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Effects of physicochemical and processing characteristics on nutritional and sensorial profile of puffed rice

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Abstract
Six different paddy varieties were subjected to traditional and microwave puffing with three different salt treatment (1.5, 2.0 and 2.5%) at three different moisture level (13, 15 and 17%) at three different temperature (220, 240 and 260 0 °C). The total number of treatments was subjected to various Physico-chemical evaluation (puffing yield, protein, carbohydrates, oil, fibre, ash, amylose and starch) as well as sensory study. Puffed rice is a popular snack food product in India and has been widely produced from centuries. It has been estimated that approximately 10% of rice is converted into snack foods. There are different methods of popping/puffing used *viz*., conventional method of dry heat, sand and salt treated, hot air popping, gun puffing, popping in hot oil and by microwave heating. Puffing yield of paddy varieties was found maximum (76.14%) in traditional method with 2.5% salt treatment, 17% conditioned moisture content and 260 °C temperature in JRH-19 variety, whereas minimum puffing yield 32.12% was found in microwave method with 1.5% salt treatment, 13% moisture and 600 watt temperature in JRB-1 variety.

Keywords: Puffed rice, production. Nursery, demonstration etc.

Introduction
Indian economy is agrarian in nature with 75% off population depending upon agriculture for their living. The crop husbandry is the largest industry of Madhya Pradesh where 87.3% of its population resides in rural areas and is involved in food production.
Rice is the staple food for 65% of the population in India. It is the largest consumed calorie source among the food grains. In India, rice is the most important and extensively grown food crop. Rice is primarily known as a high-energy or high calorie food and has high biological value of proteins. In Indian sub-continents, expanded rice (murmura), Puffed rice (Lai) and flaked rice (Poha) are popular snacks foods and have been widely produced for centuries. Ghosh *et al.* (1960) [3] reported that about 10% of the rice produced in India gets covered into these three products. Among these products, expended rice and flaked rice are very popular in our country. Puffing or popping of cereals is an old traditional practice of cooking grains to be used as snack or breakfast cereal either plain or with some spices/salt/sweeteners. (Jaybhaye *et al.*, 2014) [4].
Puffing of rice is an important unit operation for conversion of pre-gelatinized milled rice in to ready-to eats snacks. Not only is puffed rice a staple in the diet as a major source of carbohydrate and to some extent protein, it also contributes beneficial nutrients including dietary fibre, vitamins, minerals and phytochemicals which have been linked to reduce disease risk (Maisont and Narkrugsa, 2009) [6].

Materials and Methods
The study was carried out with the objective-to assess the physicochemical properties of rice varieties and their puffed product and to optimize processing variables for puffing of rice.

Experimental materials: Seeds- The pure paddy seeds were procured from the department of plant breeding and genetics, JNKVV, Jabalpur. The varieties were JR-206, JRH-5, JR-81, JR-201, JRH-19 and JRB-1. Total 39 treatments were taken for traditional puffing method and microwave method each.

Methods of puffing: Both the *Traditional* and *Microwave methods* were performed under following processing variables:-*Conditioning* – Salt water (1.5, 2.0 and 2.5%). *Moisture*- 13, 15 and 17%. *Temperature* – For traditional method - 220°C, 240 °C and 260 °C. *For microwave method* – 700 watt, 800 watt and 900 watt.

Puffing of Paddy: It involves *Cleaning:* Paddy varieties were cleaned to remove the dirt, dust and foreign matter by winnowing and sieving then graded.

Conditioning and moistening: Conditioning done prior to puffing by Salt Solution (1.5%, 2% and 2.5%) by soaking the 100 gm of paddy seeds in required salt water for 8 hrs and analysing the moisture content in every one hr.

Puffing

Traditional method: Conditioned paddy grains were put in a hot earthen pan at temperature 220°C, 240°C and 260°C and stirred continuously till the puffing sound of the grains completed, cooled for further quality analysis.

