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Effect of Incorporation of Fruit Powders in Instant Biscuit Mixes

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Mango and pineapple powders were prepared for the processing of fruit powder based instant biscuit mixes and standardised using various levels of fruit powders (10-50%) with other ingredients. The mango and pineapple powders at 30g were taken as optimum level for processing the biscuit mixes. The processed mixes were stored in different packaging materials and stored at room temperature for 270 days. The chemical characteristics and microbial load were observed during storage period. Moisture, vitamin C contents were slightly high in pineapple powder based biscuit mixes whereas reducing and total sugars, protein, fat and beta carotene were more in mango powder based biscuit mixes. A minimal increase in microbial population was observed in all the stored samples during the study period. The organoleptic scores of the biscuit mixes were found to be highly acceptable upto 270 days

Key words: Mango and pineapple powder, Instant biscuit mix, Packaging materials, Storage period

Fruit Processing industry has been termed as a “Sunrise Industry” and several efforts have been made in the last few years to give a big thrust to this sector. Fruits are important nutritional requirements of human beings, as these foods not only meet the quantitative needs to some extent but also supply vitamins and minerals to improve the quality of diet and maintain health. In view of importance of fruits in human diet, there is a need to explore ways for preserving fruits during the peak season to make them available throughout the year and minimize losses. One of the possibilities is the conversion of fruits into various stable processed products, juices, concentrates and powders. The powder of ripe fruits is sweet and has pleasant flavour with high nutritive value. Fruit powder can be used as a ready to drink product or as a flavouring material for beverages, dairy, noodles, and bakery and confectionery products. Fruit powders offer distinct advantages over the concentrated ones because they represent the ultimate in concentration and offer convenience, versality and storage stability without refrigeration. The convenience of powders outweighs the additional expense of production, packaging and transport for retail products. The introduction of fruit powder for new product formulations viz, instant mixes helps in providing new areas to utilize the fruits and helps in development of new foods for the fast moving generation.

Materials and Methods

“Totapuri” and “Giant Kew” variety of mango and pineapple were selected for the preparation of fruit powders. The procedures for the preparation of mango and pineapple powders are given in Fig 1. Mango and pineapple powders were incorporated at different levels viz., 10, 20, 30, 40 and 50 percent with maida for the preparation of instant biscuit mix. The weighed quantum of maida was thoroughly mixed with each fruit powder (mango and pineapple) in a stainless steel vessel using a ladle, followed by the addition of powdered sugar. The leavening agent was added with constant stirring. For uniform mixing, the processed instant biscuit mix was thoroughly sieved (BS 80 mesh). The control biscuit mix was prepared by following the steps mentioned above without the addition of fruit powder. The proportion of ingredients used for the fruit powder based instant biscuit mix is given in Table 1. The biscuits were prepared from mango and pineapple powders incorporated instant mixes (10, 20, 30, 40 and 50 %) were tested for consumer acceptability and compared with control. The fruit powder incorporation upto 30% in biscuits had good quality characteristics and the consumer scores were similar to control. Hence the incorporation level of 30 per cent was selected for both mango and pineapple powders for preparing instant biscuit mix. The physical and chemical characteristics of fruit powders were analysed. (Table 2 &3) The developed fruit powder based instant mixes were packed in packaging materials (Metallised Polyester Polyethylene Laminated pouches (P_1), 400 G Polyethylene covers protected by MPP (P_2) and MPP pouches stored in plastic containers (petjars) (P_3)) in duplicate and stored at room temperature for conducting storage studies for 270 days. The

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chemical characteristics viz., moisture (AOAC, 1995) acidity and pH (Saini *et al*.2000), reducing and total sugars (Ranganna,1995), protein (Lowry *et al, (*1951) fat (ISO,1973), beta carotene, vitamin C,(AOAC, 1995) were analysed before and during the storage period at regular intervals. Microbial load of the fruit powder based instant mixes was enumerated by the method described by Istavankiss (1984). The data obtained were analysed statistically by Completely Randomized Block Design as per Panse and Sukhatme (1967). The organoleptic scores of the biscuits from fruit powder based instant biscuit mixes were carried out on 4-1 hedonic scale by a panel of fifteen untrained judges according to the method Amerine *et al* (1965).

