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Development and Quality Evaluation of Little Millet Batter

Ramyashree S.R.[1], M.L. Revanna[1]*, C.T. Ramachandra[2], Shobha, D.[3] and Umashankar, N.[4]

[1]Department of Food Science and Nutrition,
University of Agricultural Sciences, GKVK Bengaluru (Karnataka), India.
[2]Department of Processing and Food Engineering, College of Agricultural Engineering,
University of Agricultural Sciences, GKVK Bengaluru (Karnataka), India.
[3]AICRP on Post-Harvest Engineering and Technology,
University of Agricultural Sciences, GKVK Bengaluru-560065 (Karnataka), India.
[4]Department of Agricultural Microbiology,
University of Agricultural Sciences, GKVK Bengaluru-560065 (Karnataka), India.

(Corresponding author: Ramyashree S.R.)*
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ABSTRACT: The objective of the study was to formulate batter from the different blend ratio of the little millet and black gram. The different blend ratios were 85:15 (LMT1), 80:20 (LMT2), 75:25 (LMT3) and 70:30 (LMT4) along with control rice and black gram (70:30) (LMT0). The samples were further studied for different parameters such as fermentation time, moisture, pH, acidity, bulk density and raise in batter volume, total solids in batter and colour. The pH of the batter ranged between 6.24 to 3.89, acidity between 0.41 to 0.66, moisture content between 64 to 67 per cent, total dissolved solids ranged between 32 to 34, rise in volume ranged from 11 to 66 per cent respectively. The *L, *a** and *b** values for the unfermented batter ranged from 78.53 to 79.20, 1.34 to 1.43 and 13.39 to 15.24 and in fermented batter values ranged from 79.92 to 81.29, 1.40 to 1.85 and 12.95 to 14.57 respectively.**

Keywords: Millets, pH, Acidity, Rise in volume, Colour, Total dissolved solids.

INTRODUCTION

Millets are the coarse cereals cultivated by smallholders and tribal farmers mainly under rainfed conditions. The distribution of millets is noted in the Asian and African continents and some portions of Europe. These are among the fore most ancient cultivated crops in India. Ministry of agriculture and farmers welfare have recognized the importance of millets and declared major millets comprising of sorghum (jowar), pearl millet (bajra), minor millets *i.e.,* finger millet (ragi/mandua), foxtail millet (kanngani/kakun), proso millet (cheena), kodo millet (kodo), barnyard millet (sawa/sanwa/jhangora), little millet (kutki), brown top millet and two pseudo millets *i.e.*, buck wheat (kuttu), amaranth (chaulai) as "nutri-cereals" for production, consumption and trade point of view (Rao *et al.*, 2017).

Millets are considered as functional foods and super foods. Functional foods contain bioactive ingredients which are beneficial for physiological benefit of human beings and can comb at with chronic diseases. Millets are a highly nutritious crop and contain considerable amounts of vitamins and minerals. Millets are a good source of energy, dietary fiber, slowly digestible starch, and resistant starch, and thus provide sustained release of glucose and thereby satiety. Compared to cereals, millets are a good source of protein and sulphur containing amino acids (methionine and cysteine) and have a better fatty acid profile (Anitha *et al.*, 2020). However, millets contain a limited amount of lysine and tryptophan, which varies with the cultivar. Millets are rich in vitamin E and vitamin B and in minerals such as calcium, phosphorus, magnesium, manganese, potassium, and iron. Millets are called as super grains because of their high nutritional value. According to the Food Safety and Standards Authority of India (FSSAI) millets are high in dietary fibre. Specifically, millet contains (7-12 %) protein, (2-5 %) fat, (65-75%) carbohydrates and (15-20%) dietary fibre. Due to their high density of nutrients including vitamins, minerals, phytochemicals and dietary fibre, millets are also excellent grains to alleviate malnutrition and micronutrient deficiency (Birania *et al.*, 2020).

Little millet (*Panicum sumatrense*) was domesticated in India and is another reliable catch crop in view of its earliness and resistance to adverse agro-climatic conditions (Rao *et al.*, 2017). Little millet is rich in B-comlex vitamins and minerals like potassium, phosphorus, iron, zinc and magnesium (Arunachalam *et al.*, 2005).

