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Original Article

DEVELOPMENT OF ANTIOXIDANT RICH INSTANT BISCUIT MIX

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ABSTRACT

Objective: Bakery products are important processed foods, commonly consumed across the world. Bakery products have become essential and significant components of the dietary profile of the people. Among that biscuits are the fast growing bakery products in India, because of consumer demand for convenient, safety, low cast, shelf life, verity taste and flavor but those are lack in nutrients and antioxidants.

Methods: To increase the nutrient content in biscuit mix, Wheat flour was added with maida and sugar at three variations (V1-50:50, V2-60:40, V3-70:30) and subjected to organoleptic evaluation. Antioxidant mix (Poshak Pro mix) was formulated using antioxidant rich foods like Finger millet, Black Gram Dhal, Spinach, Carrot, Guava and Sesame seeds. These were processed and formulated into three mixes (Finger millet based mix, Black Gram Dhal based mix and Carrot based mix) and subjected to DPPH radical scavenging test. The mix having highest activity was selected and incorporated into wheat flour biscuit mix at three variations (V1-20:80, V2-3:70, V3-40:60) and subjected to organoleptic evaluation. The accepted variation was analyzed for nutrient and shelf life at polythene and aluminum foil covers.

Results: Among the three wheat flour: Maida variations, V3-70:30 was selected in organoleptic evaluation. In DPPH radical scavenging test Finger Milled based mix was selected and incorporated into selected wheat flour biscuit mix at three variations. V1 (20:80) was selected and nutrients analysis showed that it is rich in β-carotene. In shelf life study, both (polythene and aluminum foil) covers were accepted for packaging.

Conclusion: The study proved that local commodities rich in antioxidants can be utilized effectively and economically to improve the health status of the people.

Keywords: Bakery products, Antioxidant, Finger millet, DPPH radical scavenging test, Packaging.

INTRODUCTION

India is the second largest producer of food in the world next to china. Processing technologies play an important role in conservation and effective utilization of food [1]. In food processing technology, convenience food play an important role in people's diet. The reason for using convenience food is it reduces the time and effort to prepare foods [2]. Bakery products are important processed convenience foods, commonly consumed across the world. Bakery products are no longer considered as fancy or luxury teatime snack, but have become essential and significant components of the dietary profile of the people However, the antioxidant and nutritive value of these products could be very low [3]. Among the bakery products, biscuit is one of the most popular bakery products worldwide, because of its acceptability in all age group, longer shelf life, better taste and it position as good snacks [4]. These biscuit products provide only calories and not any nutrients like vitamins, minerals, fibre, phytochemicals and antioxidants.

Antioxidants in foods act as functional agent, they protect the health against damage caused by free radicals and aging [5]. Cell damage caused by free radical is a main source of aging and more than 50 degenerative diseases such as cancer, cardiovascular disease, cataracts, immune system decline and brain dysfunction [6]. Antioxidants are capable of stabilizing or deactivating the free radical before they attack cells. Antioxidants are able to control or delay the free radical formation [7]. Hence an effort was taken to develop antioxidant rich instant biscuit mix using locally available antioxidants rich foods like Wheat, Finger Millet, Black Gram Dhal, Carrot, Guava, Spinach and Sesame Seeds. These foods were selected based on the literature available on its antioxidant value.

Wheat grain contains antioxidant such as vitamin C, vitamin E, carotenoids and some phyto-antioxidants including phenolic acids and flavonoids. High level of dietary fiber in wheat also acts as antioxidant [8]. Finger millet is a rich source of several phytochemicals, dietary fiber and mineral especially calcium and offer several health benefits [9]. Black gram dhal contain tocopherols, flavonoids and iso-flavonoids, all of act as antioxidants. Isoflavones are phytoestrogens, significantly present in black gram dhal, help to protect against hormone-dependent disease such as breast cancer and cardiovascular disease [10]. Spinach contains many health benefit components like flavonoids, phenolic compounds, carotenoids, vitamins and minerals [11]. It has various pharmacological activities like antioxidant, antiproliferative, anti-inflammatory, antihistaminic, CNS (Central Nervous System) depressant, protection against gamma radiation [12]. Guava is an excellent source of provitaminA carotenoids, phenolic compounds like myricetin and apigenin, ellagic acid and anthocyanin which are act as powerful antioxidants [13]. Carrot-Carrot is a best natural antioxidant with anticancer property due to its beta-carotenoid and dietary fiber content [14]. Regular consumption of carrot contributes to good vision, skin and mucous membranes. It regulate nervous and digestive system by its enriched mineral content especially sodium, potassium and phosphorous [15]. Sesame seed-Sesame seeds are digestive, rejuvenative, anti aging and rich in antioxidants like vitamin E, A, B complex and minerals like zinc and potassium [16].

MATERIALS AND METHODS

Phase 1: Formulation of Wheat flour biscuit mix

Wheat was added into maida and sugar powder (60g) at three variations (V1-50:50, V2-60:40, V3-70:30) and was subjected to organoleptic evaluation using five point Hedonic scale by 25 semi trained panelist.

