RESEARCH ARTICLE

STANDARDIZATION AND QUALITY EVALUATION OF IDLI PREPARED FROM PEARL MILLET (*Pennisetum glaucum*)

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ARTICLE INFO	ABSTRACT
	The present research was undertaken to determine the physical properties of batter, physio- chemical properties and organoleptic evaluation of the developed Idlis. Idlis were prepared from Rice and Black gram dhal incorporating Pearl millet. All the ingredients were collected from the local market. Three types of Idlis namely standard idli, mixed idli and pearl millet idli was prepared using different combinations of ingredients such as Rice (Parboiled), Black gram and Pearl millet. The developed products were analyzed for physical and chemical parameters and organoleptic evaluation. These scores were compared with standard. The developed millet Idlis were highly acceptable by the subjects and notable change in physical parameters of both millet incorporated batter and idli was observed when compared to the standard. Except carbohydrate remarkable increase was observed in the nutrients such as protein, fat, fibre, calcium and iron in the mixed and pearl millet Idlis compared to the standard Idlis.

INTRODUCTION

Idli is a traditional cereal/legume-based naturally fermented steamed product with a soft and spongy texture which is highly popular and widely consumed as a food item in India (Renu Agrawal et al, 2000). Idli makes an important contribution to the diet as a source of protein, calories and vitamins, especially B-complex vitamins, compared to the raw unfermented ingredients (Srilakshmi, 2003). Idli is also known as "Rice cake" is a traditional food of India. It is a favourite breakfast food in south India with spongy texture, attractive appearance, appetizing taste and flavour to get with its easy digestibility and good nutritive value contribute to its increasing popularity in all parts of India and also in other countries (Manay and shadaksharaswamy, 2001)

Pearl millet (*Pennisetum Glaucum*) is a principal source of energy, protein, vitamins and minerals for millions of the poorest people in the regions where it is cultivated. Pearl millet contains more calories than wheat, probably because of its higher oil content of 4.2% which is 50% polyunsaturated. Pearl millet is rich in B vitamins, potassium, phosphorus, magnesium, iron, zinc copper and manganese. It is a cereal grain with good drought tolerance and hardiness and short growing period. It is commonly grown in the semiarid regions of Africa and Asia (Singh and Maldonado, 2003). Millet grains can substitute for the rice or wheat component for the development of fermented foods like idli or dosa (Cheeptongkum 1976). Black gram originated in India where it has been in cultivation from ancient times and is one of the most highly prized pulses of India.

Black gram has a mucilaginous material which makes it a valuable ingredient in idli preparation. The chief proteins present in black gram are albumins and globulins and glutelins. Fenugreek is used both as an herb (the leaves) and as a spice (the seed). It is cultivated worldwide as a semi-arid crop. It is frequently used in curry and also as a main ingredient in the idli preparation. The present study was done to analyze the physical and physio chemical qualities of batter and pearl millet incorporated idli with a view to determine the organoleptic acceptability.

MATERIALS AND METHODS

Basic formulation of idlis

Three different types of idlis with varying proposition of ingredients were prepared and the composition is given in the Table 1.

Preparation of Idlis

The ingredients of different variables in the above specified proportion were soaked over night and ground separately. Rice (Parboiled), Pearl millet was ground coarse and black gram to a fine paste with Fenugreek seed. Ingredients were mixed together and salt was added. Parboiled rice is found to be more suitable than raw rice for making soft and spongy textured idlis. The specialty of Black gram in idli preparation is owing to the mucilaginous material present in it which is absent in other edible legumes. This mucilaginous principle helps in the retention of carbon dioxide evolved during fermentation. The batter was allowed to ferment for 14 hours after that it was poured in an idli steamer and steamed till it was done.

Physical properties of developed batters before and after fermentation

Various physical properties of the developed batters such

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Table 1.Proportion of Ingredients in Idli

Standard Idli	Mixed Idli	Pearl Millet Idli
Rice (Parboiled) -75g	Rice(Parboiled) – 45g	Pearl millet – 75g
Black gram -15g	Black gram – 15g	Black gram – 15g
Fenugreek seeds – 5g	Pearl millet – 30g	Fenugreek seeds – 5g
Water - required consistency	Fenugreek seeds – 5g	
	Water- required consistency	Water- required consistency

Table .2 Mean Physical Properties of the batter

Parameters	Standard			Mixed Idli			Pearl Millet Idli		
	I	F	D	I	F	D	I	F	D
Height(cm)	3.0	4.30	1.3	3.0	4.0	1.0	3.0	3.7	0.7
Weight(g)	20.0	18.5	1.5	20.0	18.7	1.3	20.0	18.6	1.4
pH	6.60	5.27	1.33	6.64	5.16	1.48	6.86	5.35	1.51
Spreadability(cm)	4.4	4.65	0.25	3.7	4.1	0.4	4.1	4.4	0.3
Specific gravity (g/cm^3)	1			0.95			0.97		