Black gram (*Vigna mungo* (L.) Hepper) or "urd bean" is the third important pulse crop in India. India is the world's largest producer as well as consumer of black gram (Rajni Modgil *et al.*, 2019). The high fiber, low glycemic index properties of black gram help to main blood glucose level and keeps control in people with diabetes mellitus. Black gram contains α-amylase and is known to delay carbohydrate absorption and to reduce peak postprandial plasma glucose concentration (Kaur *et al.*, 2015).

Fermentation of cereals, is an ancient and inexpensive food preservation method and a cultural and traditional practice within indigenous communities in Africa and in most developing countries. It improves the nutritional value and digestibility of raw products (cereals, roots), enhances sensory characteristics, and improves the functional qualities available to local communities. Traditional fermented foods are widely consumed all over the world. Generally, these are formulated from local food crops and other resources which are easily available. Fermented foods such as *idli* were described as early as 700 BC. There are numerous fermented foods are available in the market with different base material with different preparation methodologies. There is a unique group of micro-biota present in each fermented food and these micro-biota increases the level of proteins, vitamins, essential amino acids and fatty acids in the product. However, fermented foods are still produced traditionally by spontaneous fermentation and only limited knowledge has been obtained regarding the micro-biota of these products (Jeyaram *et al.*, 2009). Raw foods contain anti-nutrient components such as phytates and tannins which hinder the absorption of the nutrients and make other essential nutrients unavailable for the body, during fermentation these components activity gets reduced and results in detoxification (Gadaga *et al.*, 1999).

Foods which need some preparation like cooking, frying and reconstitution before consumption are called ready to use foods. These foods gaining acceptance primarily from Indian youth and younger generations and is becoming part of day to day life. Keeping in view of the working women and changing preferences towards convenience foods, this study was planned to standardize millet based ready- to-use batter and its quality evaluation.

MATERIALS AND METHODS

The present study was conducted in the Department of Food Science and Nutrition, University of Agricultural Sciences, GKVK, Bangalore.

Procurement of sample: Raw materials (Rice, Little millet, black gram and other ingredients) were purchased from the local market and stored at room temperature (25±2°C) in airtight containers and used as when required. The different ratios of ingredients were given in the Table 1.

Table 1: Different Proportion of ingredients used in the preparation of millet batter.

Blend ratios	Ingredients (%)		
	Rice	Little millet (LM)	Black gram
LMT0 (Control)	70	—	30
LMT1	—	85	15
LMT2	—	80	20
LMT3	—	75	25
LMT4	—	70	30

Preparation of Batter:

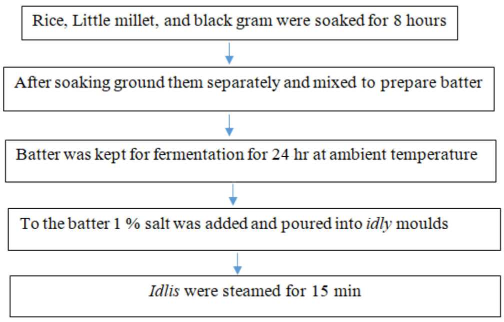

Fig. 1. Process flow chart for the batter and idly preparation.

Chemical properties of batter

Determination of Moisture Content. Moisture was determined by taking about 10 g of sample in petridish and dried in an oven at 65ºC till the weight of the petridish with its content was constant. Each time before weighing, the petridish was cooled in desiccators. Moisture content of the sample was expressed in percentage.

$$\text{Moisture content (g/100g)} = \frac{\text{Initial weight (g)} - \text{Final weight(g)}}{\text{Weight of the sample}} \times 100$$

pH: The pH of fermented batter was measured using digital pH meter.

Acidity: The acidity of fermented batter was measured using the titration method and using NaOH (1N) as the titrating chemical and phenolphthalein (1 %) as indicator.

Bulk Density g/cm^3: The bulk density was calculated as the ratio of mass to its batter volume. About 50 ml aliquots of batter were placed in a 100 ml measuring cylinder with lid.

Raise in Volume: The increase in volume of batters was analyzed by pouring the prepared batter in measuring cylinder and fermenting it for 24 hours.

The increase in volume was calculated by following formula

$$\text{Increase in Volume (\%)} = \frac{\text{Volume after fermentation} \times \text{Volume before fermentation}}{\text{Volume before fermentation}} \times 100$$

Total dissolved solids (TDS) of the batter: was measured by gravimetric method.

