study the hypoglycaemic effect of either the fruiting body or the mycelia of various edible and medicinal fungi (Anand *et al.*, 2012). Mushrooms are considered as healthy food because they are low in calories and fat, but in proteins and dietary fibers (Manzi *et al.*, 1999). The origin of Aloe Saponaria in Africa, manily in the northeastern part of Cape Island and Transe. In addition, it is also planted in

Hawaii, Florida of the United Satates & in Japan, it is also found to be cultivated. This kind of aloe has a short stem with green leaves, spotted with white stripes, of clear texture about 50 cm long. Its rhizonme elongation spreads fast, germinates and grows up in groups. Big, thick and fleshy leaves contain much gelling with mild resistance. It is along with nutritional & medicinal property aloevera also have ornamental. The human body requires 22 amino acids and *Aloevera* gel contains 20 of them. More importantly, it provides seven of the eight essential amino acids required by the body (Paul, 2003). Also reported positive effect of *Aloe vera* on bioavailability of Vit. C and Vit. E (Choo, 2003). Aloe is rich in all vitamins especially the antioxidant Vit. A (β-carotene). Antioxidants help to neutralize free radicals in the body whereas B vitamins and choline are involved in amino acid metabolism. The plant contains many vitamins, excluding Vit. D, but including the antioxidant vitamins A and C. Vitamin B1 (thiamin), B2 (riboflavin) B3 (niacin) choline and folic acid are also present (Paul, 2003). Some scientists suggest that there is also trace of Vit. B12 (Coats, 1997 and Andrew *et al.*, 1999). Reported the role of *Aloe vera* extracts in functional foods, particularly in the beverage and dairy section (Neall, 2004). *Aloe vera* gel reportedly aids in wound healing due to its anti-inflammatory activity (Reynolds, 1999 and Parrota, 2001). The fresh juice from the leaves of aloe was cooling and used to treat liver and spleen ailments, dermatitis and other skin problems. The *Aloe vera* powder was an important ingredient in preparation of a large number of Ayurvedic medicines particularly for diseases associated with the digestive system and found useful in treating stomach pain, for relieving constipation and as a tonic after pregnancy. WHO has given monographs on selected and widely used twenty-eight medicinal plants to promote international harmonization in the quality control and use of herbal medicines. Among all 28 medicinal plants Aloe vera (*Aloe barbadensis*) is one of them and the monograph has referred to Aloe vera as a safer and healthier plant (WHO, 1999). Evaluation that decortication of grains is necessary for organoleptic and technological reasons such as astringency, texture etc. and helps in reducing the antinutrients localized in the bran fraction. Decortication of bajra reduced part of fiber and iron-binding phenolic compounds, but did not successfully reduce phytate content as it was mainly located in germ and endosperm (Lestienne *et al.*, 2005). Studied the processing methods like soaking, boiling and germination of pearl millet resulted in a significant reduction of phytate phosphorus. The concentrations of calcium, magnesium, iron and zinc increased upon soaking germination, while boiling decreased calcium, magnesium and iron concentration. Solubility of minerals was higher in soaking and germination than in boiling (Sushma *et al.*, 2008). Revealed that nutritionally bajra is comparable and even superior to major cereals with respect of energy value, proteins, fat and minerals. It makes an important contribution to human diet to high levels of calcium, iron, zinc, lipids and high quality proteins. Besides, it is also a rich source of dietary fiber and micro nutrients (Sehgal, 2006).

Methodology

The present study was carried out in the Department of Food Science and Nutrition. Selection of the fresh Mushroom (*Oyster Mushroom*), Fresh Aloevera (*Aloevera* spp.) and Fresh Pearl millets (*Pennisetrum glaucum*) from Chander Shaker Azad University of Agriculture and Technology, Kanpur (U.P.), India.

Preparation of mushroom powder

The fresh mushroom, sorting and washing than trimming and blanching for 3 minutes, draining, now dry the mushroom pieces in hot air oven at 100-110^{0}C for 7-8 hours per day till become crispy than sun drying and grinding (3 times) sieving (2 times) making powder packed in air tight container.