Note: I-Initial, F-Final, D-Difference

Table 3. Co- relation matrix of the physical properties of the batter

	Height(cm)	Weight(g)	pH	Spreadability (cm)	Specific gravity (g/cm^3)
Height(cm)	1				
Weight(g)	-0.962[**]	1			
pH	-0.297	0.359	1		
Spreadability(cm)	-0.159	0.147	0.698[*]	1	
Specific gravity (g/cm^3)	0.150	-0.173	0.580	0.526	1

[**] Co-relation is significant at 0.01 level (2- tailed)
[*] Co-relation is significant at 0.05 level (2- tailed)

Table 4. Physical parameters of the developed idlis

Parameters	Standard	Mixed Idli	Pearl Millet Idli
Diameter (cms)	8.0	7.1	7.4
Width (cms)	2.9	2.1	2.2
Cooked Weight (g)	50	56	54
Cooking time(min)	7	10	11
Number of Pores in a square inch	15	12	8

as height, weight, pH, spread ability and specific gravity of the batter are analyzed using standard techniques.

Physical parameters of developed idlis
Various parameters such as diameter, width, weight of the cooked idlis, time taken for complete steaming were assessed using standard procedures. A special test called 'INK print test' was done to record the appearance of idlis permanently by means of photography on Ink prints. These prints furnish a record of number of pores per square inch in the graph sheets which indicates the softness of the developed idlis.

Organoleptic evaluation
The developed idlis were served to a group of 30 semi-trained panelists for the evaluation of appearance, colour, flavor, taste, texture and overall acceptability on a 9 point hedonic scale with a scores ranging from 9 to1 where scores 9 to1 represented like extremely and dislike extremely respectively. The quality parameters were quantified and the mean scores of the three evaluations were calculated.

Nutritive value of the developed idlis
Nutrients like carbohydrates, protein, fat, calcium and iron were analyzed. Total carbohydrates were determined by volumetric method as described by Lane Eynon method (Ranganna, 2004), protein by Micro-kjeldhal method

using a conversion factor of 6.25, fat by Soxhlet extraction method using petroleum ether (B P60 -70°C), fiber by AOAC method, calcium content was determined by KMno4 titration method, and iron content were estimated by the calorimetric methods as described by Ranganna (2004)

Statistical analysis
The collected data was compiled and analyzed by using statistical methods. Descriptive statistics, ANOVA and Correlation is computed using s statistical software SPSS version 15.0. Duncan's multiple range tests were applied to determine the significant differences between the idlis.

RESULT AND DISCUSSION

Physical properties of the batter
In the present study, the mean initial height of the batter was noticed as 3.0cm for all the variations. After fermentation (14hrs), the raise in height was higher for standard (4.3cm) followed by mixed idli (4.0cm) and the least was occupied by the pearl millet (3.7), regarding the mean weight was observed in mixed idli batter(1.3g) followed by pearl millet idli(1.4g) and standard idli (1.5g). About pH, height was noted in pearl millet idli batter (1.51) followed by mixed idli (1.48) and least by standard idli (1.33). High difference in spread ability was noted in mixed idli (0.4 cm) compared to the standard. Specific gravity was noted in the standard batter (1g/ml) compared to the pearl millet and mixed idli batter. According to Nagaraju and Manohar (2000), there was a decrease in

diameter of the product as the ratio of rice to black gram increases in the batter. According to Narpinder et al (2007) The effect of substituting rice with extrusion cooked (75, 100 and 125C) rice flour at 10, 20, 30 and 40% levels had significant effects on the specific gravity, acidity and pH of the idli batter, and textural and sensory quality of the idlis.

diameter of the standard idli was found to be high with a value of 8.0 cm followed by Pearl millet idli (7.4cm) and mixed idli (7.1cm) respectively. The highest width value (2.9cm) was obtained by standard idli followed by pearl millet idli (2.2cm). The increased weight was observed in the mixed idli (5g) and increased cooking time in the pearl millet idli (11minutes) and least in standard idli. The greater number of pores(15) per square inch in the ink

Table 5. Mean Organoleptic Scores of idlis

Type of variation	Appearance	Colour	Flavour	Texture	Taste	Over all acceptability
Standard	8.96 ± 0.054^c	8.3 ± 0.49^b	8.3 ± 0.34^a	8.7 ± 0.33^b	8.84 ± 0.21^c	8.84 ± 0.20^c
Mixed idli	7.56 ± 0.25^b	8.3 ± 0.13^b	7.9 ± 0.48^a	8.1 ± 0.21^a	7.52 ± 0.29^b	8.14 ± 0.16^b
Pearl Millet idli	6.74 ± 0.39^a	7.1 ± 0.24^a	7.9 ± 0.04^a	7.8 ± 0.27^a	7.20 ± 0.15^a	7.34 ± 0.16^a
F-ratio	38.26	22.73	1.53	12.26	73.13	85.35
P-value	0.000**	0.000**	0.234	0.001**	0.000**	0.000**

** Significant difference is at 0.01 level
* Significant difference is at 0.05 level
Value with different superscripts differ each other on application of Duncan's Multiple Rang Test.

