Madras Agric. J., 100 (1-3): 244-247, March 2013
https://doi.org/10.29321/MAJ.10.001282

Development of Sorghum and Maize Based Convenience Mix

P. Karuppasamy[1], S. Kanchana[2], G. Hemalatha[3] and N. Muthukrishnan[4]

[1, 2, 3] Department of Food Science and Nutrition
Home Science College and Research Institute, Madurai - 625 104
[4] Department of Agricultural Entomology
Agricultural College and Research Institute, Madurai - 625 104

The mix suitable for different types of foods based on sorghum (*Sorghum vulgar*) and maize (*Zea mays*) were developed and their nutritional qualities were evaluated in different packaging materials viz. High Density Poly Ethylene (HDPE) and Metalized Poly Propylene bags (MPP) during storage (90 days). A slight change was noted in the moisture (8.80-9.67%), protein (10.50-9.74%), reducing sugar (1.31-1.96%), total sugar (3.18-2.29g%) and crude fibre (4.80-4.74g%) content of the convenience mix on storage. The convenience mix was used for development of different traditional food products viz., *rava laddu, uthiri pittu, kuzha pittu and roti*. All the food products of convenience mix were organoleptically acceptable and scored high values (8.8 to 8.9 by using 9 point hedonic scale) at the end of the storage period (90 days). The microbial population of convenience mix was found to be minimum and within the safe limit on storage. Statistically the moisture (increased up to 0.87%), protein (decreased up to 0.84%), reducing sugar (increased up to 0.65%) and total sugar (decreased up to 0.89%) and showed highly significant difference at 0.01% level, but non significant difference was observed for ash (0.01%), calcium (0.02%), iron (0.05%) and tannin (0.03%) during storage. The shelf life of convenience mix was found to be good up to 90 days at ambient conditions.

Key words: Sorghum, Maize, Convenience mix, Organoleptic parameters

Millets are small seeded annual cereal grains. These are very hardy crops and can be grown successfully in infertile lands. These crops are less prone to diseases and pests. It is stable than cereals like wheat and rice, some of them are even better with regard to average protein, fat and mineral contents (Gopalan *et al*., 1997). Millets are particularly low in phytic acid and rich in dietary fibre, iron, calcium and B-vitamins. It also contains higher proportion of unavailable carbohydrates and release of sugar from millet is low. Over the past three decades cultivation and production of nutritious cereals is decreasing significantly, because of poverty, shifting consumption pattern from a balanced diet, widespread prevalence of nutritional deficiencies and also low consumption of nutritious cereals (Seetharama and Rao, 2004). But in the last two decades, grain based snack and convenience food market had witnessed a very rapid growth all over the world (Arya, 1990).

In the present era of food scarcity there exists a need to diversify the use of these millets by developing millet products. For development of convenience mix certain processing techniques such as roasting could be easily adopted. It improves the taste and flavor, decrease the moisture content which helps to minimize deterioration during storage which inturn increase the shelf life of the products (Malleshi and Desikachar, 1982)

The millet products are available in the market at a higher price. Hence, the present study was taken up to develop low cost sorghum and maize based convenience mix for four food products and evaluate the nutritional quality of the mix.

Materials and Methods

Preparation of flour

Sorghum (*Sorghum vulgar*), Maize (*Zea mays*). Sorghum and maize grains were cleaned well, sun dried and ground into semolina by using bur mill and sieved by using 60mm mesh sieve.

The combination of sorghum and maize based mixes were 40:60 (C_1), 50:50 (C_2) and 60:40 (C_3). All these combinations (C_1, C_2 and C_3) of mixes were used to prepare the various products like *rava laddu, uthiripittu, kuzhapittu* and *roti*. Among the combinations C_2 mix (50:50, Sorghum: Maize) was found to be better based on the nutrient content and organoleptic evaluation of the products.

Development of food products

***Rava laddu* :** sorghum and maize semolina (50:50) mix were slightly roasted on an iron pan at a temperature of 70-80$_0$C for 5 min. powdered sugar (50g) and heated vanaspathi (30g) or boiled milk (30ml) were added and mixed little by little and made into balls.