Preparation of aloevera pulp

Selection of fresh aloevera leaves, remove impurities and dust particles, washing, the quter thick skin was also peeled out and the translucent gel like pulp was extracted. This pulp was cut into manageable pieces and refrigeratedat 4°C and blended into a homogenous pulp to use.

Preparation of pearl millet flour

Selection of fresh bajra than remove impurities and dust particles, washing and oven drying (100°C for 7 hrs.), grinding and sieving than storage and grind and sieve to get fine powder than making powder in air tight container.

Development of products

Preparation of biscuits

The biscuits of mushroom powder, aloevera pulp, bajra flour and refined flour at three diffferent level is T_1 (30%, 30%, 10%, 30%) and T_2 (40%, 20%, 10%, 30%), T_3 (50%, 10%, 10%, 30%), respectivelly. Preheat the oven (425^{0}C) and take bajra flour, mushroom powder, aloevera pulp, refined flour & baking powder than beating the butter and sugar and prepare the dough for biscuit then cut the biscuit into desirable shape and put in the biscuits in the try than bake for 12-15 min. at 100^{0}C.

Sensory evaluation

The product biscuits was evaluated by 5 panel members acorrding to the flavour, texture, taste, colour and over all appearance on the basic of Hedonic rating scale.

Chemical analysis

Proximate analysis was done by AOAC method (A.O.A.C., 1970). Protein was estimation through kjeldahl methods, whereas fat was estimation through soxhlet method and iron was estimation through Spectrophotometric methods.

Statistical study

The experimental data was statistically adopted the produure descibed by Chandal (1995). Tested analysis of variance (ANOVA) were used to analysed the data on the basis of CRD (Completely Randomized Design).

Observation and Assessment

The results obtained obtained from the present investigation as well as relevant discussion have been summarized under following heads:

Sensory evaluation

The average score obtained for different parameter of sensory evaluation was analysed, tabulated and presented in table 1.

Appearance

Table 1 shows that mean score of control sample was 8.7 in the appearance, while the mean value of T_1 (30:30:10:30), T_2 (40:20:10:30) and T_3 (50:10:10:30), fortified of Biscuits were 7.0, 7.3, 8.3, respectively. The above table show that control and fortified sample were significant at the level of 5 per cent in critical difference. On the basis of appearance the score revealed that T_3 is rated as 'like very much'. In the comparison with control products T_3 (8.3) got comparatively low scores than the control products. So, it has been shows that control product are best due to its high score than other two treatments. During the work it was found that mushroom powder, aloevera and bajra flour were helpful in increasing appearance nutritional value of the products.

Taste

Table 1 shows that mean score of control sample was 8.3 in the taste, while the mean value of T_1 (30:30:10:30), T_2 (40:20:10:30) and T_3 (50:10:10:30), fortified of Biscuits were 6.7, 7.0, 8.0, respectively. The above table show that control and fortified sample were significant at the level of 5 per cent in critical difference. On the basis of taste the score revealed that T_3 is rated as 'like very much'. In the comparison with control products T_3 (8.0) got comparatively low scores than the control products. So, it has been shows that control product is best due to its high score than other two treatments. During the work, it was found that mushroom powder, aloevera and bajra flour were helpful in increasing taste nutritional value of the products.

Flavour

Table 1 shows that mean score of control sample was 8.7 in the flavour, while the mean value of T_1 (30:30:10:30), T_2 (40:20:10:30) and T_3 (50:10:10:30), fortified of Biscuits were 7.0, 7.7, 8.3, respectively. The above table show that control and fortified sample were significant at the level of 5 per cent in critical difference. On the basis of flavour the score revealed that T_3 is rated as 'like much'. In the comparison with control products T_3 (8.3) got comparatively low scores than the control products. So it has been shows that control product is best due to its high score than other two treatments. During the work, it was found that mushroom powder, Aloevera and Bajra Flour were helpful in increasing flavour nutritional value of the products.