Microwave oven: Microwave oven was used as a modern method of popping. 100 gm of conditioned paddy grains were put in glass bowl, Microwave glass bowl covered with lid and kept inside the microwave oven and heated it at 700, 800, and 900 watts for 130 seconds, cooled for further quality analysis.

Physicochemical properties of grains and puffed Paddy varieties: 100 Seeds Weight: Randomly selected 100 fresh grain samples were weighed accurately and average weight of Paddy was calculated (Malleshi and Desikachar, 1981) [7].

Puffing quality of Puffed Rice

Puffing yield: Puffing yield is a total weight of puffed grain divided by total weight of puffed grains plus total weight of un-puffed grain into hundred (Pordesimo *et. al.*1990) [9].

Expansion volume: The expansion volume determined by the ratio of volume of puffed Rice to the weight of raw grain (Porodesimo *et al*. 1990) [9].

L/B Ratio: In India, most of the rice varieties are common, fine and superfine grouped as on the basis of L/B ratio (< 2.5, <3 and >3) respectively. Size and shape of rice affects many other properties, namely, sieving, dehusking, polishing, storage as well as cooking.

Bulk Density: was Determined using the method, Jones *et al.* 2000.

Protein content: was determined by using conventional Micro-Kjeldhal procedure as given in AOAC (1992) [2]. Oil, Carbohydrates, Ash and fibre content were determined by the method as described in AOAC (1992) [2].

Starch Content: was determined by the enthrone method (Rangana 2001) [10].

Amylose content: It was a highly purified laboratory preparation by (Knutson *et al*. 1982) [5].

Calculation: Absorbance corresponds of the test solution using equation obtained from standard graph amylose percent was calculated.

Sensory profile: The sensory profiles were studied using nine point hedonic scales as described by Amerine *et al*. (1965) [1].

Statistical analysis- The data were statistically analyzed following the ANOVA technique (Panse and Sukhatme, 1985) [8].

Results and Discussion

Physico-chemical attributes of paddy (Raw) and puffed rice: Physico-chemical attributes Paddy varieties were studied. The data has been presented in Table 1. The result showed that paddy varieties JR-201 had maximum 2.58 and JRB-1 minimum 2.06 weights out of 100 seeds weight (g). Husk content (%) was in range of 19.01 and 21.65 respectively followed by expansion volume (ml/g) found 5.50 and 6.50. Average yield of puffed rice (%) in traditional method was between 67.35 and 73.42 and in microwave method it was in range of 36.17 and 44.49 respectively. The protein content (%) of JRH-19 found highest 7.96 among the different varieties. carbohydrate content (%) was found maximum in of JR-206 and minimum in JR-81. JR-81 showed lowest fibre content (%) 1.95 and JR-201 showed highest 2.60. ash content (%) of was in between 1.64 and 2.82. starch content (%) found in range of 73.40 and 78.08 lastly amylose content (%) of JRH-19 was found maximum 21.58 and JRH-5 minimum 18.54 percent.

Effect of processing variables on puffing yield (%) of paddy varieties: *Traditional puffing:* - Data showed in table no. 2, the average puffing yield was in the range from 67.26 to 73.32% in traditional puffing. The highest puffing yield was found in the variety JRH-19 (73.34%) followed by JRH-5 (72.16%) and JR-206 (71.70%) and lowest puffing yield was found in JRB-1 (67.27%). Results showed that there is increase in the puffing yield of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum puffing yield 76.14% was found in S3M3T3 treatments in JRH-19 variety, whereas minimum puffing yield 62.01% was found in S1M2T1 treatment in JRB-1 variety. *Microwave method:* - The average puffing yield was in the ranged from 36.13 to 44.46% in microwave puffing. The highest puffing yield was observed in JRH-5 variety (44.46%) followed by JR-206 (43.27%) and JRH-19 (42.83%) and the lowest puffing yield recorded in JRB-1 (36.13%). Results showed that there is increase in the puffing yield with increase of salt percentage in all paddy varieties whereas no major difference due to change in moisture content and microwave power. Maximum puffing yield 48.18% was found in S3M3T3 treatments in JRH-19 variety, whereas minimum puffing yield 32.12% was found in S1M1T1 treatment in JRB-1 variety.

