RESEARCH PAPER

Development and Quality Evaluation of Multigrains *Idli*

Adsare A.D.[1*], Giram K.K.[2], Kadbhane V.S.[3], Khupase S.P.[4] and John Devid[5]

[1]SRA College of Food Technology Ashti, Beed, Maharashtra, India
[2]Ph.D Scholar, SHAUTS Prayagraj, Uttar Pradech, India
[3]SRA College of Food Technology Ashti, Beed, Maharashtra, India
[4]Ph.D Scholar, SHAUTS Prayagraj, Uttar Pradech, India
[5]Professor Dean, WCDT, SHAUTS Prayagraj, Uttar Pradech, India

*Corresponding author: adsareabhijeet1@gmail.com

ABSTRACT

Cereals and pulses combination was good nutritional sources of fiber, protein and energy. This research was conducted determining the physio-chemical properties and organoleptic evaluation of developed multigrain *idli*. *Idli* was prepared from Sorghum, Pearl millet, Finger millet, Amaranth and Black gram. All the ingredient for preparation of *idli* was collected from the Krushi exhibition, farmer and local market. Formulation carried out by CRD method. Four different types of *idli* with varying proposition of ingredients was prepared. The composition was T_0 - rice 70 gm and black gram 30 gm, T_1 - sorghum: pearl millet: finger millet: amaranth: black gram; 55:5:5:5:30; T_2- 45:10:10:5:30; T3-35:15:10:10:30 respectively. These scores compared with standard *idli*. The quality evaluation of developed *idli* samples such as organoleptic evaluation and physio-chemical parameters. The organoleptic score and physio-chemical parameters of T_3 sample better than other samples. The proximate evaluation of developed *idli* samples such as T_3 sample was rich in fiber, protein, calcium, iron and cheap in carbohydrate and fat. The overall evaluations T_3 sample was better than T_0, T_1 and T_2.

Keywords: *Idli*, Physical, Chemical, Organoleptic, Amaranth

Idli was famous traditional indigenous fermented food consumed throughout India and other countries. This was prepared by steaming a fermented black gram and rice batter. It was important contribution to the diet as a source of protein, calories and vitamins. After cooking *idli* was prepared soft and spongy texture. It was easy to digestible and good nutritive value.

Different types of *idli* were prepared in India such as standard *idli*, rava *idli*, Kancheepuram *idli*, stuffed *idli*, *ragi idli* and curd *idli*. *Idli* was served with sambar and different variety of chutney such as coconut chutney, onion chutney and mint chutney.

The complete or partial replacing of rice with sorghum wasbest effect on the nutritive value by increasing the fat, fibre, protein, calcium and iron content in the developed multigrain *idli*. Pearl millet was a principal source of energy, vitamins, protein and minerals.

Finger millet (*ragi*) was rich in protein, iron, calcium, phosphorus, fibre and vitamin content. It provides highest level of antioxidants properties, phytochemicals, which make it easy and slowly digestible. Hence it helps to control blood glucose levels in diabetic patients. Amaranth content best quality protein. The "protein complement" of grain

amaranth was very near to the levels recommended by FAO/WHO. Black gram has a mucilaginous material which makes it a valuable ingredient in *Idli* preparation. The chief proteins present in black gram such as albumins, globulins and glutelins. This mucilaginous material helps to hold the carbon dioxide during fermentation.

MATERIALS AND METHODS

The methodology adopted has been described under the following headings process flow chart for preparation.

Raw Material

Selection of good quality and specific variety of raw material from the market such as Sorghum, Pearl Millet, Finger millet, Amaranth, Black Gram for the preparation of *Idli*.

Table 1: Raw Material Variety

Sl. No.	Ingredients	Varieties
1	Sorghum	Dagdi M-35-1
2	Pearl Millet	Ganga kaveri-1111
3	Finger millet	Ragi ML-365
4	Amaranth	Pusalal chaulai
5	Black Gram	Plant U 30

Formulation of *Idli*

Completely randomized designs (CRD)were used for the formulation of *idli*. The four different types of *idli* with different proportion of ingredients were prepared and the composition is given in the Table 2.

