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Development and standardization of foxtail mellet recipes through sensory panel evaluation

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Abstract
Indian culture and traditional changes from region to region with changes in food habit in the era of information & technology in metro Politian cities mixed population changed consumption pattern changed as such the South Indian Idli and Dosa is consumed over the country. Fermentation improves nutritional profile with flavour and aroma and biological enrichment.
Present study is a attempt for quality improvement with replacement of rice by foxtail millet in Appe, Dhokla, Idli and Dosa preparation. Aimed with following objectives. Family sensory evaluation for rice substitution judges scoring for changes. The study was conducted in the department of Home Science R. D. G. College for Women, Akola. Analysis of variance one way classification was used for analysis and interpretation of data.
The study finding were "The family trial recommended all the four recipes Idli, Dosa, Dhokla and appe or further screening. The judges trial 1 accepted all the four recipes on 9 point hedonic scale. During judges trial 2 Dosa was accepted on the basis of over all acceptability. Dosa prepared with declining quantity of black gram maintaining total 150 gram the combination 130:20 was over all accepted. Idli prepared with declining quantity of black gram maintaining total 150 gram the combination 130:20 was over all accepted".

Keywords: Foxtail millet (Setaria Italica L.), fermented breakfast recipe, idli, dosa, dokla, appe, sensory evaluation. 9-point hedonic scale, millet premix

Introduction
The variety of food products plays significant role in Indian diet. The Indian culture and tradition differ from north west, north south and east to west according to the food habit also vary. In era information and technology Indian culture tradition & population has mixed with consumption pattern also south idli and dosa is consumed over the country.
As such one or two dishes from each state and region are being popularised and available for consumption everywhere. Dhokla, Appe, Idli, and dosa are the fermented food products prepare from cereals and legumes. The year 2023 was celebrated as millet year all over the word to know the importance of millet consumption as sources of protein, vitamins. "millet as substitute to rice. These food items are being prepared for breakfast due to their spongy structure attractive appearance, taste and flavour achieving importance in food category of easily digestible. Replacement of rice with foxtail millet enhanced nutritive value of product with combination of protein, carbohydrate The fermentation process improves nutrition profile of food product with flavour, aroma and providing benefits to body with biological enrichment. As such the attempt made by the researcher by the quality improvement found to be beneficial improving in food quality taste, texture and also over all acceptability. The present study was conducted as experimental study to replace rice with foxtail millet for breakfast preparation. The products prepared were Appe, Dhokla, Idli and Dosa.

The objective of the study were
1. Family sensory evaluation of foxtail millet breakfast substitute for rice.
2. Judges scoring and combination changes for sensory evaluation**.**

Hypothesis
1. All the four products have equal acceptability.
2. changing combinations enhanced taste, quality & acceptability.

Review of Literature
1. India has a versatile culture heritage of traditional food. In the present days the traditional food is transformed with addition of nutritional aspects and made available to consumer on commercial scale. The traditional food alone occupies large portion of meal as they are rich in vitamins, proteins, carbohydrates satisfying the nutritional requirements of human beings. Some of the conventional foods include Uttapam, Dosa, Naan, Litti Chokha, Kefir, Idli, Dhokla, Chole Bhature etc. (Gopalan *et al*. 2004) [2]
2. The foxtail millet is rich in protein, fat content and crude fibre. Also, the foxtail millet is rich in B-complex vitamins like thiamine, minerals especially P, Ca and Fe, certain amino acids like methionine, threonine and is low in phytic acid which makes them staple crop when compared to rice (Chandra and Selvi, 2016) [1].
3. Foxtail millet is cultivated in China and India, but is also produced on a smaller scale in South Korea, North Korea, Japan, Russia, Australia, France and the United States for human food, stock feed or industrial uses. Foxtail millet has some important characteristics such as high water uses efficiency and drought resistance,

tolerance to soil of low nutrient availability, strong adaptability and good yield stability (Lu *et al*., 2015) [4]. It was once regarded as more important than rice, wheat and beans (Ketki *et al*., 2017) [3]

Methodology

The present study on recipes preparation for Appe, Dhokla, Idli, Dosa with foxtail millet as principal ingredient. The recipes conducted at home for evaluation were scored by family judges and their score analysed for further selection.

The recipes recommended by family members were Dhokla, Appe, Idli, & Dosa for sensory evaluation these recipes were prepared and tested for different character on 9 hedonic point scale in the department of home science R.D.G. college, Akola. In all 3 trials were conducted and their score recorded were presented as per suggestion made by judges only two recipes that is Dosa and Idli. Were selected for further preparation with varying levels of foxtail millet and black gram.

The combination for sample preparation all the 3 above were as below:

1. Family Trial for Recipe Selection

During the family trial phase, four recipes were selected using foxtail millet as the primary grain. For Idli and Dosa, the ingredients used included 100 g of foxtail millet, 50 g of black gram, 3 g of salt, and 5 g of fenugreek seed. For Dhokla and Appe, a combination of 100 g foxtail millet, 50 g black gram, 50 g moong dal, 50 g chana dal, and 5 g of salt was used. Fenugreek seed was excluded from these two recipes.