Effect of processing variables on Protein content (%) of paddy varieties: *Traditional puffing:* - The average protein content (%) was in the range from 6.11% to 6.72% in traditional puffing. The highest protein content (%) was found in the variety JR-81 (6.72%) followed by JRH-19 (6.36%) and JRH-5 (6.32%) and lowest protein content was found in JR-201 (6.11%). Results showed in table no. 3 that there is no change in protein content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum protein content 7.88% was found in S2M2T1 treatments in JR-206 variety, whereas minimum protein content 5.13% was found in S2M3T3 treatment in JR-206 variety. *Microwave method:* - The average protein content (%) was in the range from 6.08% to 6.38% in microwave puffing. The highest protein content (%) was found in the variety JRH-19 (6.38%) followed by JRH-5 (6.12%) and JRH-206 (6.11%) and lowest protein content was found in JR-201 (6.01%). Results showed that there is no change in protein content of all paddy varieties with increase of salt percentage, moisture content and

temperature of puffing in all treatment of paddy varieties. Maximum protein content 7.91% was found in S2M2T3 treatments in JR-206 variety, whereas minimum protein content 4.67% was found in S1M1T2 treatment in JR-206 variety.

Effect of processing variables on Oil content (%) of paddy varieties: *Traditional Method:* - In the table no. 4, average oil content (%) was in the range from 1.22% to 1.88% in traditional puffing. The highest oil (%) was found in the variety JRH-5 (1.88%) followed by JR-201 (1.40%) and JR-206 (1.39%) and lowest oil content was found in JR-81 (1.22%). Results showed that there is no change in oil content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum oil content 2.54% was found in S1M2T2 treatments in JRH-5 variety, whereas minimum oil content 0.32% was found in S1M3T3 treatment in JR-201 variety. *Microwave Method:* -The average oil content (%) was in the range from 1.90% to 2.32% in Microwave puffing. The highest oil (%) was found in the variety JR-206 (2.32%) followed by JRB-1 (2.22%) and JRH-19 (2.00%) and lowest oil content was found in JRH-5 (1.90%). Results showed that there is no change in oil content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum oil content 3.20% was found in S3M2T2 treatments in JRH-1 variety, whereas minimum oil content 1.19% was found in S1M1T2 treatment in JR-201 variety.

Effect of processing variables on Carbohydrate content (%) of paddy varieties: *Traditional Method:* - The average carbohydrate content (%) was in the range from 70.45% to 73.94% in traditional puffing. The highest carbohydrate content (%) was found in the variety JRH-5 (73.94%) followed by JR-201 (71.75%) and JRH-19 (70.71%) and lowest further carbohydrate content was found in JR-81 (70.45%). Results showed that there is no change in carbohydrate content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum carbohydrate content 77.84% was found in S2M1T3 treatments in JRH-5 variety, whereas minimum carbohydrate content 68.37% was found in S1M3T2 treatment in JRH-19 variety, in the table no. 5. *Microwave Method:* - The average carbohydrate content (%) was in the range from 71.86% to 72.53% in microwave puffing. The highest carbohydrate content (%) was found in the variety JRH-19 (72.53%) followed by JR-206 (72.47%) and JR-201 (72.27%) and lowest further carbohydrate content was found in JRH-5 (71.86%). Results showed that there is no change in carbohydrate content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum carbohydrate content 77.59% was found in S1M3T2 treatments in JRH-19 variety, whereas minimum carbohydrate content 65.72% was found in S1M2T3 treatment in JR-81 variety.