Phase 2: Processing and formulation of antioxidant rich mix (Poshak Pro)

The following ingredients were selected according to their Total Phenolic Content (TPC) value.

- Wheat (TPC=379 mg/kg)
- Finger Millet (TPC=298 mg/kg) [17]
- Black Gram Dhal (TPC=418 mg/kg) [18]

- Carrot (TPC=39.76 mg/kg) [19]
- Spinach (TPC=7168 mg/kg) [20]
- Guava (TPC=31.97 mg/kg) [21] and
- Sesame seeds (TPC=148 mg/kg) [22]

Finger millet, black gram dhal and sesame seeds were dry roasted at 70 °C for 10 minutes and ground. Carrot was blanched at 90 °C for 1 minute, shade dried and ground. Blanching of carrot involved in partial conversion of all trans-carotenoid to their cis-isomers. Trans-isomers stabilize the bio-availability of carotenoid to human[23]. Spinach and guava were shade dried and ground. All the fine powders were formulated into three mixes (Finger millet based mix, black gram dhal based mix and carrot based mix) and was subjected to DPPH Radical Scavenging Activity test. The mix which has got the highest antioxidant was selected for further study.

Phase 3: Formulation of antioxidant instant biscuit mix

Based on the results of DPPH Radical Scavenging Activity test, the antioxidant mix which has got highest inhibition rate was selected and incorporated into wheat flour biscuit mix into three variation (V1-20:80, V2-30:70, V3-40:60) and the acceptable variation was selected after organoleptic evaluation by 25 semi trained panelist and subjected to nutrient analysis and shelf life study.

Phase 4: Nutrient analysis

Nutrients like energy, carbohydrate, protein, fat, vitamin A, fiber, calcium and iron were analyses by AOAC standard method for the selected antioxidant rich instant biscuit mix.

Phase 5: **Shelf life study**

Shelf life of the product was determined by microbial analysis method. Microbiological testing is an essential factor to assure safety and quality of the product for the customer. The shelf life of the selected antioxidant rich instant biscuit mix with was studied by storing in two packages (polythene bag and aluminum foil bag) for a period of one month.

RESULTS

Phase 1: **Organoleptic evaluation for wheat flour biscuit mix**

The wheat flour biscuit mix was subjected to sensory evaluation as biscuit by adding butter (60g). From the result showed in table 1, V3 was highly acceptable in all criteria except color compared to V1 and V2.

Table 1: Organoleptic evaluation for wheat flour: Maida biscuit variations

Criteria	Control	V 1	V 2	V 3
Appearance	4.75±0.10	4.45±0.10	4.4±0.08	4.75±0.10
Color	4.4±0.08	4.4±0.08	4.65±0.10	4.5±0.03
Texture	4.15±0.06	4.35±0.10	4.65±0.10	4.8±0.05
Flavor	3.6±0.04	4.35±0.10	4.6±0.02	4.85±0.10
Taste	3.5±0.10	4.4±0.08	4.4±0.08	4.85±0.10
Overall acceptability	3.65±0.09	4.45±0.10	4.6±0.02	4.85±0.10

Phase 2: **Processing and formulation of antioxidant rich mix (Poshak Pro**)

The processed and formulated antioxidant rich mixes (V1–Finger Millet Based Mix, V2–Black Gram Dhal Based Mix and V3–Carrot based Mix) were subjected to DPPH Radical Scavenging Activity test. DPPH scavenging capacity test is used as a significant tool to identify the primary antioxidants which can donate the hydrogen to scavenge free radicals ([24]). Extraction was carried out by dissolving 6 grams of each powder (V1, V2 and V3) in 100 ml of 80% methanol. The mixture was kept overnight under shaking condition. The extract was filtered using Whatmann no.1 filter paper. The filtrate was collected and evaporated at room temperature. The concentrated extract was stored at 4 °C. 10 ml of the different concentrations of extracts (V1, V2 and V3)was centrifuged at 3000rpm using a centrifuge for 10 minutes and supernatant collected. The supernatant of the extract (1 ml) was added to 3 ml of methanol solution of DPPH (2, 2-diphenyl-1-picrylhydrazyl) (20 mg/l) in a test tube. The reaction mixture was kept at 25°C for one hour in an incubator. The absorbance of the residual DPPH solution was determined at 517 nm in UV-Visible Spectrophotometer. Ascorbic Acid was used as positive control. The inhibition was calculated in following formula,

$$I\ (\%) = 100\times (A_0\text{-}A_1)/A_0$$

Where A_0 is the absorbance of the control, A_1 is the absorbance of the Antioxidant mix extract, respectively.

From the result showed in table 2, it is evident that V1 has highest inhibition rate (79 per cent) at 30 mg then V2 and V3. Hence, V1-Finger Millet Based Mix was selected to incorporate into wheat flour biscuit mix.

Phase 3: **Organoleptic evaluation for antioxidant rich instant biscuit mix**

Finger millet based antioxidant mix was incorporated into wheat flour mix at three variations (V1-20:80, V2-30:70, V3-40:60). V1 (20:80) was acceptable in all criteria of sensory characteristics and the result is presented in table 3.