Results and Discussion

Physico chemical characteristics of fruit powder. The physical and chemical compositions of mango and pineapple powders were given in Table 2&3.The prepared mango and pineapple powders had good

Table 1. Proportion of ingredients used for the fruit powder based instant biscuit mix

Ingredient	Control (T_0)	Fruit Powder Based	
		Mango (T_1)	Pine apple (T_2)
Maida	100	70	70
Mango fruit Powder	….	30	…
Pineapple Powder	…	…	30
Powdered Sugar	50	50	50
Baking Powder	0.5	0.5	0.5

flavor, taste and colour of the respective fruits. The fruit powders were found to be pale yellow and opaque yellow. The texture of the powders was free

Table 2. Physical characteristics of mango and pineapple powders

Characteristics	Mango Powder	Pineapple Powder
Colour	Pale yellow	Opaque yellow
Flavour	Mango Flavour	Pineapple flavour
Taste	Mango taste	Pineapple taste(slightly acidic)
Texture	Free Flowing fine powder	Free Flowing fine powder

flowing and fine. The moisture and pH content of pineapple powder were found to be more than the mango powder. Mango powder recorded 0.90 per

Table 3. Chemical composition of selected fruit powders (100g) (DWB)

Chemical Characteristics	Mango Powder	Pineapple powder
Moisture (%)	2.54	2.71
Acidity (g)	0.90	1.10
pH	3.50	4.50
Protein (g)	3.50	2.50
Fat (g)	2.60	2.20
TSS (^{0}bx)	42.00	35.0
Reducing sugar (g)	5.10	3.50
Total sugar (g)	31.90	25.80
β-carotene (µg)	3120	20.00
Vitamin C (mg)	52.00	75.20

cent acidity whereas the pine apple powder contained 1.10 per cent. The protein and fat content of mango and pineapple powders were 3.5, 2.5 and 2.6 and 2.2 per cent respectively. The TSS of mango powder was the highest with 42 ^{0} bx followed by pineapple powder (35^{0}bx). The reducing and total sugar contents of fruit powder were 5.10 and 31.90 (mango) and 3.50 and 25.80 (pineapple) per cent respectively. The reducing and total sugar contents of mango were 13.0 and 28.50 per cent. (Kalalingam, 2003). Bhaskar *et al.* (2003) prepared banana powder from ripe banana pulp having moisture content 6.78 per cent, pH 5.25, acidity 1.5 per cent (as per cent citric acid), ascorbic acid 56.7mb/100g, total sugar 65.87 per cent, protein 4.14 per cent, fat 0.75 per cent and ash content 2.84 per cent. The fibre content of mango powder was high (6.50%) compared to pineapple powder (3.50%)The beta carotene contents of mango and pineapple powders were 3120 and 20 µg/100g respectively. The β carotene content of Dashehari variety of ripe mango powder was 1855 µg/100 g (Sagar *et al*., 2000). The vitamin C contents of mango and pinapple powder were 520.0 and 75.20 mg/100g respectively. Ramteke *et al* (1999) indicated that drum dried mango fruit powder retained more ascorbic acid and β carotene.

Chemical changes in the fruit powder based instant mixes during storage period

Moisture: The hygroscopic nature of fruit powder might be due to the absorbed moisture during the storage period irrespective of the packaging materials. The samples stored in MPP (P_1) without protection had slightly higher moisture content followed by P_2 and P_3 irrespective of the treatments. The actual per cent increase in the moisture content of the samples ranged between 0.68 and 0.98 (T_0), 0.75 and 1.22 (T_1) and 1.37 and 1.5% (T_2) during storage. Chitra (2000) reported that moisture content in banana based weaning mix was 7.0 per cent.