Effect of processing variables on Fibre content (%) of paddy varieties: *Traditional Puffing:* - the table no. 6 showed fibre content (%) was in the range from 1.86% to 2.31% in Traditional puffing. The highest fibre content (%) was found in the variety JRH-19 (2.31%) followed by JR-201 (2.29%) and JRB-1 (2.23%) and lowest fibre content was found in JR-206 (1.86%). Results showed that there is no change in fibre content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum fibre content 3.44% was found in S3M2T2 treatments in JR-201 variety, whereas minimum fibre content 1.27% was found in S3M2T3 treatment in JR-206 variety. *Microwave Puffing:* -The average fibre content (%) was in the range from 1.66% to 2.53% in Microwave puffing. The highest fibre content (%) was found in the variety JR-201 (2.53%) followed by JRH-19 (2.50%) and lowest fibre content was found in JR-81 (1.66%). Results showed that there is no change in fibre content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum fibre content 3.64% was found in S2M3T2 treatments in JRH-19 variety, whereas minimum fibre content 1.22% was found in S2M2T1 treatment in JR-81 variety.

Effect of processing variables on Ash content (%) of paddy varieties: *Traditional Puffing:* -The average ash content (%) was in the range from 1.85% to 2.04% in traditional puffing. In the table 7, the highest ash content (%) was found in the variety JR-81 (2.04%) followed by JRB-1 (1.99%) and JR-206 (1.90%) and lowest further ash was found in JRH-5 (1.85%). Results showed that there is no change in ash content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum ash content 2.72% was found in S3M3T1 treatments in JRB-1 variety, whereas minimum ash content 1.26% was found in S1M1T2 treatment in JR-206 variety. *Microwave Puffing:* -The average ash content (%) was in the range from 2.81% to 3.08% in microwave puffing. The highest ash content (%) was found in the variety JR-201 (3.08%) followed by JRH-19 (3.00%) and lowest ash was found in JR-206 (2.81%). Results showed that there is no change in ash content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum ash content 3.57% was found in S1M1T3 treatments in JRH-19 variety, whereas minimum ash content 2.06% was found in S2M3T3 treatment in JR-206 variety.

Effect of processing variables on Amylose content (%) of paddy varieties: *Traditional puffing:* - The average amylose (%) was in the range from 20.18% to 20.62% in traditional puffing. The highest amylose (%) was found in the variety JR-206 (20.62%) followed by JR-201 (20.61%) and JRB-1 (20.40%) and lowest further amylose was found in JRH-5 (20.18%). Results showed in table no. 8, that there is no change in amylose content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum amylose content 27.62% was found in S1M2T2 treatments in JR-206 variety, whereas minimum amylose content 14.04% was found in S2M1T1 treatment in JRH-5 variety. *Microwave puffing:* - The average amylose (%) was in the range from 19.91% to 21.10% in microwave puffing. The highest amylose (%) was found in the variety JRH-5 (21.10%) followed by JRB-1 (20.65%) and JR-201 (20.60%) and lowest amylose was found in JRH-19 (19.91%). Results showed that there is no change in amylose content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum amylose content 28.10% was found in S2M1T3 treatments in JRH-5 variety, whereas minimum amylose

content 17.17% was found in S3M2T1 treatment in JR-201 variety.

Effect of processing variables on starch content (%) of paddy varieties:

Traditional method: - The average starch (%) was in the range from 75.46% to 76.13% in traditional puffing. The highest starch (%) was found in the variety JRB-1 (76.13%) followed by JRH-19 (76.02%) and JRH-5 (76.01%) and lowest starch was found in JR-201 (75.46%). Results showed that there is no change in starch content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum starch content 78.59% was found in S1M2T1 treatments in JRH-5 variety, whereas minimum starch content 73.13% was found in S2M1T1 treatment in JR-81 variety. *Microwave puffing:* - The table no. 9 showed average starch (%) was in the range from 75.42% to 75.90% in microwave puffing. The highest starch (%) was found in the variety JRH-5 (75.90%) followed by JRH-19 (75.86%) and JR-206 (75.82%) and lowest starch was found in JR-201 (75.42%). Results showed that there is no change in starch content of all paddy varieties with increase of salt percentage, moisture content and temperature of puffing in all treatment of paddy varieties. Maximum starch content 78.51% was found in S1M2T2 treatments in JR-206 variety, whereas minimum starch content 73.07% was found in S2M1T1 treatment in JRH-5 variety.