2. College Trial 1 for Recipe Selection on (28-03-2025)

In the first college trial conducted on March 28, 2025, the Idli recipe remained the same as the family trial. However, the Dosa recipe was slightly modified, using 80 g of foxtail millet and 40 g of black gram, along with 3 g of salt and 5 g of fenugreek seed. The Dhokla and Appe recipes remained unchanged from the family trial, using 100 g foxtail millet, 50 g each of black gram, moong dal, and chana dal, with 5 g of salt and no fenugreek seed.

3. College Trial 2 for Recipe Selection on (29-03-2025)

The second college trial on March 29, 2025, included further reduction in ingredients. For Idli, the composition was 80 g foxtail millet, 40 g black gram, 3 g salt, and 5 g fenugreek seed. Dosa was prepared using 60 g foxtail millet and 20 g black gram with 3 g salt and 5 g fenugreek seed. Dhokla and Appe were tested using 80 g foxtail millet, 25 g each of black gram, moong dal, and chana dal, along with 5 g salt and no fenugreek seed.

4. Foxtail Millet Idli Trials (150 g Batch) – 21-05-2025

Four variations of Idli were tested in this trial.

- **Sample A:** 100 g foxtail millet, 50 g black gram, 3 g salt, 5 g fenugreek seed.
- **Sample B:** 110 g foxtail millet, 40 g black gram, 3 g salt, 2 g fenugreek seed.
- **Sample C:** 120 g foxtail millet, 30 g black gram, 3 g salt, 2 g fenugreek seed.
- **Sample D:** 130 g foxtail millet, 20 g black gram, 5 g salt, 2 g fenugreek seed.

5. Foxtail Millet Dosa Trials (150 g Batch) – 22-05-2025

The dosa trials followed a similar structure.

- **Sample A:** 100 g foxtail millet, 50 g black gram, 3 g salt, 5 g fenugreek seed.
- **Sample B:** 110 g foxtail millet, 40 g black gram, 3 g salt, 2 g fenugreek seed.
- **Sample C:** 120 g foxtail millet, 30 g black gram, 3 g salt, 2 g fenugreek seed.
- **Sample D:** 130 g foxtail millet, 20 g black gram, 5 g salt, 2 g fenugreek seed.

Result and Discussion

Table 1: Home trial scores on 9-point Hedonic scale

Recipe	Colour	Texture	Taste	Aroma	Appearance	Flavour	Sweetness	Mouthfeel	Over all acceptability
	1	2	3	4	5	6	7	8	9
	Average	Average	Average	Average	Average	Average	Average	Average	Average
Dosa	7.8	7.4	7.6	5.2	7.6	8	8	7.6	7.6
Appe	7.8	7.6	8.2	7.4	8.4	8.2	8.2	8.6	7.4
Idli.	7.2	8.2	8.4	7.2	8	8.2	8.4	8.4	7.6
Dhokla	8	7.6	7.2	7.2	7.2	7.4	7.6	7.2	7
Mean	7.7	7.7	7.85	6.75	9.6	7.95	8.05	7.95	7.4
S.E.	0.324	0.324	0.316	0.412	0.3	0.332	0.3	0.283	0.346
C.D.	0.687	0.687	0.67	0.874	0.636	0.703	0.636	0.6	0.734
F. Test	Non-sig	Non-sig	Non-sig	Significant	Non-sig	Non-sig	Non-sig	Significant	Non-sig

In the present study Dosa, Appe, Idli, Dhokla were prepared and family judges scoring on 9-point hedonic scale was recorded for colour, texture, taste, aroma, appearance, flavour, sweetness, mouthfeel and over all acceptability. All 4 recipes score were non significant accept for mouthfeel and aroma.

Idli and appe mouthfeel was found better. On the these base line, judges trial was conducted on 28-03-2025. The result are present in Table no. 2.

Table 2: Judges trial 1 for recipes selection on 28-03-2025

Recipe	Colour	appearance	Texture	Aroma	taste	Flavour	Sweetness	Mouthfeel	Over all acceptability
	1	2	3	4	5	6	7	8	9
	Average	Average	Average	Average	Average	Average	Average	Average	average
Appe	7.2	8.2	8	7	8	7.4	6.2	8	8
Idli	7.4	7.8	8.2	7.4	7.8	7.6	5	8	8.2
Dhokla	7.2	7.4	8	7.6	8	7.4	5.2	7.8	8.2
Dosa	7.4	7.6	7.2	6.4	7.2	6.2	4.2	6.2	7.2
Mean	7.3	9.5	7.85	7.1	7.75	7.15	5.15	7.5	7.9

S.D.	0.592	0.548	0.542	0.566	0.648	0.552	0.964	0.495	0.48
C.D.	1.254	1.161	1.151	1.199	1.374	1.171	2.044	1.049	1.017
F. test	Non-sig	Non-sig	Non-sig	Non-sig	Non-sig	Non-sig	Non-sig	Non-significant	Non-significant

The analysis concludes that the differences were statistically non-significant.
Therefore the another trail was conducted on 29-03-2025. The result are present in Table no. 3.