Table 2: Formulation of *idli*

Ingredients	Sample			
	T_0 (Control)	T_1	T_2	T_3
Sorghum (gm)	—	55	45	35
Pearl Millet (gm)	—	5	10	15
Finger millet (gm)	—	5	10	10
Amaranth (gm)	—	5	5	10
Rice (gm)	70	—	—	—
Black Gram (gm)	30	30	30	30

Preparation of *idli*

The all ingredients on different proportion were soaked in 2 to 5 hrs and after soaking Sorghum, pearl millet, finger millet and amaranth were ground coarse and black gram to a fine paste. This paste was mixed together and added of salt. Obtained batter was allowed to ferment for 14 hours after that it was poured in an *idli* steamer and steamed till it for 24 min in medium flame and finally *idli* was done.
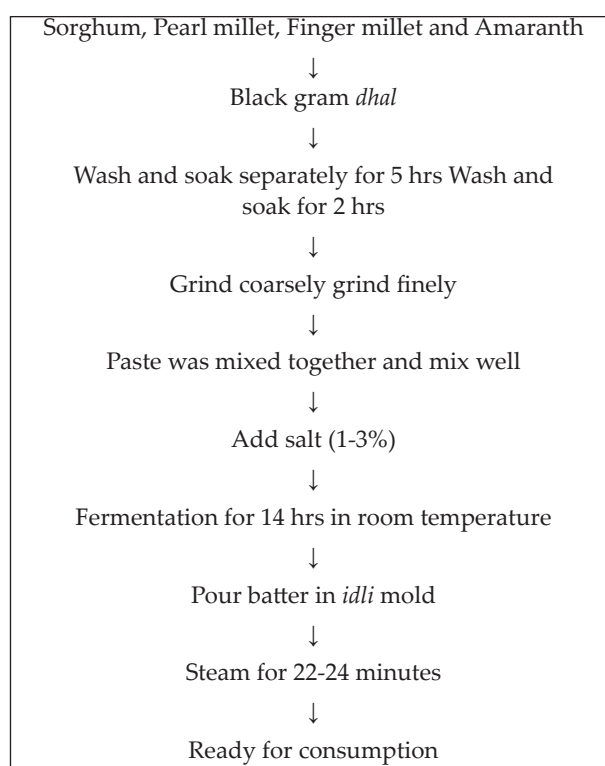
Flow chart for preparation of *idli*

Sorghum, Pearl millet, Finger millet and Amaranth
↓
Black gram *dhal*
↓
Wash and soak separately for 5 hrs Wash and soak for 2 hrs
↓
Grind coarsely grind finely
↓
Paste was mixed together and mix well
↓
Add salt (1-3%)
↓
Fermentation for 14 hrs in room temperature
↓
Pour batter in *idli* mold
↓
Steam for 22-24 minutes
↓
Ready for consumption

Fig. 1: Prepared Sample of Multigrain *idli*

RESULTS AND DISCUSSION

Proximate evaluation of raw material used for *idli* preparation

The Physico-chemical properties of raw materials were analyzed to check the quality of final product. The nutritional composition of Sorghum, Pearl millet, Finger millet, Amaranth and Black gram given in table 3.

Proximate evaluation of Developed *idli*

The nutritive value of the developed multigrain based *idli* is presented in table 4.

Organoleptic evaluation of Multigrain *idli*

The sensory evaluation of *idli* was determined by using a taste panel. This taste panel is a semi-trained panel using nine-point hedonic scale. By this rating score sample no. T3 has been found best with scoring of 38.05 marks. The acceptability statements and their marks given in table 5.

Physical Parameters of Multigrain *idli*

Various physical parameters of developed *idli* determined & compare with standard *idli* such as diameter, thickness, weight, fermentation time and time taken for complete steaming.

