

Evaluation of Sensory, Packaging and Storage Quality Attributes of different varieties of Paddy for Popped Rice

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ABSTRACT: This study was aimed to evaluate of sensory, packaging and storage quality attributes of seven paddy varieties developed product such as popped rice from varieties developed by JNKVV Jabalpur. It was observed that significant differences found in most of the characteristics of packaging, sensory and storage quality of popped rice were observed across different cultivars. Among the seven rice varieties, best popping quality product was obtained by the JR-206 and Kranti varieties. It was found that most acceptable popped rice had the best overall acceptability score viz. 7.73 was observed in JR-206 and least score viz. 7.44 in kranti variety. The highest score of color, flavor, texture, taste and overall acceptability score was found in aluminum foil packaging material in the storage period up to 90 days. The probable reason could be the better popping quality of rice. It was noticed that higher popping quality characteristics were observed for each variety at 150-160°C roasting temperature. Higher popping yield was found in JR-206 and Kranti varieties which was rated high in sensory acceptability. The data were analyzed by skeleton of ANOVA for complete randomized design (CRD). Selection of rice variety for popping is primarily dependent upon its quality of popped grain which is directly correlated with its expansion during popping and its sensory preferences. However, the sensory preferences also vary among popped rice produced from different varieties of rice with similar high amylose content. Current work aims to establish storage duration with packaging material for retain of moisture and economical losses. A rice from a group of similar long storage period containing varieties by forming correlations between sensory characteristics of popped rice.

Keyword: Packaging, popping, sensory, cultivars, storage.

INTRODUCTION

Rice (*Oryza sativa*) is the staple food for 65% of the population in India. It remains the largest expended calorie source among the food grains. Popped, Puffed and flaked rice is a general snack food product in India and has been widely produced for centuries. Global paddy production in 2020-21 is 791 MT (FAO), India and MP produce record of 117.46 MT and 10.9 MT in 2020-21 respectively (Ministry of Agriculture and Farmers Welfare). In the present research application of sand roasting in the production of value-added products from rice such as popped and roasted cereals. In addition, the importance of sand roasting in terms of grain characteristics, nutritional, sensory, and functional properties of the products is highlighted (Mishra *et al.*, 2014) Popped rice. It is known as pelalu (telugu), khoi (bengali) etc. in various Indian languages. It is a traditional value-added product with high cold water

swelling capacity originated from raw paddy; arising from high starch gelatinization and low retrogradation. It is prepared directly by high-temperature short-time treatment from the moisture-adjusted raw paddy (12–14%) by sand roasting in a pan at a temperature of 220–240°C for 25–45s. In comparison with other value-added rice products, popped rice production is less and mostly used during religious ceremonies (Chitra *et al.*, 2010). Popping using advance technologies are processes which can accomplish all these targets. As a simple, inexpensive and quick traditional method of dry heat application for preparation of weaning food formulations and ready to eat snacks products, popping has been practiced since hundreds of years. Popped rice is one of the earliest known rice's based popular traditional ready to eat breakfast cereal products in South-East Asia (Bhat *et al.*, 2008). Except moisture, not much is known on the factors influencing popping

in rice unlike in maize, where several physio-chemical properties of the kernel are well studied (Ceylan *et al.*, 2002). High popping could be achieved with paddy containing moisture content between 14 and 15%. Time of heating is a sensitive parameter for sharp rise in popping percentage as compared to power level (Swarnakar *et al.*, 2014). The present study was conducted to determine the effect of processing conditions, including temperature and moisture percentage on expansion of popped rice cultivars.

This study aims to clarify the various properties of popped rice and flake rice starch products. In this study, we investigated the effects of processing conditions such as temperature, soaking time, and moisture of rice products on the expansion of processed rice varieties.

MATERIALS AND METHODS

Concept of Popping and Roasting. Popping of cereals has been practiced since hundreds of years. Popping is a process in which kernels are heated until internal moisture expands and pops out through the outer shell of the kernel.

Roasting is cooking in dry heat in an oven or on a split with the addition of fat or oil. Radiant heat is the means of cooking when using a split; oven roasting is a combination of convection and radiation. (Arkhipov *et al.*, 2005).

Sand roasting method. Pre-gelatinized cereals are exposed to hot sand, while temperature of sand is about 250°C. Due to sudden thermal gradient, the moisture inside the grains vaporizes and tries to escape through the micropores, expanding the starchy endosperm in size in this process (Chinnaswamy and Bhattacharya 1983).