Sensory profile: Rice product like puffed rice was served to each member of panel. The 10 member's panel were subjected to sensory studies. The highest colour score (8.41) was found in JRH-19 variety and the lowest colour score (7.21) was found in JR-81. Highest flavour score (8.41) was found in JRH-19 variety and the lowest flavour score (6.37) was found in JR-206 variety. Highest texture score (8.42) was found in JR-206 variety and the lowest texture score (6.42) was found in JRB-1. Highest taste score (8.71) was found in JRH-19 variety and the lowest taste score (7.29) was found in JR-81. Highest overall acceptability score (7.67) was found in JRH-19 variety and the lowest overall acceptability score (7.26) was found in JR-201. The Highest sensory score in all the attributes was found in JHR-19 followed by JR-206.

Table 1: Physico-chemical attributes of paddy varieties

S. No.	Physico-chemical attributes		Varieties					
			JRH-19	JRH-5	JR-81	JR-201	JR-206	JRB-1
1.	100 grain weight (gm)		2.46	2.76	2.60	2.58	2.25	2.06
2.	Bulk density (gm/ml^3)		0.595	0.625	0.585	0.641	0.609	0.638
3.	Husk content (%)		20.73	20.44	19.01	19.75	22.18	21.65
4.	Length and Breadth ratio (L/B)		3.81	3.59	4.31	3.199	3.50	3.13
5.	Yield of puffed rice	*Traditional method*	71.73	72.25	70.22	69.50	73.42	67.35
		Microwave method	43.28	44.49	39.45	40.47	42.88	36.17
6.	Expansion volume (ml/g)		6.40	5.70	6.20	6.50	5.80	5.50
7.	Protein (%)		7.96	7.56	7.56	5.97	6.37	7.16
8.	Oil (%)		2.80	2.28	2.54	2.76	2.68	2.86
9.	Carbohydrate (%)		76.42	77.88	72.32	75.00	79.41	73.64
10.	Fibre (%)		2.10	2.05	1.95	2.60	2.10	2.50
11.	Ash (%)		2.66	2.28	1.64	2.82	2.54	2.06
12.	Starch %		75.52	74.58	77.80	73.40	78.08	76.65
13.	Amylose %		21.58	18.54	19.12	19.02	20.08	18.54

Table 2: Effect of different processing variables, method of puffing on average puffing yield of different paddy varieties