*Corresponding author email: samysks@gmail.com

- ***Uthiripittu*** : To 100g of the blend, 25ml of water with salt was added and mixed well. It was steamed in idli cooker for 10min.
- ***Kuzhapittu***: To 100g of blend, 25ml of water with salt was added and mixed well and kept in kuzhapittu mould and steamed for 10 minutes.
- ***Roti***: The blend of sorghum and maize (100g) were added with other ingredients (chopped onion-30g, green chillies-2g. chilly powder-0.5g, cumin seed powder – 0.5g, turmeric powder-1.0g, salt-1.0g, chopped curry leaves-little amount and required amount of water) and mixed well. Required quantity of water was added and made into a ball and kept for 30minutes. The ball was pressed with hand to make roti (12cm diameter and 0.4cm thickness). The roti was shallow fat fried on a preheated tawa by smearing oil (5ml) for 5-10minutes.

The prepared mix was packed in different packaging materials (HDPE & MPP) stored in ambient conditions and analysed for proximate composition of moisture, protein, fat, reducing sugar, total sugar, crude fibre, ash, calcium, iron and tannin content by the following methods.

The product was analyzed for Moisture (Hot air oven method), Protein (Kjeldahl method), Reducing sugar & Total sugar (Shaffer Somogyi), Starch (Anthrone Method), Fibre (Acid and Alkali titration), Tannin (Calorimeter), Sensory evaluation (Hedonic rating scale 9-1) and Statistical analysis (Factorial Complete Randomized Design-FCRD) as per procedure given in the references.

Results and Discussion

Moisture

The convenience mix prepared from sorghum and maize had a moisture content of 8.80 per cent. It is lower than rice semolina mix (10.90%) (Table 1). The moisture content of the mixes increased gradually depending on the different packaging materials (9.67 for HDPE and 9.26 for MPP) at the end of storage (Table 2). The moisture absorption is low in metalized poly propylene bag (MPP) than high density polyethylene bag (HDPE). The moisture content of the mixes showed highly significant differences at 0.05% level on storage.

Table 1. Nutrient Content of Mixes

Products	Moisture (g)	Protein (g)	Fat (g)	Ash (g)	Reducing Sugar (g)	Total Sugar (g)	Crude fibre (g)	Calcium (mg)	Iron (mg)	Starch (g)	Tannin (mg)
Rice semolina mix (Control- C)	10.90	6.80	0.30	0.40	1.12	4.30	0.85	9.10	2.60	45.25	1.60
Convenience mix (T)	8.80	10.50	1.90	1.56	1.31	3.18	4.80	16.90	3.95	51.05	12.84

The moisture content might be due to the barrier capacity of the packaging materials. Selvaraj *et al*., (1995) observed a similar increase in moisture content on storage of cake doughnut premix and khadi mix respectively. These were packed in high density polyethylene bag (HDPE) and it was stable for 9 months, when stored at room temperature.

Protein

Protein content of convenience mix is higher (10.50g %) than rice semolina mix (6.80g %). During storage the protein content declined in convenience mix (T) stored in HDPE and MPP and the values were 9.69 and 9.74 at the end of storage period. The loss in protein content was found to be more in high density polyethylene bag (0.81g %) than metalized poly propylene bag (0.76g %). Statistically highly significant difference at 0.05% level was observed on storage. Nithya (2004) studied on the storage stability of nutrimix and stated that the protein content of all the samples declined slightly at end of storage period.

Table 2. Nutrient changes of convenience mix on storage

Nutrients / Storage	Moisture **(g)		Protein** (g)		Reducing ** Sugar (g)		Total Sugar ** (g)		Crude fibre ** (g)		Iron (mg)		Tannin (mg)	
	HDPE	MPP	HDPE	MPP	HDPE	MPP	HDPE	MPP	HDPE	MPP	HDPE	MPP	HDPE	MPP
Initial (0 days)	8.80	8.80	10.50	10.50	1.31	1.31	3.18	3.18	4.80	4.80	3.95	3.95	12.84	12.84
Final (90 days)	9.67	9.26	9.69	9.74	1.96	1.87	2.31	2.29	4.74	4.77	3.90	3.93	12.81	12.82

** Highly significant HDPE - High Density Poly Ethylene MPP - Metalized Poly Propylene

Reducing sugar

The convenience mix had higher reducing sugar content (1.31%), when compared to rice semolina mix (1.12%) at the end of storage period. The initial reducing sugar content of the convenience mix was 1.31per cent whereas rice semolina mix was 1.12 per cent. It was increased to 1.96 per cent for HDPE and 1.87% for MPP of convenience mix on storage. The conversion of total sugar to simple sugar during storage might have increased the reducing level in the stored mixes. Statistically highly significant difference at 0.05% level was observed on storage. Parveen, (1990) stated that the germinated flours from red gram and green gram exhibited an increasing trend in the reducing sugar content during storage periods.