Acidity: The T_2 sample contained slightly higher acid content than the control throughout the study period irrespective of the packaging materials. Significant increase in acid contents of fruit powder based instant biscuit mixes were observed between treatments, packaging materials and storage. Similar result was quoted by Kala lingam (2003).

pH : A gradual decreasing trend in pH was observed in fruit powder based instant biscuit mix during storage. The sample (T_2) had low pH before and after storage when compared with T_0 and T_1 samples.

Total Sugar: Among the freshly prepared biscuit mixes, mango powder based mix (T_1) had the maximum total sugar content followed by pineapple powder based biscuit mix (T_2) and control (T_0). The reduction in total sugar content was observed throughout the storage period may be due to the

Table 4. Effect of storage intervals on chemical composition of fruit powder based instant biscuit mixes

Treatment	Moisture (%)		Acidity (g/100g)		pH		Total sugar (g/100g)		Reducing sugar (g/100g)		Protein (g/100g)		Fat (g/100g)		βcarotene (µg/100g)		Vitamin C (mg/100g)	
	Storage period (days)		Storage period (days)		Storage period (days)		Storage period (days)		Storage period (days)		Storage period (days)		Storage period (days)		Storage period (days)		Storage period (days)	
	0	270	0	270	0	270	0	270	0	270	0	270	0	270	0	270	0	270
T_0P_1	4.30	5.56	0.130	0.163	6.50	6.10	21.50	20.20	3.50	4.17	9.00	8.18	1.50	1.46	22.00	15.00	-	-
T_0P_2	4.30	5.01	0.130	0.160	6.50	6.15	21.50	20.35	3.50	4.15	9.00	8.42	1.50	1.46	22.00	15.50	-	-
T_0P_3	4.30	4.95	0.130	0.156	6.50	6.20	21.50	20.40	3.50	4.14	9.00	8.51	1.50	1.47	22.00	16.00	-	-
T_1P_1	5.56	6.75	0.220	0.265	5.90	5.60	28.40	27.10	5.60	6.01	10.70	9.95	1.80	1.76	947.50	657.42	3.60	2.30
T_1P_2	5.56	6.36	0.220	0.260	5.90	5.70	28.40	27.20	5.60	6.00	10.70	10.15	1.80	1.76	947.50	695.70	3.60	2.63
T_1P_3	5.56	6.21	0.220	0.254	5.90	5.71	28.40	27.25	5.60	5.98	10.70	10.20	1.80	1.77	947.50	700.28	3.60	2.71
T_2P_1	6.10	7.56	0.281	0.345	5.41	5.10	23.60	22.40	5.26	5.92	9.50	8.75	1.65	1.61	21.50	14.90	10.20	6.25
T_2P_2	6.10	7.41	0.281	0.340	5.41	5.12	23.60	22.52	5.26	5.87	9.50	8.81	1.65	1.62	21.50	14.95	10.20	6.35
T_2P_3	6.10	7.29	0.281	0.336	5.41	5.15	23.60	22.62	5.26	5.87	9.50	8.86	1.65	1.63	21.50	15.20	10.20	6.48
SED (tps)																		
T_0 Vs T_1	0.37802		0.00057		0.34761		0.01774		0.02604		0.01238		0.00365		2.10819			
SED(tps)																	(T_1 vsT_2)	
T_0Vs T_2	0.01295		0.00216		0.00471		0.01581		0.00816		0.00587		0.00596		0.05401		0.02332	
CD at 5 %																		
(tps)T_0 Vs T_1	0.74847		0.00112		0.68825		0.03513		0.05156		0.02452		0.00723		4.17417		(T_1 vsT_2)	
CD at 5 %																	0.04601	
(tps)T_0 Vs T_2	0.02565		0.00427		0.00933		0.0131		0.01617		0.01162		0.01181		0.10693			

T-Treatment P- Packaging
T_0- Control P_1- MPP Pouches
T_1-Mango powder based P_2- 400 G polyethylene covers protected by Mpp Pouches
T_2- Pineapple Powder based P_3 - Mpp pouches kept in plastic containers

utilization of sugars in non enzymatic browning reaction occurring during storage.