Bengal gram can also be puffed when the preliminary roasting of grains with sand at 170°C for 75s was carried out followed by tempering the grains for about 90 minutes to reach the moisture content of about 14.9% (wb). The tempered grains were then dipped in water for 5 seconds and impacted between a roller and a hot plate for de-husking and splitting. Under these conditions the bulk volumes of grains doubled during puffing (Pratare and Kurlien 1986).

Popped rice. About 1 kg of paddy was moistened to a ~14% moisture and tempered (equilibrated) overnight. It was then subjected to high temperature short time (HTST) treatment in hot sand (temperature of sand ~240° C) for 25-30 sec as described by Hsieh and Bor (1991), Swarnakar *et al.* (2014). The paddy to sand ratio taken was 1:10. The mixture was then poured on to a sieve of ~12 mesh size, all the sand particles were removed and popped rice was poured on to a measuring cylinder and expansion ratio was calculated by taking the ratio of the volume of popped rice to volume of processed paddy (initial volume).

Packaging and storage quality. The cooled popped Paddy was packed in three different packaging materials *i.e.*, low density polyethylene bags, Aluminum Foil bags and polypropylene bags for storage study. The sample size was kept in each packaging materials for storage. The duration for experiment was 90 days and observations were

recorded at 30 days interval up to 90 days (Lim K.R. *et al.* 2004).

Sensory Evaluations. Breakfast cereal was evaluated for sensory parameters like colour, taste, crunchiness and overall acceptability at different intervals of 0, 30, 60 and 90 days by the panel of 10 selected judges. A panel consisting of 10 people evaluated the product for individual characters as color, taste, crunchiness and overall acceptability. The 9- point hedonic scale was used to assess the degree of liking that ranged from 'Like very much' to 'Dislike very much' with 'Neither like Nor Dislike'(NLND) as midpoint. Data were analyzed and expressed the number of responses, as percentage (Ranganna, 1986; Rathi *et al.*, 2004).

Statistical Analysis. All experiment were replicated and standard deviations have been reported. The experiment was conducted in complete randomized design (CRD) using OPSTAT, (<http://14.139.232.166/opstat/>). The data was subjected to one-way analysis of variance (ANOVA) at 5% level of significance: (Cyprien and Kumar 2012).

RESULT AND DISCUSSION

Results showed significant differences between newly introduced rice varieties for most of the traits investigated.

Sensory attributes. Rice product like popped rice was served to each member of panel. The panel consisted of 10 members belonging to scientist, research scholars and student of food Technology. On the basis of popping yield and chemical parameters the best-found treatment of all varieties was subjected to sensory studies. Sensory parameters were judges on the basis of 9 points hedonic scale (0-9). The mean score value for these attributes of the popped rice processed from different paddy varieties are presented in Table 1. On the basis of observations recorded by the panelist for the varieties Kranti, JRH5, JRH-8, JRH-10, JR-206, JRH-19 and IR-36, the mean color score was 7.31, 7.33, 7.31, 8.51, 8.88, 7.57 and 7.25, mean flavor score was 7.49, 7.47, 7.59, 6.47, 7.51, 7.98 and 7.77, mean texture score was 6.48, 6.43, 6.38, 8.43, 8.39, 8.29 and 6.64 mean taste score was 7.51, 8.34, 7.28, 7.43, 7.33, 8.70 and 7.51, mean overall acceptability score was 7.44, 7.31, 7.27, 7.57, 7.67, 7.73 and 7.27 respectively.

The highest color, flavor, taste and overall acceptability wise score (8.88), (7.98), (8.70) and (7.28) were found in JR-206 variety and the lowest color score (7.25) was found in IR-36, the lowest flavor score (6.47) was found in JRH-10 variety, lowest taste score was found in (7.28) in JRH-8 variety. Highest texture score (8.43) was found in JRH-10 variety. The lowest texture score (6.37) was found in JRH-8 and the lowest taste score (7.28) was found in JRH-8 and the lowest overall acceptability score (7.27) was found in IR-36.

2 % salt addition was also found to be optimum during the sensory evaluation of the popped rice samples. It was also interesting to note that the addition of salt produced a smoother surface of the popped rice while rice popped without the addition of salt showed an uneven blistered surface (Hoke *et al.*, 2005).

Table 1: Effect of different processing variables, method of popping on average sensory score of selected treatments of paddy varieties.