The Colour of the batter was estimated using a reflecting colorimeter (Chroma meter CR-300). The samples were kept in a colorimeter petri dish and readings were taken in triplicates. The *L**, value is a measure of lightness/brightness, ranging from 0 (black) to 100 (white). The *a** value is a measure of greenness/redness, ranging from –60 (green) to +60 (red) and the *b** value is a measure of bluishness/yellowness, ranging from –60 (blue) to +60 (yellow).

Statistical Analysis. The data were subjected to analysis of variance (ANOVA) for testing the significance of variation using SPSS (Statistical Package for Social Sciences) software 16.0.

RESULTS AND DISCUSSIONS

The results of moisture content and total dissolved solids of various blend ratios were depicted in the table 2. The results revealed that, moisture content varied from 64 to 67 per cent. The highest moisture content was observed in the blend ratio LMT3 which was on par with LMT0 followed by LMT2 and slight low moisture content was observed in LMT4. The variation in moisture content was due to change in the ratio of ingredients used. TDS were one of the important parameter to describe product texture and the results revealed that, there was no significant difference was found in the blend ratios. The solids was ranged between 32 to 35 % and results found to be positively associated with respect to the product (*Idly and dosa*).

Table 2: Moisture content and Total dissolved solids in the batter.

Blend ratios	Total dissolved solids (TDS) %	Moisture content in Finger Millet (FM) batter %
LMT0	32.70±333	67.29±667
LMT1	34.36	65.64
LMT2	33.38±333	66.61±667
LMT3	32.72	67.28
LMT4	35.71	64.29
C.D.	2.11±4	2.11±4
SE(m)	0.662	0.662
SE(d)	0.937	0.937
C.V.	3.396	1.732

Table 3: pH of the batter during fermentation time.

Blend ratio / Time in hr	0	2	4	6	10	12	14	16	18	20	24
LMT0	6.233±333	6.203±333	6.1	6.063±33	5.75	5.363±33	4.873±33	4.563±33	4.53	5.386±66	5.386±66
LMT1	6.246±667	6.31	6.086±667	6.02	5.826±66	5.283±33	5.013±33	4.84	4.53	5.036±66	5.036±66
LMT2	6.226±667	6.246±667	6.086±667	6.026±66	5.943±33	5.656±66	4.876±66	4.44	4.32	4.95	4.973±33
LMT3	6.233±333	6.216±667	6.1	6.056±66	5.763±33	5.363±33	4.166±66	4.073±33	4.53	5.326±66	5.326±66
LMT4	6.246667	6.246667	6.043333	6.026667	5.95	5.456667	3.98	3.89	4.336667	4.84	4.84
Factors	**C.D.**				**SE(d)**			**SE(m)**			
A	0.041				0.020			0.014			
B	0.060				0.030			0.021			
AXB	0.135				0.068			0.048			

The pH value of batter at different fermentation time was studied for 24 hrs and results were presented in Table 3. It was found that pH ranged between 6.22 and 3.89. There was an increasing trend of acidity level, reduction in pH value during fermentation time, irrespective of blend ratio. According to Mukherjee *et al.* (1965), leavening action of hetero fermentative lactic acid bacterium, *L. mesenteroides* which causes increase in acidity with time. Acidification and leavening are the two most important changes that occur during fermentation similar results was recorded by Susheelamma and Rao (1978); Soni and Sandhu (1989). There exists a higher reduction of pH for LMT4 blend ratio. Soni and Arora (2000) have reported that the contribution of yeast towards the acid and gas production. Also, black gram provides a maximum number of microorganisms for fermentation it was supported by Ghosh and Chattopadhyay (2010).

The Table 4 presents data on the acidity and bulk density of different treatments labeled as LMT0, LMT1, LMT2, LMT3, and LMT4. The acidity ranges from 0.49 to 0.66 percent of lactic acid. There was no significant difference foundin acidity of the sample with respect to different blend ratios. The bulk density of batter during different fermentation time and blend ratio was ranged between 0.41 to 0.90g/cm^3. It was found that, the bulk density increased with the increase of fermentation time. This trend is corroborated with the action of various hetero fermentative lactic acid bacteria which in turn produces carbon dioxide by acting upon fermentable sugars.

