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Organoleptic Quality Attributes of Maize Idli

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ABSTRACT

A study was conducted to evaluate the organoleptic quality and physicochemical characteristics of maize *idli*. *Idlis* were prepard using maize semolina and black gram dhal in three different ratios of 2:1, 3:1 and 4:1 along with the control (rice: blackgram dhal). They were subjected to sensory evaluation as well as descriptive sensory profile. The batter properties such as pH, titrable acidity, volume increase after fermentation and consumer acceptability were recorded. The percentage of increase in batter volume was significantly high for maize batter (22.80%) compared to rice batter (16.46%). The mean sensory scores for parameters such as taste, texture and overall acceptability were found to be significantly more for the combination 3:1 followed by 2:1, indicating that organoleptically acceptable *idli* with good physicochemical characteristics can be prepared by fermenting 3:1 combination of maize:blackgram dhal for 14hrs . This was acceptable by both rural (90-92%), urban children (80%) and adults (86%) respectively.

MAIZE is widely cultivated around the world and has broad geographical adaptability. India ranks fifth in the world in maize production with 23 mt grown on an area of 7.5 m ha with a productivity of 2.5 t ha^{-1} during 2013-14 (Annon, 2014). In spite of increasing production and productivity, maize has not yet occupied main position in human nutrition due to deficiency of amino acids such as lysine and tryptophan. However, these deficiencies were overcome by the development of QPM (quality protein maize). Maize can also be used to prepare nutrious foods by combining good quality pulses and by various processing techniques such as germination, roasting, malting and fermentation.

Fermentation is a desirable process wherein biochemical modification of primary food matrix is brought about by microorganisms and their enzymes. Lactic acid fermentation of cereals is a long-established processing method being used in Asia, Africa and other countries. In India, number of fermented foods such as fermented rice idli (pazhaiyasoru), dosa, ambali, nan, siddhu (Sekar and Mariappan, 2007) and dhokla (Ravi *et al.,* 2010) prepared from rice and other cereals are already popular. However, fermented foods from nontraditional crops such as maize are yet to become popular among larger mass. Huge potential exists for fermented products, which have improved nutritional quality at lower cost. Hence a study was conducted with an objective to evaluate the organoleptic quality and batter characteristics of maize *idli.*

Standardization of idli: Grains of maize were treated with 1 per cent lime solution and were dry milled in a mini SS dry grinder mill and passed through 25 BS sieve to get maize semolina (suji) of 600 microns. Three different types of idlis with varying proposition of maize semolina and black gram dhal in 2:1, 3:1 and 4:1 ratios were prepared along with the control (rice:blackgram in the ratio 3:1). The standardized procedure for the preparation of idli is depicted in Fig. 1. Immediately after batter preparation and 14 h after fermentation, the batter properties such as pH, titrable acidity, volume of the batter before fermentation and volume after fermentation were recorded as per Balasubramanian and Vishwanathan (2006). The standardised maize *idli* was distributed to children as well as adults of both rural and urban

areas in order to elicit the general (consumer) acceptability of the product by common mass.

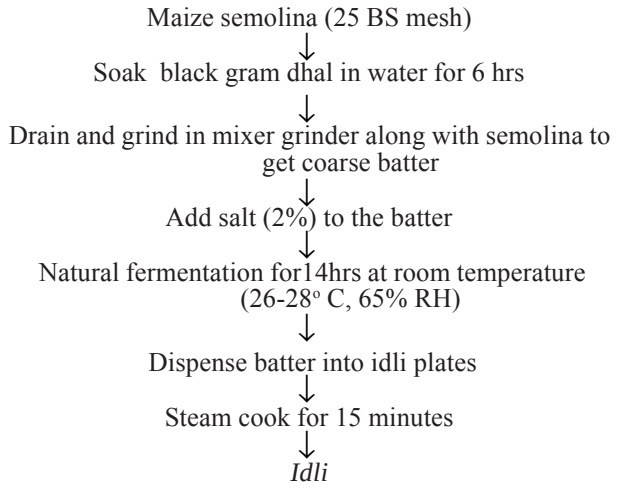

Fig. 1: Flow chart depicting standardized procedure for the preparation of maize idli.

The products were evaluated for appearance, texture, aroma, taste and overall acceptability on a nine point hedonic scale. The expert panelists (six members) also evaluated four sets of idlis at separate times for descriptive sensory profile. The panelists were asked to put (√) mark on the descriptive profile sheet which describes the product best. A special test called 'INK print test' was used as suggested by Nazni and Shalini (2010) to record the appearance of idlis permanently by means of ink impression.