Table 6. Co- relation matrix for the physical parameters with organoleptic scores of the idlis

	Diameter (cm)	Thickness (cm)	Weight (g)	Number of pores (sq inch)	Cooking time (min)	Texture	Taste	Over all acceptability
Diameter (cm)	1							
Thickness (cm)	0.976	1						
Weight (g)	-1.000**	-0.976	1					
Number of pores (sq inch)	0.847	0.942	-0.847	1				
Cooking time (min)	-0.837	-0.937	0.839	-1.000**	1			
Texture	0.786	0.901	0.786	0.994	-0.996	1		
Taste	0.786	0.901	-0.786	0.994	-0.996	1.000**	1	
Overall acceptability	0.866	0.954	-0.866	0.999*	-0.999*	0.990	0.990	1

** Co-relation is significant at 0.01 level (2- tailed)
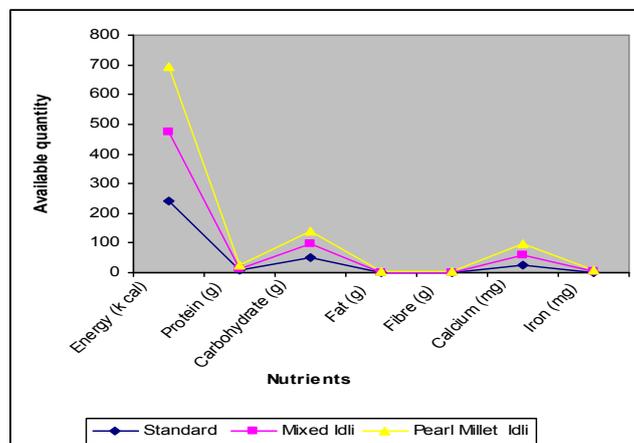* Co-relation is significant at 0.05 level (2- tailed)

Fig 1. Nutritive value of the developed idlis

There was significant correlation between the variables of weight and height of the batter at 5% level in negative sense which shows if weight increases air holding capacity decreases. Spreadability of the batter has strong positive co-relation with the pH of the batter at 1% level (Table-3). According to Soni *et al.* (2000), density of the batter decreases as the level of air incorporation or water addition to the batter increased .The spreadability of batter was directly proportional to the water content but inversely proportional to the air in corporation in the batter. The radial growth decreased linearly with increase in apparent viscosity of batter.

Physical parameters of the developed idlis
Physical parameters of the idlis are given in Table 4. The

print test was noted in the standard idli followed by mixed idli(12) and least by the pearl millet idli(8) which shows that if the number of pores increases the softness of the idli will also increases(Table-4).

Organoleptic evaluation of idlis
The mean acceptability scores obtained by the sensory evaluation of millet idlis are in Table 5. Among the different variations standard idli has got a highest scores of 8.96 followed by the variation mixed idli with a score of 7.56 and the least score 6.74 is obtained by the pearl millet idli for the appearance attributes. Regarding the colour attributes the highest score 8.3 is obtained by both standard and mixed idli with the following variation pearl millet idli score is 7.1. The texture attributes was found to

be maximum for the standard with the score of 8.3 and the followed by the mixed idli (8.1). Regarding the taste attributes the highest score of 8.84 is obtained by the standard which is followed by the mixed idli with the score of 7.52. The overall scores of standard was found to be slightly higher (8.84) than the mixed idli with the score of 8.14.

Duncan's test reveals that there was significant difference between standard and other variations for the attributes of appearance, colour, texture, taste and overall acceptability except flavour attribute. It was found that there was a strong negative correlation for the diameter with weight, number of pores with cooking time and cooking time with over all acceptability at 5% level. It was found that there was a strong positive correlation between number of pores and overall acceptability of idlis at 1% level and positive correlation with texture and taste at 5% level.

Nutritive value of the developed idlis

The data pertaining to nutritive value of the developed millet based idlis is presented in Fig.1. Energy values of Pearl millet idli (218.94 Kcal) though less in comparison to standard (241.94 Kcal) and mixed idli (231.70 Kcal) the difference was not significant. On comparing the protein content of the three types of ldli, it was found to be maximum in Pearl millet idli (9.16g) followed by mixed idli (7.28g) and standard idli (7.0g). Pearl millet can be considered to be the most superior to mixed and standard idli in protein content. Fat content was improved in pearl millet idli (2.87g) in comparison to mixed (1.39g) and standard idli (0.54g), carbohydrate content of standard idli (52.10g) was maximum followed by mixed idli (44.23g) and minimum for pearl millet idli (42.29g). Fiber in pearl millet idli (1.10g)which was the highest as present in mixed (0.75g) and standard idli (0.62g). Calcium content was found to be maximum in pearl millet (41.44mg) followed by mixed idli (30.48mg) and standard idli (26.76mg). Presence of iron in pearl millet, mixed and standard idli was 4.7mg, 2.43 mg and 1.16 mg respectively.

Conclusion

Pearl millet can be used in idli preparation instead of rice in scarcity areas. Mean while pearl millet is a short duration, rapid growth and drought tolerance crop and hence this is an attempt to optimize various methods for utilizing in diversified ways. Replacing rice with pearl millet had good impact on the nutritive value by increasing the protein, fat, fibre, calcium and iron content in the developed idlis. Thus pearl millet idli is found to be acceptable, palatable and nutritious.

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