Sensory attributes	Varieties						
	Kranti	JRH-5	JRH-8	JRH-10	JRH-19	JR-206	IR-36
Color	7.31	7.33	7.31	8.51	7.57	8.88	7.25
Flavor	7.49	7.47	7.59	6.47	7.51	7.98	7.77
Texture	6.48	6.43	6.37	8.43	8.39	8.29	6.64
Taste	7.51	8.34	7.28	7.43	7.33	8.70	7.51
Overall acceptability	7.44	7.31	7.29	7.57	7.67	7.73	7.27

Storage study on the basis of Sensory attributes. On the basis of popping sensory score, the best treatment of the variety JR-206 was subjected to storage study on 90 days in the interval of 30 day in three different type of packaging material *i.e.*, polypropylene, Low density polyethylene and aluminum foil.

In polypropylene the color score found in the range from 5.74 to 8.70, flavor score found in the range from 5.66 to 7.75, texture score varied from 5.66 to 8.48, taste score varied from 5.46 to 8.73 and overall acceptability score was found in the range from 5.33 to 7.38 in the storage period up to 90 days.

In low density polyethylene color score was varied from 6.35 to 8.42, flavor score varied from 6.72 to 7.45, texture score varied from 5.71 to 8.63, taste score varied from 5.81 to 7.79 and overall acceptability score was varied from 6.65 to 7.78 in the storage period up to 90 days.

In aluminum foil color score was found in the range of 6.85 to 8.75 and the highest color score was found in aluminum foil in 0 days to 90 days, flavor score was found in the range of 7.59 to 8.84 and the highest flavor score was found in aluminum foil in 0 days to 90 days, texture score was found in the range of 6.74 to 8.85

and the highest texture score was found in aluminum foil in 0 days to 90 days, taste score varied from 6.67 to 8.89 and the highest taste score was found in aluminum foil in 0 days to 90 days and overall acceptability score was found in the range of 6.57 to 8.15 and the highest overall acceptability score was found in aluminum foil in 0 days to 90 days in the storage period up to 90 days.

The results showed that the highest color, flavor, texture, taste and overall acceptability score was found in aluminum foil in the storage period up to 90 days of stored popped rice. The overall acceptability of popped rice was significantly affected by different packaging materials and storage days. Popped rice variety was better in aluminum foil bags as compared to low density polyethylene and polypropylene bags during storage. This might be due to high absorption and permeability of atmospheric gasses involved in reduction of color and flavor. The similar finding was reported by Bunker *et al.* (2012).

The highest color, flavor, texture, taste and overall acceptability score was found in aluminum foil in the storage period up to 90 days.

Table 2: Effect of different packaging materials on average sensory score of JR-206 paddy variety.

Packaging Materials	Sensory attributes	Storage Period (days)			
		0 days	30 days	60 days	90 days
Polypropylene (PP)	Color	8.70	7.57	6.52	5.74
	Flavor	7.75	5.70	5.66	5.73
	Texture	8.48	5.66	5.77	5.59
	Taste	8.73	5.46	6.52	6.91
	Overall acceptability	7.38	5.92	5.39	5.33
Low density polyethylene (LDPE)	Color	8.42	6.35	6.74	6.66
	Flavor	7.45	6.95	6.72	6.78
	Texture	8.63	7.84	5.81	5.71
	Taste	7.79	6.78	6.97	5.81
	Overall acceptability	7.78	6.84	6.71	6.65
Aluminum Foil	Color	8.75	7.82	7.36	6.85
	Flavor	8.84	7.72	7.59	7.61
	Texture	8.85	7.76	7.68	6.74
	Taste	8.89	7.81	6.84	6.97
	Overall acceptability	8.15	7.75	6.92	6.57

CONCLUSIONS

Popping is a simple and low-cost processing method that improves the textural and sensory qualities of cereals while causing minimal changes in the nutrient composition of the processed product. The current study's goal is to examine several advanced methods for measuring the sensory quality of popped rice and to

propose a traditional method for evaluating rice product in sensory evaluation based on hardness. We measured the packaging and storage properties of commercial rice roasted product to assess their quality and deterioration during storage and increased significantly after 30 days at room temperature storage.

Traditionally, popped products are only prepared on a few occasions. As consumer preferences shift toward

more convenient foods and less refined or polished grains, this type of home processed ready-to-eat snack has a large market potential as value added health products and convenient food.

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Conflict of Interest. None.

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