Total sugar

A decreasing trend in the total sugar during storage was observed. The sorghum and maize based convenience mix had low total sugar (3.18g %) when compared to rice semolina mix (4.30g %)

Table 3. Data Analysis of convenience mix

	Moisture		Protein		Reducing sugar		Total sugar		Fibre		Iron	
	SED	CD(0.05%)	SED	CD(0.05%)	SED	CD(0.05%)	SED	CD(0.05%)	SED	CD(0.05%)	SED	CD(0.05%)
Treatment	0.0028	0.0075	0.0030	0.0081	0.0029	0.0077	0.0027	0.0073	0.0024	0.0066	0.0024	0.0049
Package	0.0028	0.0075	0.0030	0.0081	0.0029	0.0077	0.0027	0.0073	0.0024	0.0066	0.0024	0.0049
Storage	0.0052	0.0141	0.0057	0.0152	0.0054	0.0145	0.0051	0.0136	0.0046	0.0123	0.0046	0.0092
TP	0.0040	0.0106	0.0043	0.0115	0.0041	0.0110	0.0038	0.0103	0.0035	0.0093	0.0035	0.0070
PS	0.0074	0.0199	0.0080	0.0215	0.0077	0.0205	0.0072	0.0193	0.0065	0.0174	0.0065	0.0131
TS	0.0074	0.0199	0.0080	0.0215	0.0077	0.0205	0.0072	0.0193	0.0065	0.0174	0.0065	0.0131
TPS	0.0105	0.0282	0.0114	0.0305	0.0109	0.0291	0.0102	0.0273	0.0092	0.0246	0.0092	0.0185

initially. At the end of storage period the total sugar content of the convenience mix was 2.31g% for HDPE and 2.29g% for MPP. Among the packaging materials higher per cent retention of total sugar content was observed in the samples packed in HDPE followed by MPP. Statistically highly significant difference at 0.05% level was observed on storage. Narayan (1999) stated that the initial total sugar content of the weaning mixes decreased during storage.

Crude fibre

The fibre content of the convenience mix had higher than rice semolina mix. i.e. 0.85g per cent for rice semolina mix and 4.80g per cent for convenience mix.

A slight change was observed in the fibre content 4.74 per cent for HDPE and 4.77g per cent for MPP of convenience mix. Change was observed in the fibre content at the end of storage period. Among the packaging materials the retention of fibre content was better in the mix packed in metalized polypropylene (MPP) bags. Statistically highly significance at 0.05% level on storage. Narayan (1999) reported a very slight change in the crude fibre (0.58-0.56%) content of instant weaning mix.

Iron

A slight change was observed in the samples during storage. The convenience mix had higher iron content (3.95mg) than rice semolina mix (2.60mg). It was decreased to 3.90mg for HDPE and 3.93mg for MPP. Nithya (2004) stated that there was a slight reduction in the iron content of the nutrimix stored in polyethylene bag without vacuum and pet jar.

Tannin

Tannin content of the mix was higher (12.84mg) in convenience mix than rice semolina mix (1.60mg). A slight change was observed in the tannin (0.06mg for HDPE and 0.03mg for MPP) at the end of the storage period. Bhavani (2000) reported a slight decrease in tannin content of instant adai mix after 180 days of storage at room temperature. Rooney (2005) stated the tannins are benefits to human health.

Sensory Characteristics

Table 4 shows the sensory characteristics like colour and appearance, flavor, texture, taste and overall acceptability of the *laddu, uthiripittu, kuzhapittu and roti* scored higher values at the end of the storage periods (90 days). The score values ranged from 8.8 to 8.9 for HDPE and MPP packaging initially and 8.5 to 8.8 for HDPE and MPP at the end of the storage period. All the food products were acceptable up to 90 days of storage period.