Microbial analysis of Multigran *idli*

In microbial analysis Yeast and mould count was observed to be 15×10^4 cfu/g in control *idli* at zero day, on first day it was observed 24×10^4 cfu/g and on second day it was 45×10^4 cfu/g respectively. Total plate Counts (TPC) was observed to be 8×10^4 cfu/g

Table 3: Proximate analysis of raw material used for *idli*

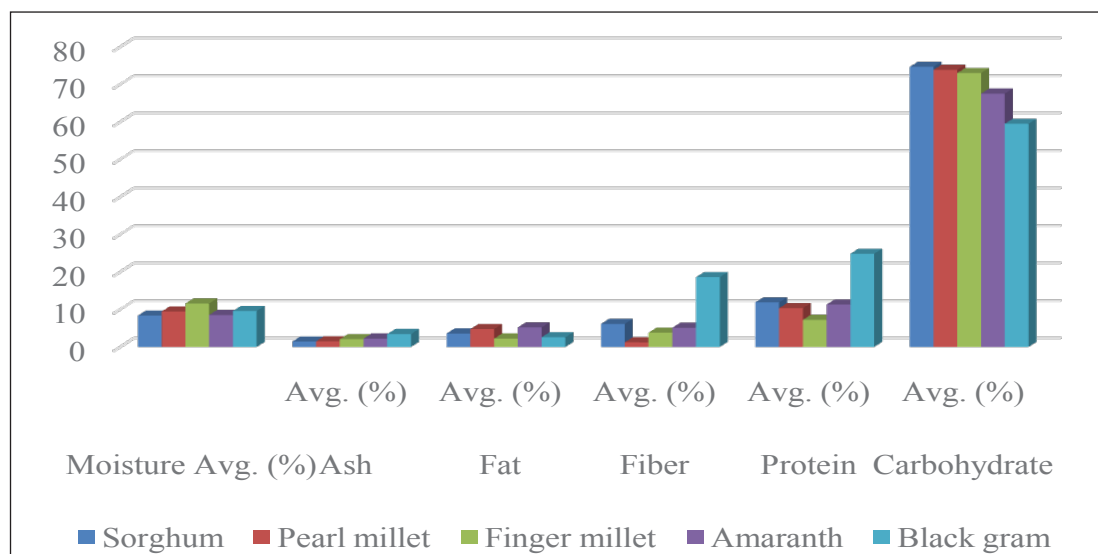| Sl. No.	Sample	Parameter (%)					
		Moisture	Ash	Fat	Fiber	Protein	Carbohydrate
1	Sorghum	8.37	1.44	3.60	6.15	11.90	74.69
2	Pearl millet	9.46	1.50	4.78	1.24	10.36	73.89
3	Finger millet	11.60	2.08	2.24	3.81	7.24	73.03
4	Amaranth	8.54	2.24	5.24	5.12	11.32	67.54
5	Black gram	9.59	3.45	2.60	18.62	24.85	59.51

Fig. 2: Proximate analysis of raw material

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Table 4: Nutritive value of the developed *idli* per 100 gm

Parameter	Sample				Std. Dev.	Mean	CV%
	T_0	T_1	T_2	T_3			
Moisture	63.45	64.92	62.96	62.90	0.80	63.82	1.25
Ash	1.59	1.70	1.82	1.84	0.11	1.73	6.68
Fat	0.86	0.85	0.78	0.73	0.10	0.87	12.39
Protein	7.0	8.75	9.01	9.10	0.98	8.46	11.67
Carbohydrate	31.50	21.30	22.46	21.06	5.0	24.03	20.83
Fiber	1.17	2.50	2.90	2.90	0.82	2.36	34.64
Calcium	25.0	40.86	46.42	50.51	11.18	40.69	27.48
Iron	3.25	3.08	3.52	3.57	0.53	3.03	17.75