Texture

Table 1 shows that mean score of control sample was 8.3 in the texture, while the mean value of T_1 (30:30:10:30), T_2 (40:20:10:30) and T_3 (50:10:10:30), fortified of biscuits were 6.7, 7.3, 7.7, respectively. The above table show that control and fortified sample were significant at the level of 5 per cent in critical difference. On the basis of texture the score revealed that T_3 is rated as 'like very much'. In the comparison with control products T_3 (7.7) got comparatively low scores than the control products. So, it has been shows that control product is best due to its high score than other two treatments. During the work, it was found that mushroom powder, aloevera and bajra flour were helpful in increasing texture nutritional value of the products.

Colour

Table 1 shows that mean score of control sample was 8.7 in the colour, while the mean value of T_1 (30:30:10:30), T_2 (40:20:10:30) and T_3 (50:10:10:30), fortified of biscuits were 6.0, 6.7, 7.7, respectively. The above table show that control and fortified sample were significant at the level of 5 per cent in critical difference. On the basis of appearance the score revealed that T_3 is rated as 'like very much'. In the comparison with control products T_3 (7.7) got comparatively low scores than the control products. So, it has been shows that control product is best due to its high score than other two treatments. During the work, it was found that Mushroom

powder, aloevera and bajra flour were helpful in increasing a colour nutritional value of the products.

Over all acceptability

Table 1 shows that mean score of control sample was 8.5 in the overall acceptability, while the mean value of T_1 (30:30:10:30), T_2 (40:20:10:30) and T_3 (50:10:10:30), fortified of biscuits were 6.8, 7.4, 8.1, respectively. The table shows that control and fortified sample were significant at the level of 5 per cent in critical difference. On the basis of overall acceptability the score revealed that T_3 is rated as 'like very much'. In the comparison with control products T_3 (8.1) got comparatively low scores than the control products. So, it has been shows that control product is best due to its high score than other two treatments. During the work, it was found that mushroom powder, aloevera and bajra flour were helpful in increasing over all acceptability nutritional value of the products.

Chemical analysis

The data obtained in respect to chemical composition of chemical analysis of biscuits *i.e.* moisture, protein, fat, ash, iron was analysed, tabulated and presented in table 2.

Moisture

Table 2 show that mean score of moisture content in control product sample of biscuits was 18.71, while the mean value of Moisture T_1 (30:30:10:30), T_2 (40:20:10:30) and T_3 (50:10:10:30), fortified products of biscuits were 30.80, 31.37, 32.05, respectively. Table indicates that products were found significantly differed from each other's. It was found that T_3 (32.05) sample was highly significant to control sample at 5% critical difference. From the table found that moisture content of 10% fortification product was higher than control and other fortified products, which reveals that the moisture content of product were increased as the level of fortification of mushroom powder was increased in aloevera pulp and bajra flour biscuits.

Ash

Show that mean score of ash content in control product sample of biscuits was 2.63, while the mean value of ash T_1 (30:30:10:30), T_2 (40:20:10:30) and T_3 (50:10:10:30), fortified products of biscuits (3.58), (3.52), (3.33) were respectively. Table indicates that products were found significantly differed from each other's. It was found that T_1 (3.58) sample was highly significant to control sample at 5% critical difference. From the table found that moisture content of 10% fortification product was higher than control and other fortified products, which

reveals that the moisture content of product were increased as the level of fortification of mushroom powder was increased in aloevera pulp and bajra flour biscuits.

Protein

It is evident the table the mean score of protein content in control product sample of biscuits was 24.00, while the mean value of protein T_1 (30:30:10:30), T_2 (40:20:10:30) and T_3 (50:10:10:30), fortified products of biscuits (13.24), (12.32), (11.39) were respectively. Table indicates that products were found significantly differed from each other's. It was found that T_1 (13.24) sample was highly significant to control sample at 5% critical difference. From the table found that protein content of 10% fortification product was higher than control and other fortified products, which reveals that the protein content of product were increase as the level of fortification of mushroom powder was increased in aloevera pulp and bajra flour biscuits.