Reducing sugar: The conversion of total sugar to simple sugar during storage might have increased the reducing sugar level in the stored instant biscuit mixes. Similar to this the fruit powder based instant biscuit mix had higher reducing sugar content.

Protein: The mango powder based instant biscuit mix had slightly higher protein content before and after storage than T_2 and T_0. The fruit powder based instant biscuit mix exhibited a very slight reduction in the protein content during storage period.

Table 5. Changes in microbial population of the fruit powder based instant biscuit mix during storage

Treatment	Bacteria (10^6/g)		Fungi (10^4/g)		Yeast (10^5/g)	
	Storage period (days)		Storage period (days)		Storage period (days)	
	0	270	0	270	0	270
T_0P_1	1.0	4.0	1.0	3.0	1.0	3.0
T_0P_2	1.0	2.0	1.0	2.0	1.0	2.0
T_0P_3	1.0	2.0	1.0	2.0	1.0	2.0
T_1P_1	2.0	5.0	1.0	4.0	1.0	4.0
T_1P_2	2.0	4.0	1.0	3.0	1.0	3.0
T_1P_3	2.0	3.0	1.0	2.0	1.0	2.0
T_2P_1	2.0	6.0	1.0	4.0	1.0	4.0
T_2P_2	2.0	5.0	1.0	3.0	1.0	3.0
T_2P_3	2.0	4.0	1.0	3.0	1.0	2.0

Fat: The fat contents of the fruit powder based instant biscuit mixes was slightly reduced at the end of the storage period. The mango fruit powder based instant biscuit mix recorded slightly higher fat content initially and finally than T_0 and T_2.

β **Carotene**: The composition and type of the fruit powder selected for preparation of instant mixes had influence on the β carotene content of the processed mixes. The mango powder based instant mixes (T_1) had higher β carotene content than pineapple powder based instant mixes. (T_2).The losses were significantly affected by the type of package as well as by the source of powder. The per cent loss of β carotene was significantly lower in P3, than P_2 and P_1, which was due to the permeability of packaging materials to oxygen and light.

Vitamin C: Among the fruit powder based instant biscuit mixes, the pineapple powder based instant mixes showed the highest vitamin C content followed by mango powder based instant mixes. The incorporation of fruit powders in the control recorded zero vitamin C content. The vitamin C content of freshly prepared fruit powder based instant biscuit mixes was found to be 3.60 (T_1) and 10.20 (T_2) mg/100 g which was reduced drastically to 2.30, 2.63 and 2.71 and 6.25, 6.35 and 6.48 mg/100 g in T_1, T_2 for P_1, P_2, and P_3 respectively at the end of the storage. The initial β carotene contents of mango and apple based eggless cake mixes were 1350.96 and 10.80µg/100g which were reduced to 1246.48 and 8.24µg/100 g packed in MPP pouches at the end of storage period.(270 days) (Kalalingam, 2003). Similar trend of reduction in β carotene content was observed in the present investigation too.

A significant difference in the moisture, acidity, pH, total and reducing sugars, protein, fat, β carotene and vitamin C contents of fruit powder based instant biscuit mixes were observed between treatments, packaging materials and period of storage.

Table 6. Mean Organoleptic Scores of biscuits prepared from fruit powder based instant biscuit mixes during storage

Treatment	Colour	Score	Appearance	Score	Flavour	Score	Texture	Score	Taste	Score	Overall acceptability	Score
T_0	Very good (0-5)	4.0	Highly acceptable (0-5)	4.0	Cooked starchy, matted flavour (0-9)	2.9	Very crisp (0-9)	4.0	Very good (0-6)	4.0	Highly acceptable (0-5)	4.0
	Good (6-9)	39.	Acceptable (6-7)	4.0	-	-	-	-	Good (7-9)	3.9	Acceptable (6-9)	3.9
T_1	Very good (0-7)	4.0	Highly acceptable (0-8)	4.0	Strong mango flavour (0-7)	4.0	Verycrisp (0-9)	4.0	Very good (0-7)	4.0	Highly acceptable (0-7)	4.0
	Good (8-9)	3.9	Acceptable (8-9)	3.9	Mild mango flavour (8-9)	3.9			Good (8-9)	3.9	Acceptable (8-9)	3.9
T_2	Very good (0-6)	4.0	Highly acceptable (0-6)	4.0	Strong pineapple flavour (0-6)	4.0	Verycrisp (0-9)	4.0	Very good (0-6)	4.0	Highly acceptable (0-6)	4.0
	Good (7-9)	3.9	Acceptable (7-9)	3.9	Mild pineapple flavour (7-9)	3.9	-	-	Good (7-9)	3.9	Acceptable (7-9)	3.9