All values are means ± SD of the triplicate, CV% = Coefficient of Variance.
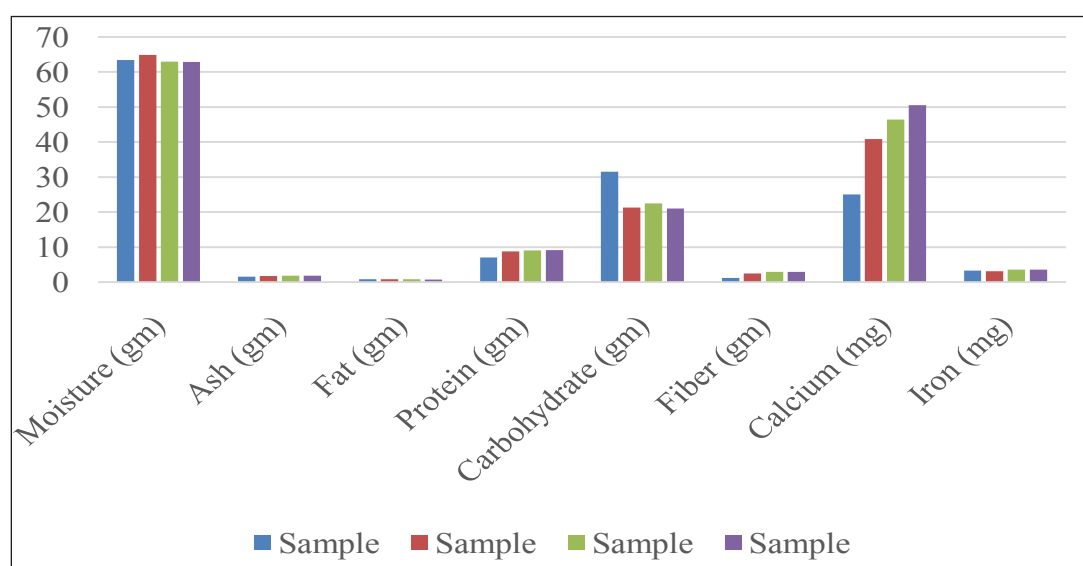
Fig. 3: Proximate Analysis of Developed *idli*

Table 5: Organoleptic Scores of Multigrain *idli*

Sample	Parameter				
	Colour	Texture	Flavour	Taste	Over all acceptability
T_0	7.1	7.2	7.1	7.8	7.30
T_1	7.7	8	6.9	6.8	7.35
T_2	6.9	8.3	7.3	7.4	7.49
T_3	7.1	8.3	7.1	7.8	7.57
Std. Dev.	0.34	0.51	0.16	0.47	0.12
Mean	7.2	7.95	7.1	7.45	7.42
CV%	4.81	6.53	2.29	6.34	1.67

All values are means ± SD of the triplicate, CV% = Coefficient of Variance.

to zero day, on first day it was observed 15×10^4 cfu/g and second day it was 25×10^4 cfu/g respectively. The *E. coli* count was not detected in anyof the formulated multigrain *idli* on any of the storage days. The microbiological analysis of multigrain *idli* at different storage period showed that the total plate counts and yeast and mould count increased with increase in storage period.
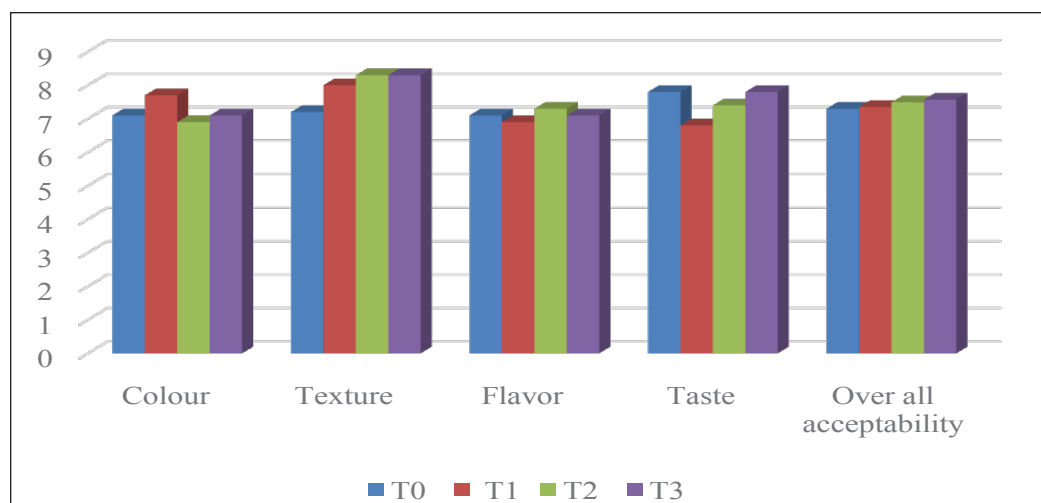
Fig. 4: Organoleptic Scores of Multigrain *idli*

Table 6: Physical Parameters of Multigrain *idli*

Parameter	Sample				Std. Dev.	Mean	CV%
	T_0	T_1	T_2	T_3			
Diameter (cm)	7.2	7.2	7.2	7.3	0.05	7.22	0.69
Thickness (cm)	1.8	1.7	1.9	2.1	0.17	1.87	9.1
Cooking weight of *idli* (gm)	39.5	39.8	40.1	44.5	2.5	40.8	6.14
Cooking time (min)	24	24	24	24	0	24	0
Fermentation time (hrs.)	14	14	14	14	0	14	0

All values are means ± SD of the triplicate, CV% = Coefficient of Variance.

