

Instant puttu mix preparation from finger millet and foxtail millet

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Abstract

Instant mix are easy to prepare, easy to cook and less time consume. Millets contain high nutritional value compare to rice and wheat. To blend millets in preparation of traditional based food product is due to rich in dietary fiber, protein, minerals like calcium, magnesium, iron and phosphorus. Puttu is steam cooked food product usually made from rice but blends with millets gives several health benefits. Instant millets puttu mix prepared from combination of finger millets with foxtail millets (50:50) were found to be better acceptability in organoleptic property and nutritional quality. Instant puttu mix stored in low density polyethylene and aluminium standing pouch for three months at ambient temperature (27±5°C). The chemical composition of finger millet and foxtail millet instant puttu mix comprise average value of crude protein 12.18 per cent, crude fiber 9.15 per cent, calcium 200.68 mg/100g, iron 6.24 mg/100g, magnesium 170.54 mg/100g, phosphorus 294.25 mg/100g.

Keywords: Instant puttu mix, finger millet, foxtail millet, sensory and nutritional

1. Introduction

Rice is the cereal staple food in India but higher consumption of rice as a daily diet usually seen in South Indian people compare to North Indian people. Nowadays millets are playing important role in therapeutic people who are mainly suffering from diabetes, obesity, and cardiovascular disease. The present trending is usage of millets in replacing rice based product due to people giving importance to keep healthy diet. South Indian breakfast is so popular in around the India due its of products variety made from rice like idli, dosa, pulav, pulivagare, lemon rice and apam, puttu etc. Recent data shows people suffering from diabetes is increasing due to higher consumption of rice based product during morning breakfast as well as regular diet.

Finger millet has higher dietary fiber, minerals, and sulfur containing amino acids compared to white rice, the current major staple food in India. Finger millet or ragi, one of the important minor millet cereals is a rich source of several phytochemical and among them polyphenols are the most important because of their nutraceutical potentials. The seed coat-rich fraction of the millet contains over 70% of polyphenols of the millet (Banerjee, 2012) [4]. Traditionally in India, finger millet was processed by methods such as grinding, malting, and fermentation for products like beverages, porridges, Idli (Indian fermented steamed cake), Dosa (Indian fermented pan cake), and roti (unleavened flat bread) (Malathi and Nirmalakumari, 2007) [7]. Health benefits of finger millet is excellent source of calcium it strengthen bones, maintain blood glucose levels, lowers cholesterol, prevents anemia, relaxation to the body, play

important role in losing weight and wound healing (Mathangi and Sudha, 2012) [8].

In India, foxtail millet is grown primarily in the hot drought prone and semiarid zones and used mostly for food purposes especially by people with low income. The main component of millet includes starch, protein, lipid, vitamin, and minerals (Usha *et al.*, 1996) [14]. It was further reported that minerals like magnesium, manganese and phosphorus were significantly in higher amount than the others (Gopalan *et al.*, 1987) [6]. Health benefits of aqueous extract of foxtail millet have excellent anti-hyperglycemic activity (Sireesha *et al.*, 2011) [12]. Foxtail millet contains 47mg polyphenolics per 100g so it acts as an antioxidant. In addition, defatted foxtail millet protein hydrolysates also exhibited antioxidant potency (Mohamed *et al.*, 2012) [9]. Significant reduction was recorded in serum glucose (23%), serum cholesterol (6%), serum LDL (20%) and glycosylated hemoglobin (16.5%), and a slight decrease in serum triglycerides and VLDL. Serum HDL increased significantly by 23 per cent (Thathola *et al.*, 2011) [13]. Also used in the treatment of dyspepsia; poor digestion and food stagnancy in abdomen (Yeung, 1985) [15].

Puttu is generally prepared in a metal puttu vessel with two sections. The lower section holds water and upper section holds the puttu – where the rice mixture is inserted with layers of grated coconut. Perforated lids provided in the bottom of puttu vessel to allow the steam to pass between them. Other types of cooking vessels include a pan similar to an idli pan with small holes in the bottom, pressure cookers and mainly in the hollow bamboo stalks.

Puttu is a one of the best breakfast food product in which

millets can be used in place of rice for increasing their nutritional value and maintaining good human health. Therefore, present investigation was carried out to find the millets suitability in the instant puttu mix preparation.

Materials and method

Material

Raw material like rice finger millet, foxtail millet, jaggery and desiccated coconut powder were obtained from local market. The packaging material viz., low density polyethylene (LDPE) and aluminium standing pouches were procured from local market and used for packaging of instant puttu mix for storage study chemicals and reagent were used from laboratory store.