Processing Variables			JR-206			JRH-5			JR-81			JR-201			JRH-19			JRB-1		
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Traditional	S1	M1	69.84	68.02	68.95	70.45	71.89	69.53	67.78	68.66	69.10	67.67	68.41	70.47	73.37	72.51	72.38	62.98	64.10	65.19
		M2	65.24	67.72	71.11	73.51	74.50	74.45	69.02	69.88	71.08	68.37	71.08	73.42	71.45	72.10	73.22	62.02	64.87	66.99
		M3	68.90	71.73	74.18	69.52	72.07	73.27	69.44	70.88	72.02	65.43	69.57	72.49	73.08	73.40	74.38	63.82	68.93	66.98
	S2	M1	70.80	73.02	73.50	70.15	71.07	72.71	68.07	68.98	70.68	67.60	69.08	69.54	71.45	71.72	73.40	63.87	65.31	67.27
		M2	69.91	70.86	74.66	70.55	71.11	73.47	69.84	67.67	71.50	70.69	68.28	70.06	72.75	74.15	74.42	65.11	66.92	71.55
		M3	70.18	71.76	75.82	72.17	73.89	75.23	70.00	71.08	72.46	67.54	70.40	69.00	72.10	73.74	74.62	67.42	70.58	72.84
	S3	M1	71.84	75.00	75.18	70.22	71.34	73.07	68.96	70.79	72.02	68.00	70.99	69.24	72.80	73.60	74.66	66.66	63.85	72.14
		M2	70.75	73.40	75.10	71.07	71.93	73.45	69.45	71.68	72.50	70.92	69.29	68.22	72.74	74.34	74.82	71.33	70.32	72.38
		M3	70.19	73.90	75.00	71.89	72.77	75.43	70.46	71.02	71.11	69.96	70.22	70.56	74.40	74.74	76.16	63.02	70.36	71.66
CD @ 0.05%			0.23			0.24			0.41			0.18			0.46			0.20		
SEM±			0.08			0.08			0.14			0.06			0.16			0.07		
Microwave	S1	M1	36.40	38.12	39.88	40.85	41.41	39.43	38.72	39.26	39.88	38.27	38.83	39.95	41.00	41.78	42.64	32.08	32.56	33.44
		M2	37.80	39.28	40.54	43.09	41.53	41.41	39.58	39.62	40.76	38.21	40.59	40.87	41.60	44.38	45.14	34.22	34.78	32.12
		M3	39.68	42.88	43.32	43.49	44.93	45.45	39.98	39.44	40.70	37.99	38.41	38.55	41.16	45.80	45.34	34.24	35.16	36.06
	S2	M1	44.04	44.62	44.98	46.23	41.41	41.75	37.92	28.66	39.28	39.97	40.47	42.89	41.30	42.40	41.20	36.66	34.46	36.28
		M2	45.34	46.82	45.30	42.19	45.05	45.63	39.66	39.42	40.44	37.99	40.15	40.51	42.70	43.58	44.66	36.80	37.10	36.08
		M3	47.76	40.82	43.20	47.45	41.25	47.99	40.12	40.90	41.48	41.99	40.81	41.69	43.22	44.10	43.86	34.78	38.88	39.14
	S3	M1	43.82	46.84	44.58	47.29	47.53	48.37	38.68	39.66	40.14	40.33	40.29	40.31	41.78	42.10	41.88	37.30	33.90	34.64
		M2	47.32	47.92	47.98	44.09	45.35	46.01	39.62	40.06	40.74	41.65	42.27	43.11	41.32	41.98	42.92	38.16	38.82	38.38
		M3	42.70	42.96	43.58	46.37	47.59	48.13	39.56	40.12	40.68	40.83	42.33	43.27	42.68	43.20	44.12	38.60	40.66	41.36
CD@0.05%			0.26			0.19			0.18			0.25			0.18			0.18		
SEM±			0.09			0.07			0.06			0.08			0.06			0.06		

Table 3: Effect of different processing variables, method of puffing on average protein content (%) of different paddy varieties