Phase 4: **Nutrient analysis of antioxidant rich instant biscuit mix**

Nutrients like carbohydrate, protein, fat, vitamin A, iron, calcium and fiber were determined by AOAC standard method. The result is presented in table 4 and fig. 2. Results revealed that Antioxidant Rich Instant Biscuit Mix with PoshakPro was highly nutritious then commercial biscuits (prepared by refined wheat flour and sugar). It contains fiber (16 mg), calcium (56 mg), iron (6 mg) and vitamin A (20 IU) which act as powerful antioxidant.

Table 2: Dpph radical scavenging activity of antioxidant mixes

Concentration (mg)	Inhibition (%)			
	Ascorbic Acid	V1	V2	V3
5	76	68	40	13
10	79	70	47	15
15	81	71	58	19
20	86	74	62	21
25	92	77	68	41
30	94	79	74	60

The proportion of finger millet based Antioxidant (poshak Pro) mix was presented in fig. 1.

Table 3: Organoleptic evaluation for value added instant antioxidant biscuit mix

Criteria	Control	V 1	V 2	V 3
Appearance	5	5	4.95±0.10	4.95±0.10
Color	4.96±0.10	4.85±0.12	4.8±0.10	4.85±0.14
Texture	4.96±0.10	4.95±0.10	4.8±0.10	4.7±0.03
Flavor	4.96±0.05	4.96±0.10	4.8±0.10	4.7±0.14
Taste	4.95±0.01	4.95±0.10	4.8±0.10	4.8±0.10
Overall Acceptability	5	5	4.85±0.10	4.75±0.12

Table 4: Nutrient analysis of antioxidant rich instant biscuit mix

Nutrients	Control	Antioxidant instant rich biscuit mix
Energy (kcal)	404.08	410.91
Carbohydrate (g)	79.66	73.16
Protein (g)	12.04	14.62
Fat (g)	1.0	3.0
Vitamin A (IU)	BDL	20.0
Iron (mg)	2.0	6.0
Calcium (mg)	20.0	56.0
Fiber (g)	3.0	16.0

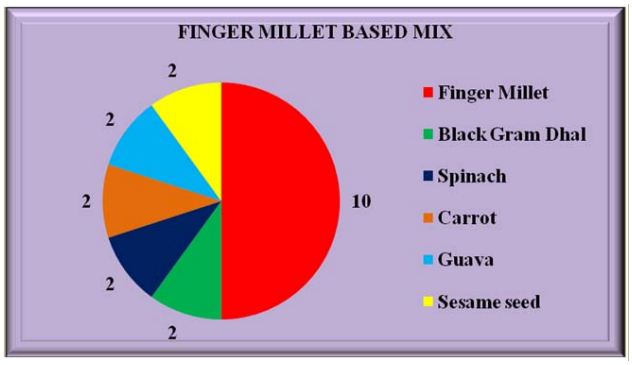

Fig. 1: Proportion of finger millet based poshakpro mix

Phase 5: Shelf life study

Antioxidant Rich Instant Biscuit Mix was packed in both polythene and aluminum foil bags and stored for one month. Microbial growth was estimated at 15 days interval by serial dilution method. The results were given in the table 5. Microbial load was slightly higher in 30th day compared to 15th day. Hence the shelf life of the product is for a month. I can be packed in either bag for storage.

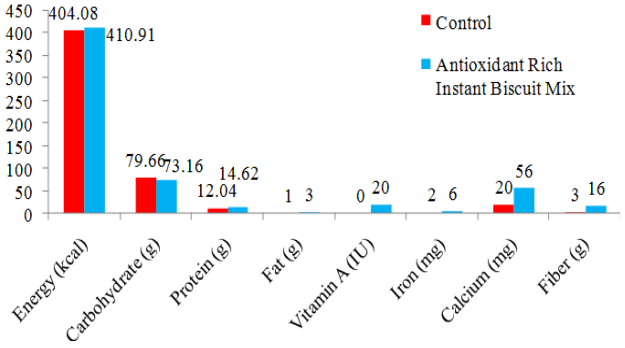

Fig. 2: Nutrient analysis of antioxidant rich instant biscuit mix

Table 5: Microbial analysis of antioxidant rich instant biscuit mix

No. of days	Microbial analysis							
	Polythene bag				Aluminum bag			
	Bacteria cfu/ml×(10^{+3})		Fungi cfu/ml×(10^{+6})		Bacteria cfu/ml×(10^{+3})		Fungi cfu/ml×(10^{+6})	
	Control	Sample	Control	Sample	Control	Sample	Control	Sample
15th day	12	8	1	1	10	6	1	1
30th day	25	21	5	4	23	18	5	3

CONCLUSION

Locally available inexpensive food items are rich in essential nutrients and antioxidants. This study has proved that effective utilization and incorporation of such foods to improve the nutritional value of unhealthy foods will change our diet pattern and helps us to lead a healthy life.

CONFLICT OF INTERESTS

Declared None

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