Methods

A. Preparation of instant puttu mix

Firstly rice was soaked in water for about 2 hours then drained off the water. The soaked rice was dried in hot air oven at 75°C for about 4 hours. Then dried rice are roasted at 100 °C 4 min. The processed cleaned and decorticated finger millet and foxtail millet and rice were grinded and made it as flour with the help of cereal grinder. The flour was utilized for preparation of instant puttu mix. The product was evaluated organoleptically for quality attributes.

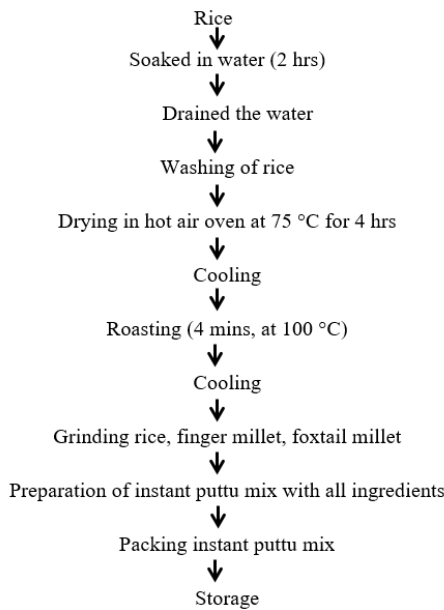


Fig 1: Flow diagram for preparation of instant puttu mix

B. Treatment details

Table 1: Treatment details of rice and finger millet flour mixture

Treatment	Rice (%)	Finger millet (%)
T ₁	100	00
T ₂	75	25
T ₃	50	50
T ₄	25	75
T ₅	00	100

Table 2: Treatment details of rice and foxtail millet flour mixture

Treatment	Rice (%)	Foxtail millet (%)
T ₁	100	00
T ₂	75	25
T ₃	50	50
T ₄	25	75
T ₅	00	100

Table 3: Treatment details of finger millet and foxtail millet flour mixture

Treatment	Finger millet (%)	Foxtail millet (%)
T ₁	100	00
T ₂	75	25
T ₃	50	50
T ₄	25	75
T ₅	00	100

C. Chemical characteristic of rice, finger millet and foxtail millet

The moisture content, crude protein content, crude fat, crude fiber of the sample was estimated by A.A.C.C. method (2000) [1]. The content of carbohydrate in the samples were obtained by subtracting from 100, the sum of values of moisture, protein, fat and ash content per 100 g of the sample (Raghuramulu, *et al.*, 1993) [10]. The mineral contents like calcium (Ca), iron (Fe) and, magnesium (Mg) were determined by the method described in AOAC (2005). Phosphorus content was determined by vanadomolybdate colorimetry method (Ch. Zinzadae, 1935) [5].

D. Sensory Evaluation

The sensory evaluation of instant puttu mix was carried out according to the method of Amerine *et al.*, (1980) [3] on 9 point hedonic score card. In all, each treatment of instant puttu mix were judged for the quality characteristics viz., colour and appearance, texture, flavour, taste and overall acceptability. The average score given by all the semi-trained judges for different quality characteristics were recorded.

F. Packaging materials

Different packaging materials viz., low density polyethylene (LDPE) and aluminium standing pouches were used for storage of instant puttu mix.

G. Storage condition

Instant puttu mix were packed in low density polyethylene and aluminium standing pouches stored at ambient temperature (27 ± 5°C) for 3 month, the sample were drawn at an interval of thirty days and evaluated for chemical and sensory quality.

H. Statistical Analysis

All experiments were carried out by using Factorial Completely Randomized Design (FCRD). The result obtained in the present investigation were analyzed for the statistical significance according to the procedure given by Rangaswamy (2010) [11].

Result and Discussion

A. Nutritional quality of instant puttu mix

1. Moisture content

The results indicated that highest moisture content observed in T₂ i.e. 12.09 per cent and least in T₄ i.e. 11.91 per cent (Table 1). During storage studies the moisture content increases from 12.02-12.05 per cent observed in LDPE and from 12.00-12.01 per cent in Aluminium standing pouch. The statistical analysis showed that the packaging material had non-significant effects on moisture content. Moisture content values are statistically at par with each other.