Sensory evaluation scores for idli are depicted in Figure 2. The mean sensory scores for parameters such as taste, texture and overall acceptability were

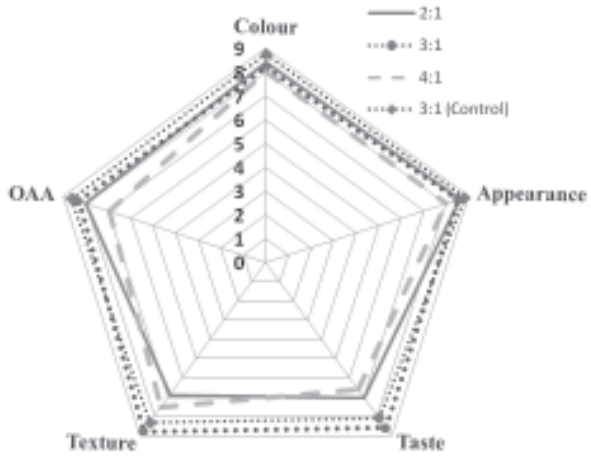

Fig. 2: Sensory attributes of maize idli prepared in 2:1, 3:1 and 4:1 proportion of maize semolina: black gram dhal and control idli (rice: black gram dhal), on a 9-point Hedonic scale: (9-like extremely, 8-like very much, 7-like moderately, 6-like slightly, 5-neither like nor dislike, 4-dislike slightly, 3-dislike moderately, 2- dislike very much and 1-dislike extremely)

found to be significantly more for the combination 3:1 followed by 2:1, indicating better acceptability of 3:1 combination. Similar kind of study on Millet *idli* batter and its organoleptic quality evaluation carried out by Balasubramanian *et al.*(2015) indicated that millet *idli* in the ratio of 4:1 prepared after 14 h fermentation showed a maximum overall acceptability.

The sponginess, aroma and taste scores were also found to be appropriate for 3:1 combination followed by 2:1 (Table I). None of the combinations exhibited stickiness in idlis prepared.

TABLE I

Descriptive sensory profile of idli by expert panelists (n=6)

	Maize *idli*			Rice *idli* (Control)
	2:1	3:1	4:1	3:1
Appearance	Moderately appealing	Moderately appealing	Moderately appealing	Extremely appealing
Colour	Light yellow	Moderate yellow	Dark yellow	Typical white
Sponginess	Slightly firm	Moderately spongy	Slightly spongy	Moderately spongy
Mouthfeel	Not at all Sticky	Not at all Sticky	Not at all Sticky	Not at all Sticky
Aroma	Optimally fermented	Optimally fermented	Optimally fermented	Optimally fermented
Taste	Typical idli taste	Typical idli taste	Moderately Sour	Typical idli taste
Overall acceptability	Extremely acceptable	Extremely acceptable	Moderately acceptable	Extremely acceptable

2:1, 3:1 and 4:1 are maize semolina: black gram dhal, Control is rice: black gram dhal (3:1).

TABLE II

Batter characteristics of maize idli compared to rice idli

Particulars	Maize *idli* batter	Rice *idli* batter
Titratable Acidity (before fermentation) (%)	0.06±0.01 [a]	0.09±0.01 [a]
Titratable Acidity (after fermentation) (%)	0.16±0.01 [b]	0.21±0.01 [b]
pH (before fermentation)	4.41±0.01 [b]	4.55±0.01 [b]
pH (after fermentation)	3.84±0.01 [a]	3.71±0.01 [a]
Initial volume of the Batter (cm^3)	260±0.35 [b]	240±0.42 [a]
Final volume of the Batter (cm^3)	530±0.14 [b]	430±0.14 [a]
Batter volume increased after fermentation (%)	22.80±0.02 [b]	16.46±0.10 [a]
Volume of Batter after expulsion of gas (cm^3)	315±0.53 [a]	360±0.69 [b]
Batter volume decreased after expulsion of gas (%)	40.57±0.07 [b]	16.28±0.07 [a]

Values are mean ± standard deviations. Data followed by different letters for maize and rice idli batter indicated significant differences at 5% and the same letters indicated non- significant differences (PÂ0.05) (n=3).

Perusal of the Table II revealed the batter characteristics of maize and control *idli* in the standardised ratio of 3:1 .The pH of the batter after fermentation decreased significantly with a concomitant increase in titrable acidity in both the samples. The percentage of increase in batter volume was significantly high for maize batter (22.80 %) compared to rice batter (16.46%). Similar kind of results for rice *idli* were reported by Balasubramanian and Viswanathan (2006), Ghosh and Chattopadhyay (2010) and Durgadevi and Shetty (2014). The increase in batter volume could be attributed to the microbial growth and secretion of enzymes, which catalyse the hydrolysis of carbohydrates, lipids, proteins, anti-nutritional and toxic factors (Rolle, 1998). The pattern of pores distribution in maize and control *idli* is depicted in Figure 3. There were more pores in maize idli than in rice idli per square inch.

Consumer acceptability revealed that both rural children (90%) and adults (92%) liked maize idli

(a) (b)

Fig.3: Ink print picture showing the patter of pores distribution in (a) rice idli and (b) maize idli

TABLE III

Consumer acceptability of maize idli

	Like	Dislike	Neither like nor dislike
Children Rural (n= 50)	45(90)	3(6)	2(4)
Children Urban (n= 50)	40(80)	8(16)	2(4)
Adults Rural (n= 50)	46(92)	4(8)	-
Adults Urban (n= 50)	43(86)	3(6)	4(8)

Figures in the parenthesis indicate percentage

(Table III) compared to urban mass (80-86%). The study indicated that the organoleptically acceptable *idli* with good physicochemical characteristics can be prepared by fermenting 3:1 combination of maize: blackgram dhal for 14 hrs and was acceptable by both rural and urban children as well as adults.

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