Fat

It is evident the table the mean score of fat content in control product sample of biscuits was 4.67, while the mean value of Fat T_1 (30:30:10:30), T_2 (40:20:10:30) and T_3 (50:10:10:30), fortified products of biscuits (2.39), (2.79), (3.24) were respectively. Table indicates that products were found significantly differed from each other's. It was found that T_3 (3.24) sample was lower significant to control sample at 5% critical difference. From the table found that protein content of 10% fortification product was higher than control and other fortified products which reveals that the protein content of product were increase as the level of fortification of mushroom powder was increased in aloevera pulp and bajra flour biscuits.

Iron

It is evident the table the mean score of iron content in control product sample of biscuits was 2.50, while the mean value of iron T_1 (30:30:10:30), T_2 (40:20:10:30) and T_3 (50:10:10:30), fortified products of biscuits (4.27), (4.18), (4.02), fortified products were respectively. Table indicates that products were found significantly differed from each other's. It was found that T_1 (4.27) sample was highly significant to control sample at 5% critical difference. From the table found that Moisture content of 10% fortification product was higher than control and other fortified products which reveals that the Moisture content of product were increased as the level of fortification of Mushroom powder was increased in aloevera pulp and bajra flour biscuits. It is concluded that mushroom fortification aloevera pulp and bajra flour
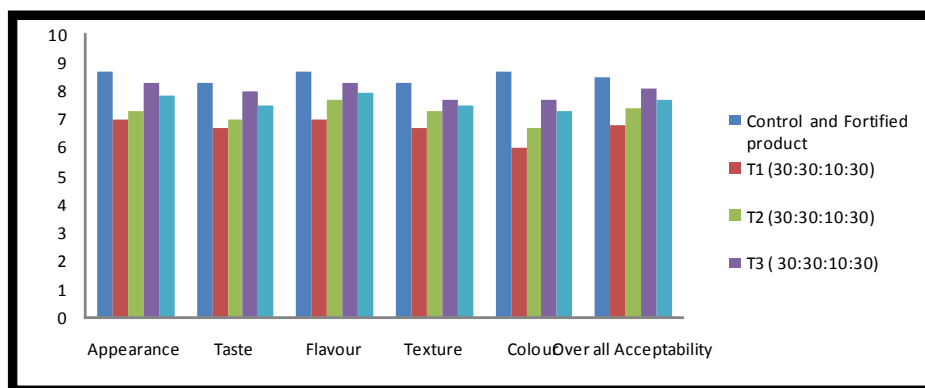
Fig. 1 : Mean score of overall characteristics of sensory evaluation of aloevera, mushroom and bajra flour fortified of biscuit.
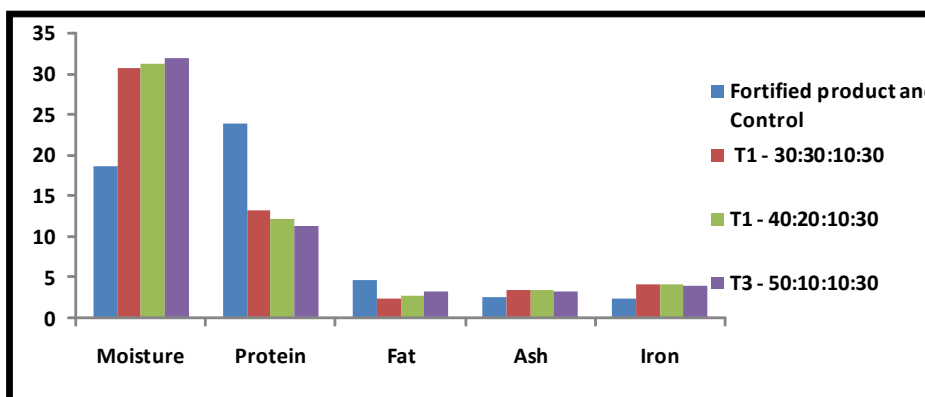

Fig. 2 : Mean score of moisture, protein, fat, ash, iron in develop product of biscuit.