Table 4: Moisture content in instant puttu mix during storage

Treatments	Moisture content (%)			
	Storage period (days)			
	0	30	60	90
T ₁	12.00	12.01	12.02	12.03
T ₂	12.09	12.10	12.11	12.12
T ₃	12.06	12.07	12.08	12.09
T ₄	11.91	11.92	11.93	11.94
SE±	0.004	0.004	0.004	0.004
CD@5%	0.01	0.01	0.01	0.01
Packaging				
P ₁	12.02	12.03	12.04	12.05
P ₂	12.00	12.00	12.01	12.01
SE±	0.003	0.002	0.002	0.002
CD@5%	NS	NS	NS	NS

*All values are mean of four replication, - = spoiled sample
 T₁= Control puttu (100:00) T₂= Rice and finger millet puttu (50:50)
 T₃= Rice and foxtail millet puttu (50:50) T₄= Finger and foxtail millet puttu (50:50)
 Q₁= Refrigerated (5±2°C) Q₂= Deep freezer (-18±2°C)

2. Carbohydrate

The results indicated that highest carbohydrate content observed in T₁ i.e. 78.78 per cent and least in T₂ i.e. 78.27 per cent (Table 5). During storage studies carbohydrate content remain unchanged both in LDPE and in Aluminium standing pouch. The statistical analysis showed that the packaging material had non-significant effects on carbohydrate content. Carbohydrate content values are statistically at par with each other.

Table 5: Carbohydrate content in instant puttu mix during storage

Treatments	Carbohydrate (%)			
	Storage period (days)			
	0	30	60	90
T ₁	78.78	78.83	78.82	78.82
T ₂	78.27	78.23	78.22	78.21
T ₃	78.45	78.46	78.45	78.44
T ₄	78.65	78.64	78.63	78.62
SE±	0.036	0.004	0.004	0.004
CD@5%	0.10	0.01	0.01	0.01
Packaging				
P ₁	78.52	78.54	78.53	78.52
P ₂	78.55	78.54	78.53	78.52
SE±	0.026	0.002	0.002	0.003
CD@5%	NS	NS	NS	NS

*As indicated in Table 4

3. Crude Protein

The results indicated that highest crude protein content observed in T₄ i.e. 12.18 per cent and least in T₁ i.e. 9.16 per cent (Table 6). During storage studies protein content was

remain unchanged in LDPE and in Aluminium standing pouch. These result indicate that there is no significant effects of treatment or packaging material on protein content during storage. The statistical analysis showed that the packaging material had non-significant effects on crude protein content. Also interaction between them was non-significant. Statistically crude protein content values are at par with each other.

Table 6: Crude protein content in instant puttu mix during storage

Treatments	Crude Protein (%)			
	Storage period (days)			
	0	30	60	90
T ₁	9.16	9.16	9.15	9.13
T ₂	9.42	9.44	9.40	9.40
T ₃	11.92	11.91	11.91	11.89
T ₄	12.18	12.17	12.16	12.14
SE±	0.004	0.004	0.005	0.005
CD@5%	0.01	0.01	0.01	0.01
Packaging				
P ₁	10.67	10.67	10.65	10.63
P ₂	10.66	10.67	10.66	10.64
SE±	0.002	0.003	0.003	0.003
CD@5%	NS	NS	NS	NS

*As indicated in Table 4

4. Crude Fat

The results indicated that highest crude fat content observed in T₄ i.e. 4.35 per cent and least in T₁ i.e. 2.09 per cent (Table 7). During storage studies crude fat content was remain unchanged in LPDE and in Aluminium standing pouch. The statistical analysis showed that the packaging material had non-significant effects on crude fat content. Also interaction between them was non-significant. Statistically crude fat content values are at par with each other.

Table 7: Crude fat content in instant puttu mix during storage

Treatments	Crude Fat (%)			
	Storage period (days)			
	0	30	60	90
T ₁	2.09	2.09	2.07	2.06
T ₂	2.48	2.47	2.45	2.44
T ₃	3.96	3.95	3.94	3.93
T ₄	4.35	4.34	4.32	4.32
SE±	0.004	0.004	0.004	0.004
CD@5%	0.01	0.01	0.01	0.01
Packaging				
P ₁	3.22	3.22	3.20	3.19
P ₂	3.22	3.21	3.20	3.18
SE±	0.003	0.003	0.003	0.003
CD@5%	NS	NS	NS	NS

*As indicated in Table 4

5. Crude Fiber

The results indicated that highest crude fiber content observed in T₄ i.e. 9.15 per cent and least in T₁ i.e. 4.25 per cent (Table 8). During storage studies crude fiber content remained unchanged in LPDE and in aluminium standing pouch. The statistical analysis showed that the packaging material had non-significant effects on crude fiber content. Also interaction between them was non-significant. Statistically crude fiber content values are at par with each other.