Table 4: Acidity and Bulk density of the batter.

Blend ratio	Acidity	Bulk density (g/cm^3)
LMT0	0.467	0.410
LMT1	0.540	0.720
LMT2	0.627	0.733
LMT3	0.660	0.777
LMT4	0.493	0.907
C.D.	0.040	0.027
SE(m)	0.013	0.009
SE(d)	0.018	0.012
C.V.	3.931	2.091

Table 5: Rise in volume of the batter during fermentation.

		Raise in Volume (%) LM							
Blend ratio	**Time in Hrs**	**0**	**4**	**8**	**12**	**16**	**18**	**22**	**24**
LMT0		0	11.66±7	33.33±3	45.66±7	53.33±3	57.00	63.33±3	63.33±3
LMT1		0	0	20.66±7	25.00	33.33±3	38.33±3	41.66±7	41.66±7
LMT2		0	0	32.33±3	43.16±7	52.33±3	56.56±7	62.33±3	62.33±3
LMT3		0	0	25.18±3	32.88±7	42.33±3	56.67	56.0	56.0
LMT4		0	10	24.0	33.0	45.0	56.22±0	66.0	66.0
Factors		**C.D.**		**SE(d)**			**SE(m)**		
A		1.111		0.557			0.394		
B		1.406		0.705			0.499		
A × B		3.143		1.576			1.115		

The Table 5 presents the volume increase in percent for different treatments (LMT0 to LMT4) at various time intervals (0, 4, 8, 12, 16, 18, 22, and 24 hours). It was showed that, theincrease in volume of the batter during fermentation was decreased with increase in the amount of little millet and also was affected by the room temperature, as the room temperature is less in monsoon and winter seasons. The range of increase in volume is 10 to 66 per cent. In both LMT0 and LMT4 the increase in volume is 66 per cent which is significantly high.

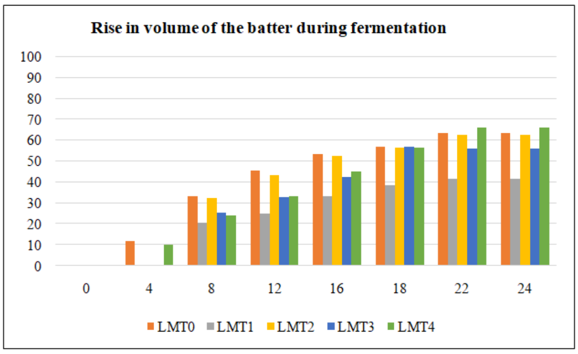

Fig. 2. Rise in volume of the batter during fermentation.

The colour analysis of the batter results were depicted in Fig. 3. The results revealed that, *L**, *a** and *b** values of the unfermented batter ranged from 78.53 to 79.20, 1.34 to 1.43 and 13.39 to 15.24 and in fermented batter values ranged from 79.92 to 81.29, 1.40 to 1.85 and 12.95 to 14.57 respectively. The analyzed values showed that, there is a no significant difference found among unfermented and fermented batters.

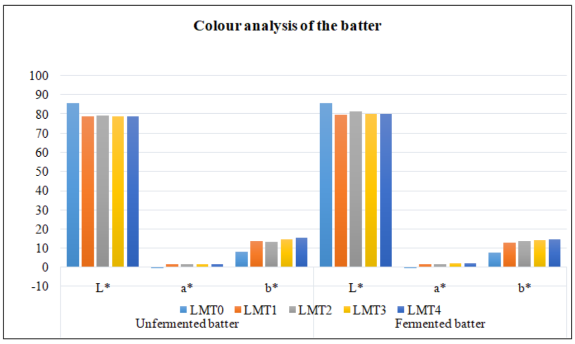

Fig. 3. Rise in volume of the batter during fermentation.

Similar results of batter was reported for maize batter during natural fermentation Shobha & Neena Joshi (2015); Balasubramanian *et al.* (2015). The least volume recorded in LMT1 (42 %) in 24hrs. The blend ratio is significant for percent volume rise of batter at (p<5%).

CONCLUSIONS

Among these batter blends, LMT4 (70:30) ratio and LMT3 (75:25) with 16 hr of fermentation time was found to be optimum was acceptable with respect to sensory attributes. Hence the study concluded that, the fermented little millet batter can be utilized as convenient food.

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