Table 1 : Mean score of overall characteristics of sensory evaluation in biscuits fortified mushroom powder, aloevera pulp, bajra flour (9 point Hedonic Rating Scale).

Attributes	Treatments				Mean
	Control	T₁ (30:30:10:30)	T₂ (30:30:10:30)	T₃ (30:30:10:30)	
Appearance	8.7	7.0	7.3	8.3	7.83
Taste	8.3	6.7	7.0	8.0	7.50
Flavour	8.7	7.0	7.7	8.3	7.93
Texture	8.3	6.7	7.3	7.7	7.50
Colour	8.7	6.0	6.7	7.7	7.28
Over all Acceptability	8.5	6.8	7.4	8.1	7.70

Note : 30:30:10:30 = Bajra Flour: Mushroom Powder: Aloevera Pulp: Refined Flour.
30:20:10:30 = Bajra Flour: Mushroom Powder: Aloevera Pulp: Refined Flour.
30:10:10:30 = Bajra Flour: Mushroom Powder: Aloevera Pulp: Refined Flour.

Table 2 : Mean score of moisture, protein, fat, ash, iron in biscuits (in per 100gm).

S. no.	Level of fortified	Treatments	Moisture	Protein	Fat	Ash	Iron
1.	Fortified product	Control	18.71	24.00	4.67	2.63	2.50
2.	30:30:10:30	T₁	30.80	13.24	2.39	3.58	4.27
3.	40:20:10:30	T₂	31.37	12.32	2.79	3.52	4.18
4.	50:10:10:30	T₃	32.05	11.39	3.24	3.33	4.02

Note : 30:30:10:30 = Bajra Flour: Mushroom Powder: Aloevera Pulp: Refined Flour.
30:20:10:30 = Bajra Flour: Mushroom Powder: Aloevera Pulp: Refined Flour.
30:10:10:30 = Bajra Flour: Mushroom Powder: Aloevera Pulp: Refined Flour.

biscuits are considered as healthy food because they are high in calories and fat but rich in protein and iron. So, it is prescribed for growing children, pregnant and lactating women, old age person.

Conclusion

On the whole mushroom, aloevera and pearl millet are nutritious with various health benefits. The inclusion of products aloevera, mushroom and pearl millet in the diet of an individual can add to the diet's nutritive and therapeutic value and medicinal value. Hence, measures should be taken to create awareness about aloevera, mushroom and pearl millet products among people to include it in their diet. This study indicates that the developed products of biscuits with mushroom, aloevera and pearl millets can easily prepared under optimized condition. The various parameters such as moisture, protein, fat, ash and iron were analysis. Analysis of variance revealed that fortification of mushroom powder (30%, 20%, 10%) and fortification of aloevera pulp (10%, 10%, 10%) and fortification of bajra flour (30%, 40%, 50%), refined flour (30%, 30%, 30%) in biscuits and like very much. So, it has been shown that product treatment of T_3 (50%, 10%, 10%, 30%) is best due to its high score than other two treatments. On the basis of appearance, taste, flavour, texture, colour and overall acceptability the score revealed that T_3 (50%, 10%, 10%, 30%) is rated as 'like very much'. The sensory of evaluation of products on all attributes (appearance, taste, flavour, texture, colour and overall acceptability) was found in biscuits, which was highly acceptable, due to bajra flour, wheat flour, aloevera, milk cream and butter. The analysis nutritional content (protein, fat, iron) of developed products conclude that nutritive value of mushroom, aloevera and pearl millets was highest then other developed products. The mushroom, aloevera and pearl millets by fortified product have tremendous potential for overcoming the problem of malnutrition and micronutrient deficiency.

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