Table 8: Crude fiber content in instant puttu mix during storage

Treatments	Crude Fibre (%)			
	Storage period (days)			
	0	30	60	90
T ₁	4.25	4.24	4.23	4.23
T ₂	5.14	5.14	5.13	5.12
T ₃	8.09	8.09	8.09	8.09
T ₄	9.15	9.15	9.13	9.13
SE±	0.082	0.004	0.006	0.005
CD@5%	0.24	0.01	0.01	0.01
Packaging				
P ₁	6.66	6.66	6.65	6.65
P ₂	6.65	6.65	6.66	6.63
SE±	0.003	0.003	0.003	0.004
CD@5%	NS	NS	NS	NS

*As indicated in Table 4

Table 9: Ash content in instant puttu mix during storage

Treatments	Ash (%)			
	Storage period (days)			
	0	30	60	90
T ₁	1.66	1.65	1.62	1.61
T ₂	2.76	2.75	2.73	2.72
T ₃	3.16	3.15	3.14	3.13
T ₄	4.13	4.12	4.10	4.09
SE±	0.08	0.08	0.08	0.08
CD@5%	0.02	0.02	0.02	0.02
Packaging				
P ₁	2.91	2.90	2.88	2.86
P ₂	2.95	2.94	2.93	2.92
SE±	0.011	0.011	0.011	0.011
CD@5%	NS	NS	NS	NS

*As indicated in Table 4

6. Ash

The results indicated that highest ash content observed in T₄ i.e. 4.13 per cent and least in T₁ i.e. 1.66 per cent (Table 9). During storage studies ash content was remained unchanged in LPDE and in aluminium standing pouch. The statistical analysis showed that the packaging material had non-significant effects on ash content. Also interaction between them was non-significant. Statistically ash content values are at par with each other.

7. Calcium

The results indicated that highest calcium content observed in T₄ i.e. 200.68 mg/100g and least in T₁ i.e. 23.19 mg/100g (Table 10). During storage studies calcium content was remained unchanged in LPDE and in aluminium standing pouch. The statistical analysis showed that the packaging material had non-significant effects on calcium content. Also interaction between them was non-significant. Statistically calcium content values are at par with each other.

Table 10: Calcium content in instant puttu mix during storage

Treatments	Calcium (mg/100g)			
	Storage period (days)			
	0	30	60	90
T ₁	23.19	23.18	23.15	23.13
T ₂	185.33	185.32	185.31	185.30
T ₃	28.69	28.67	28.66	28.65
T ₄	200.68	200.66	200.65	200.63
SE±	0.008	0.008	0.008	0.008
CD@5%	0.02	0.02	0.02	0.02
Packaging				
P ₁	109.43	109.42	109.40	109.39
P ₂	109.50	109.49	109.45	109.44
SE±	0.011	0.011	0.011	0.011
CD@5%	NS	NS	NS	NS

*As indicated in Table 4

8. Iron

The results indicated that highest iron content observed in T₄ i.e. 6.24 mg/100g and least in T₁ i.e. 4.20 mg/100g (Table 11). During storage studies iron content was remained unchanged in LPDE and in aluminium standing pouch. The

statistical analysis showed that the packaging material had non-significant effects on iron content. Also interaction between them was non-significant. Statistically iron content values are at par with each other.

Table 11: Iron content in instant puttu mix during storage

Treatments	Iron (mg/100g)			
	Storage period (days)			
	0	30	60	90
T ₁	4.20	4.17	4.16	4.13
T ₂	5.79	5.78	5.75	5.74
T ₃	5.25	5.22	5.20	5.19
T ₄	6.24	6.23	6.21	6.20
SE±	0.008	0.008	0.008	0.008
CD@5%	0.02	0.02	0.02	0.02
Packaging				
P ₁	5.37	5.36	5.35	5.33
P ₂	5.52	5.50	5.49	5.48
SE±	0.011	0.011	0.011	0.011
CD@5%	NS	NS	NS	NS

*As indicated in Table 4

9. Magnesium

The results indicated that highest magnesium content observed in T₄ i.e. 170.54 mg/100g and least in T₃ i.e. 102.24 mg/100g (Table 12). During storage studies magnesium content was remained unchanged in LPDE and in aluminium standing pouch. The statistical analysis showed that the packaging material had non-significant effects on magnesium content. Also interaction between them was non-significant. Statistically magnesium content values are at par with each other.