Microbial Population

The microbial population of convenience mix was found to be minimum initially. It was increased from 2.0 $x10^{-4}$ to 7.0 $x10^{-4}$ for HDPE and from 1.0 $x10^{-4}$ to 5.0 $x10^{-4}$ for MPP at end of the storage period.

Table 4. Sensory quality of food products prepared from convenience mix on storage (0-90days)

Products	Score (0-9)																			
	Color & Appearance				Flavor				Texture				Taste				Overall acceptability			
	HDPE		MPP		HDPE		MPP		HDPE		MPP		HDPE		MPP		HDPE		MPP	
	0	90	0	90	0	90	0	90	0	90	0	90	0	90	0	90	0	90	0	90
Laddu	8.9	8.7	8.9	8.7	8.9	8.7	8.9	8.7	8.8	8.7	8.8	8.7	8.9	8.7	8.9	8.8	8.9	8.7	8.9	8.8
Uthiripittu	8.9	8.6	8.9	8.7	8.9	8.6	8.9	8.6	8.8	8.7	8.8	8.7	8.9	8.5	8.9	8.6	8.9	8.6	8.9	8.7
Kuzha pittu	8.9	8.6	8.9	8.7	8.9	8.6	8.9	8.6	8.8	8.7	8.8	8.7	8.9	8.5	8.9	8.6	8.9	8.6	8.9	8.7
Roti	8.9	8.8	8.9	8.8	8.8	8.5	8.8	8.6	8.8	8.6	8.8	8.6	8.9	8.7	8.9	8.7	8.8	8.5	8.8	8.5

HDPE - High Density Poly Ethylene MPP - Metalized Poly Propylene

Among the packaging materials MPP packed samples had low microbial population in all the treatments. It was within the safer limit on storage.

Conclusion

It can be concluded that sorghum and maize semolina mix are highly nutritious, low cost and it can be effectively used in the preparation of nutritious food items like *laddu, uthiripittu, kuzhapittu* and *roti* after suitable processing. The shelf life of mixes were found to be acceptable up to 90 days at ambient conditions under high density polyethylene bag and metalized poly propylene packaging.

References

Arya, S.S. 1990. Grain based snacks and convenience foods. *Indian Food Packer*. **40:** p.17-38.

Bhavani, S. 2000. Processing and evaluation of instant adai mixes. M.Sc., Thesis. Tamil Nadu Agricultural University, Coimbatore.

Gopalan, C., Ramasastri, B.V and Balasubramaniyan, S.C. 1997. Nutritive Value of Indian Foods**.** National Institute of Nutrition, ICMR, Hyderabad.

Malleshi, N.G and Desikachar, H.S.R. 1982. Formulation of weaning food with low hot paste viscosity based on malted ragi and green gram. *J. Food Sci. Technol*., **19:** 193-197.

Mc Donald, F.J. and Foley, B.Y. 1960. *J. Assoc. Office. Agri. Chem.*, **43:** p. 645.

Narayan, S. 1999. Processing and evaluation of weaning mixes based on greens and malted grains. M.Sc. (FSN) Thesis, Tamil Nadu Agricultural University, Coimbatore.

Nithya, A. 2004. Impact of nutrimix on the selected female athletic performance. M.Sc., Thesis, Tamil Nadu Agricultural University, Coimbatore.

Parveen, K. 1990. The development of germinated legume flours from red gram (*Cajanus cajan*) and green gram (*Phaseolus aurecus*). The miracle of germinated cereal powders (ed.) Dr.B.K. Chakraborthy, UNICEF house, New Delhi, p. 260.

Ranganna, S. 1995. Manual of analysis of fruits and vegetable products. *Tata Mc Graw Hill Publishing Co., Ltd.,* New Delhi, p.71.

Rooney,L. 2005. Sorghum Research-Ten Myths about tannins in sorghum. ISMN. **46**: 3-5.

Sadasivam, S. and Manickam, A. 1996. Biochemical methods. II$_{nd}$ edition, *New Age International (P) Ltd*. New Delhi, p.63.

Seetharama, N. and Rao, D.B. 2004. Sustaining nutritional security. The Hindu, Survey of Indian Agriculture. 37.

Selvaraj, A. Balasubramanyam, N. and Rao, P.H. 1995. Studies on cake doughnut premix. Packaging and keeping quality in flexible packs. *J. Food Sci. Technol.,* **32**: 227-230.

Received: April 10, 2012; Accepted: May 31, 2012