Table 3: Judges trial 2 for recipes selection no 29-03-2025

Recipe	Colour	appearance	Texture	Aroma	taste	Flavour	Sweetness	Mouthfeel	Over all acceptability
	1	2	3	4	5	6	7	8	9
	Average	Average	Average	Average	Average	Average	Average	Average	average
Dhokla	6.4	5.2	5.2	6	4.6	5	3.2	3.8	4.8
Appe	5.6	5.6	6.6	6.4	7	6.2	4.2	6.4	6.6
Idli	7.2	8	8	6.8	8.2	7.8	4.6	7.8	7.6
Dosa	8.2	8.4	8	7.8	8	8	6.6	8.6	9
Mean	6.85	6.8	6.95	6.75	6.95	6.75	4.65	6.66	7
S.D.	0.725	0.735	0.806	0.579	0.707	0.587	1.36	0.791	0.7
C.D.	1.536	1.558	1.709	1.227	1.499	1.245	2.884	1.676	1.484
F. Test	Non-sig	Significant	Non-sig	Non-sig	significant	significant	Non-sig	significant	significant

Where, the taste, flavour, mouthfeel and over all acceptability was better for dosa than other recipes. Therefore, the judges suggested to go for the changes in ingredient combination with foxtail millet for idli and dosa.

Table 4: Trial for Foxtail Millet Idli (150 g) 21-05-2025

Recipe	Appearance	Colour	Texture	Aroma	Taste	Flavour	Sweetness	Mouthfeel	Over all acceptability
	1	2	3	4	5	6	7	8	9
	Average	Average	Average	Average	Average	Average	Average	Average	Average
Sample A	7	6.2	6.4	5.8	7	6.4	4.8	6.6	6.6
Sample B	6	7.2	6.6	7	6.8	7	5	6.2	7
Sample C	7.2	7.4	8	7.2	8.2	7.8	5.6	7.6	8.2
Sample D	8.2	7.4	8.8	7	9	8.6	6.6	8.6	9
Mean	7.1	7.05	7.45	6.75	7.75	7.45	5.5	7.15	7.7
S.E.	0.58	0.41	0.33	0.41	0.44	0.37	0.33	0.39	0.31
C.D.	1.22	0.86	0.69	0.86	0.92	0.77	0.69	0.82	0.65
F. Test	significant	Non-sig	Significant	Non-sig	Significant	significant	significant	significant	significant

The table no. 4 present foxtail millet with different combination on going through the analysis it is observed that the foxtail millet 130 g and black gram 20-gram combination.
Idli scored significantly higher score for appearance, texture, taste, flavour, sweetness, mouthfeel and over all acceptability concluding idli in 130:20 recommended for further recipe preparation and for final sensory evaluation.
The following table present the dosa prepared with different combination.

Table 5: Trial for Foxtail Millet Dosa (150g) On 22-05-2025

Recipe	Appearance	Colour	Texture	Aroma	Taste	Flavour	Sweetness	Mouthfeel	Over all acceptability
	1	2	3	4	5	6	7	8	9
	Average	Average	Average	Average	Average	Average	Average	Average	Average
Sample A	7	7	6.8	7	7	7	6.2	6.8	7.4
Sample B	7.6	7.2	7.8	7	7.2	6.4	5.6	6.8	7
Sample C	7.4	7.6	8	7.2	7.6	7.2	5.6	7.6	7.8
Sample D	8.4	8.6	8.8	7.8	9	8.6	6.4	8.8	9
Mean	7.6	7.6	7.85	7.25	7.7	7.3	5.95	7.5	7.8
S.E.	0.21	0.3	0.23	0.21	0.31	0.33	0.45	0.38	0.22
C.D.	0.44	0.63	0.48	0.44	0.65	0.69	0.94	0.80	0.46
F. Test	significant	significant	significant	Non-sig	significant	Significant	Non-sig	Significant	significant

The finding for the table were as follows appearance, colour, texture, taste, flavour, mouthfeel and over all acceptability was significant for sample D indicating of 130:20 was also found is better in dosa recommended for further sensory trial.

Conclusion

1. The finding family trial recommended all the four recipes Idli, Dosa, Dhokla and appe for further screening.
2. The judge's trial 1 accepted all the four recipes on 9-point hedonic scale.
3. During judges trail 2 Dosa was accepted on the basis of over all acceptability.
4. Dosa prepared with declining quantity of black gram maintaining total 150 gram the combination 130:20 was over all accepted.
5. Idli prepared with declining quantity of black gram maintaining total 150 gram the combination 130:20 was over all accepted.

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