Table 12: Magnesium content in instant puttu mix during storage

Treatments	Magnesium (mg/100g)			
	Storage period (days)			
	0	30	60	90
T ₁	106.78	106.77	104.76	104.75
T ₂	130.17	130.16	130.15	130.13
T ₃	102.24	102.23	102.22	102.21
T ₄	170.54	170.52	170.52	170.52
SE±	0.008	0.006	0.008	0.015
CD@5%	0.02	0.01	0.02	0.04
Packaging				
P ₁	127.34	127.33	127.32	127.31
P ₂	127.52	127.51	126.50	126.49
SE±	0.011	0.012	0.011	0.022
CD@5%	NS	NS	NS	NS

*As indicated in Table 4

Phosphorus

The results indicated that highest phosphorus content observed in T₄ i.e. 294.25 mg/100g and least in T₁ i.e. 167.74 mg/100g (Table 13). During storage studies phosphorus content was remained unchanged in LPDE and in Aluminium standing pouch. The statistical analysis showed that the packaging material had non-significant effects on phosphorus content. Also interaction between them was non-significant. Statistically phosphorus content values are at par with each other.

Table 14: Organoleptic evaluation of instant puttu mix

Treatments	Colour and appearance		Flavour		Taste		Texture		Over all acceptability	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
T ₁	8.73	8.67	8.08	7.88	8.75	7.76	8.00	7.76	8.00	7.46
T ₂	8.26	8.20	7.92	7.75	8.06	7.78	8.06	7.78	8.00	7.43
T ₃	8.73	8.67	8.10	7.88	8.17	7.72	8.17	7.72	8.21	7.96
T ₄	8.48	8.42	8.03	7.85	8.76	7.81	8.26	7.81	8.51	7.98
SE±	0.016	0.016	0.015	0.016	0.015	0.016	0.015	0.016	0.013	0.012
CD@5%	0.04	0.04	0.04	0.01	0.04	0.04	0.04	0.04	0.03	0.03
Packaging										
P ₁	8.56	8.50	7.66	7.41	8.41	7.75	8.38	7.75	8.25	7.83
P ₂	8.54	8.48	8.44	8.27	8.45	7.78	8.43	7.78	8.30	7.89
SE±	0.023	0.023	0.224	0.023	0.021	0.023	0.021	0.023	0.015	0.02
CD@5%	NS	NS	0.06	0.06	0.06	0.06	0.06	0.06	0.04	0.06

*As indicated in Table 4

Conclusion

The sensory score of all parameters decreased continuously during storage. The overall acceptability score of rice and finger millet instant puttu mix, rice and foxtail millet instant puttu mix and finger millet and foxtail millet instant puttu mix decreased in both LDPE bag and aluminium standing pouches. The instant puttu mix stored in aluminium standing pouches showed good quality than in low density

Table 13: Phosphorus content in instant puttu mix during storage

Treatments	Phosphorus (mg/100g)			
	Storage period (days)			
	0	30	60	90
T ₁	167.74	167.73	167.71	167.68
T ₂	194.72	194.71	194.69	194.68
T ₃	232.69	232.67	232.65	232.63
T ₄	294.25	294.23	294.20	294.19
SE±	0.016	0.016	0.016	0.016
CD@5%	0.10	0.10	0.10	0.10
Packaging				
P ₁	230.84	230.83	230.81	230.80
P ₂	230.95	230.93	230.92	230.90
SE±	0.04	0.04	0.04	0.04
CD@5%	NS	NS	NS	NS

*As indicated in Table 4

Organoleptic evaluation of instant puttu mix

For colour and appearance T₁ and T₃ got same score i.e. 8.73 to 8.67 and least score was found in T₂ i.e. 8.26. The statistical results indicated that there was non-significant different in colour of instant puttu mix for different packaging material. During storage studies flavour retention was found better in P₂ up to 90 days. Highest score was found in T₃ and least in T₂. Taste is one of the organoleptic parameter by which from consumer can decide to accept or reject the product. Highest score was found in T₄ and least in T₂. Texture depends on adding the water while preparation of puttu and it also depends on different size of the flour. Present results indicated that millet based puttu food product gives acceptable texture to the product. Highest score was found in T₄ and least in T₃. Under over all acceptability all organoleptic parameters are considered for that products acceptance for consumption. Present results indicated that there is a change in the organoleptic properties but it remains in acceptable limit and gives good acceptance by the consumers. Highest score was found in T₄ and least in T₂. Therefore utilization of millets in the preparation of breakfast item puttu is acceptable. Except colour and appearance other parameter.

polyethylene bag during 3 months of storage. The roasted flavour retention was observed more in aluminium standing pouches than in LDPE bag stored at ambient temperature. The instant puttu mix were acceptable up to 3 month and amongst the all stored puttu samples, finger millet and foxtail millet puttu showed better in nutritional properties and organoleptic properties.

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