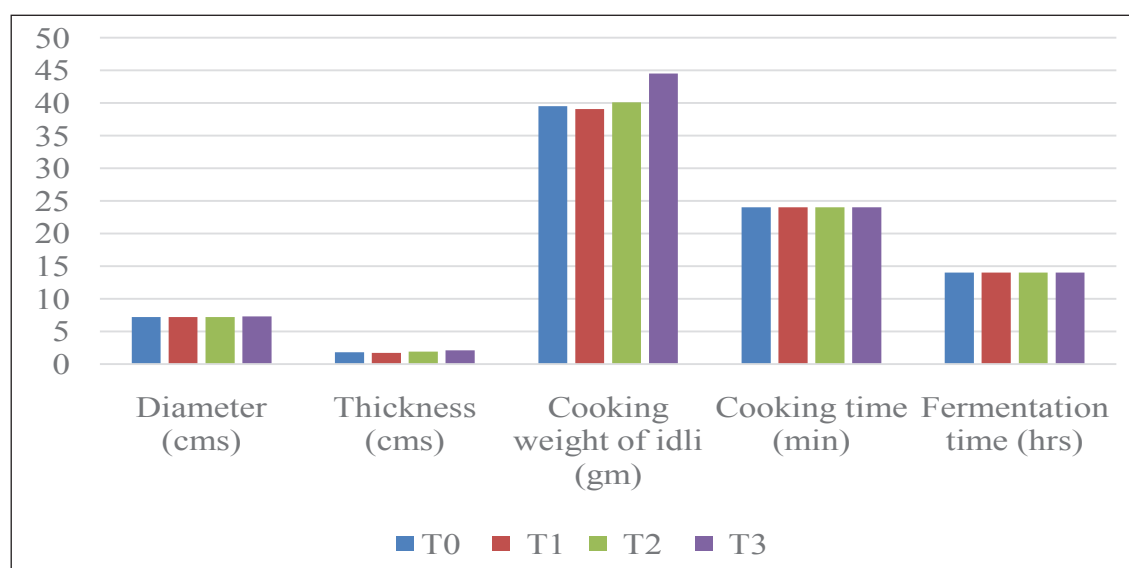**Fig. 5:** Physical Parameters of Multigrain *idli*

Table 7: Microbial analysis of *idli*

| Parameters | Storage period (Days) | Sample | | | | |
		T0 Control	T$_1$	T$_2$	T$_3$	T$_4$
Yeast and Mould (cfu/g 10^4)	0	15	12	13	16	12
	1	24	22	20	25	23
	2	45	41	44	43	40
	3	TNTC	TNTC	TNTC	TNTC	TNTC
Total Plate Count (cfu/g 10^4)	0	8	7	9	6	8
	1	15	13	16	18	14
	2	25	24	29	22	23
	3	TNTC	TNTC	TNTC	TNTC	TNTC
E. coli count (cfu/g 10^4)	0	ND	ND	ND	ND	ND
	1	ND	ND	ND	ND	ND
	2	ND	ND	ND	ND	ND
	3	ND	ND	ND	ND	ND

*CFU- Colony Forming Unit, TNTC- Too Numerous to Count, ND- Not Detected.

CONCLUSION

The cereal and legume were blends especially high fiber and protein sources. Complete replacing of rice with multigrain was good impact on the nutritive value by increasing the protein, fat, fiber, calcium and iron content in the developed multigrain *idli*. The quality evaluation of developed multigrain *idli* samples such as organoleptic evaluation and physio-chemical parameters. The organoleptic score and physical parameters were T$_3$ sample better than other samples. The quality evaluation of developed multigrain *idli* T$_3$ sample was rich in fiber, protein, calcium, iron and less in carbohydrate and fat. The overall analysis of T$_3$ sample was better than T$_0$, T$_1$ and T$_2$.

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