Microbial population of fruit powder based instant biscuit mix

An increase in microbial population of fruit powder based instant biscuit mix was observed as the storage period increases in the selected samples. After 270 days the bacterial population of the treated samples was slightly higher than control whereas yeast and fungal population were more or less equal in all the samples. The final bacteria, fungal and yeast counts of fruit based instant cake

Fig.1. Flowchart for processing of Fruit powders

mix were in the range of 2.0-6×10^6, 2.0-4.0×10^9 and 2.0-4.0×10^5 cfu/g at the end of 270 days (Kalalingam, 2003). The microbial population of the fruit powder based instant biscuit mixes showed similar picture. Though the microbial population of the instant biscuit mixes had increased during the storage period but it was within the acceptable limits, So it was highly acceptable for consumption.

Quality analysis of the prepared biscuits from fruit powder based instant mixes

The sensory attributes such as colour, appearance, flavour, texture, taste and overall acceptability of the biscuits did not show much difference between the initial and the final score values packed in different packaging materials. From the data on the organoleptic evaluation of the prepared biscuits indicated that mango powder biscuits were highly acceptable than control and pineapple powder based.

Conclusion

Highly acceptable instant biscuit mixes could be prepared by incorporating the fruit powders (mango and pineapple) upto 30 per cent. There was negligible change in the acidity, pH, total and reducing sugars, whereas a notable change was observed in moisture, β carotene and vitamin C irrespective of the fruit powder based instant mixes during storage. Among the packaging materials, MPP pouches kept in plastic containers was found to be the best. A negligible change in microbial load was observed in all the stored samples during the study period.

References

AOAC.1995 Official Methods of Analysis. 14th Edn. Association of Official Analytical Chemists, Arlington, USA.

Amerine, M.A., Pangborn, R.M. and Roessier, E.B.1965. Principles of Sensory Evaluation of Food. Academic Press. Newyork.

Bhaskar, N.K., Maheswari, P.N. and Singh, K. 2003. Studies on optimization of pretreatments and processing conditions in preparation of banana powder. IFCON, souvenir, Dec 5-8, CFTRI, Mysore, India-pp-25.

Chitra, P. 2000. Processing and preservation of selected products from three banana cultivars. Ph.D., Thesis submitted to Dept of Food Science and Nutrition, Home Science College and Research Institute, TNAU, Madurai.

ISO.1973.Codex approved method. Extraction/gravimetry TYPE I Method, P: 18.

Istavankiss, 1984. Testing Methods in Food Microbiology. Elsevier Pub.Ltd, 395-397.

Kalalingam, 2003. Processing and evaluation of fruit based eggless instant cake mix. Ph.D Thesis Submitted to Dept of Food Science and Nutrition, Home Science College and Research Institute, TNAU, Madurai.

Lowry, O.H., Rosebrough, N.J., Farr, A.L., and Randall, R.J. 1951. *J.Biol.Chem.,* **193**: 265 (The original method

Ramteke,R.S., Vijayalakshmi, M.R. and Eipeson, W.E. 1999. Processing and value addition to mangoes. Indian Food packer. **38**: 155-162.

Ranganna, 1995. Analysis and quality control for fruit and Vegetable Products, Mcgraw Hill Publishing Company ltd, Newdelhi, p-187.

Saini, R.S., Sharma, K.D., Dhankar, O.P. and Kaushik, R.A. 2000. Laboratory manual of analytical techniques in horticulture, agrobios (India). Jodhpur.

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