Processing Variables			JR-206			JRH-5			JR-81			JR-201			JRH-19			JRB-1		
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Traditional	S1	M1	6.35	5.84	6.62	5.44	5.43	6.34	7.45	7.27	6.86	5.76	5.40	6.55	5.56	6.39	6.72	6.39	5.73	6.39
		M2	5.60	5.62	6.34	6.59	5.56	5.76	7.39	7.62	6.35	6.52	5.55	6.37	6.11	6.58	6.42	6.49	5.69	5.69
		M3	7.16	5.94	6.36	6.34	7.28	6.36	7.59	6.48	5.42	6.72	5.57	5.63	7.32	7.70	6.54	6.75	4.93	5.57
	S2	M1	5.77	5.37	6.56	6.55	5.66	7.41	7.25	6.50	7.52	5.71	7.42	6.69	5.60	6.53	5.70	6.32	5.60	7.35
		M2	7.88	5.56	7.23	5.49	6.38	5.27	5.81	5.34	6.43	5.61	5.39	5.85	7.33	6.39	5.52	6.32	5.45	6.48
		M3	6.20	5.82	5.13	6.47	6.39	5.32	7.25	6.56	5.77	5.65	6.52	6.31	5.56	6.56	6.40	6.53	6.41	5.63
	S3	M1	5.56	6.34	6.31	5.65	6.39	7.62	6.35	7.24	7.60	6.38	7.27	7.54	7.18	6.48	6.60	5.44	6.57	7.21
		M2	7.60	7.18	5.38	7.26	5.43	7.41	6.35	5.59	7.22	6.64	5.59	7.36	6.38	6.54	5.36	6.41	5.54	6.40
		M3	6.35	6.50	7.63	7.33	6.25	7.26	7.41	7.62	5.31	7.11	6.47	6.45	5.30	7.14	5.74	5.71	5.52	6.51
CD @ 0.05%			0.22			0.38			0.38			0.45			0.37			0.89		
SEM±			0.08			0.13			0.13			0.15			0.13			0.30		
Microwave	S1	M1	6.59	5.42	5.56	5.92	6.31	6.70	6.41	6.73	5.51	6.72	5.71	6.71	5.48	6.49	6.69	6.65	5.65	5.48
		M2	5.88	6.31	5.50	5.57	5.53	6.32	6.40	5.95	6.28	5.61	6.46	5.39	5.56	6.45	6.72	5.90	6.34	5.48
		M3	6.60	6.81	5.51	6.76	5.60	5.93	6.41	4.81	5.91	5.70	5.39	5.63	7.21	7.52	6.72	6.76	6.69	5.66
	S2	M1	5.73	4.67	6.60	6.75	5.52	6.30	7.10	5.92	6.66	6.50	5.57	6.83	5.77	6.75	5.54	5.73	3.76	6.62
		M2	7.23	6.38	7.91	7.20	5.47	6.25	5.36	5.67	5.67	7.21	5.81	5.52	7.22	6.50	5.79	7.27	6.47	7.73
		M3	5.51	5.79	5.44	6.36	6.81	5.57	5.71	6.65	5.66	6.66	6.39	5.41	5.93	6.50	6.31	5.70	5.73	5.48
	S3	M1	6.77	5.54	5.90	6.93	5.21	5.56	5.76	6.62	6.81	5.66	5.59	5.39	7.30	6.43	6.49	6.55	5.37	5.93
		M2	6.44	6.62	6.56	6.70	6.36	5.65	5.81	6.47	5.49	5.79	5.60	6.85	6.60	6.49	5.39	6.44	6.34	6.52
		M3	5.87	5.47	6.39	6.73	6.36	5.92	5.66	6.82	5.49	6.32	6.19	5.68	5.45	7.23	5.64	5.74	5.49	6.55
CD @ 0.05%			0.24			0.13			0.44			0.41			0.36			0.54		
SEM±			0.08			0.05			0.15			0.14			0.12			0.19		

Table 4: Effect of different processing variables, method of puffing on average oil content (%) of different paddy varieties

Processing Variables			JR-206			JRH-5			JR-81			JR-201			JRH-19			JRB-1		
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Traditional	S1	M1	1.22	1.56	1.30	2.11	2.25	1.62	1.20	0.89	1.49	1.47	1.32	1.56	1.51	1.36	0.93	1.56	1.64	1.36
		M2	1.52	0.93	1.25	1.80	2.54	2.27	1.39	1.45	1.30	1.59	1.48	1.29	1.00	1.31	1.46	1.47	1.18	1.46
		M3	1.47	1.83	0.87	2.19	1.85	1.61	1.26	0.94	0.93	1.42	1.34	0.32	2.15	1.49	1.29	1.50	1.58	1.27
	S2	M1	1.58	1.12	1.75	1.81	1.60	1.67	1.05	1.49	1.33	1.56	1.12	0.96	1.04	1.69	1.55	1.02	1.27	1.55
		M2	1.54	1.75	1.57	1.75	2.14	2.28	1.27	1.39	1.28	1.55	1.66	1.68	1.56	0.98	1.03	1.51	1.33	1.40
		M3	1.39	1.23	0.94	1.90	1.75	1.52	1.23	0.92	0.92	1.34	1.68	1.01	1.44	1.64	0.85	1.58	1.48	1.29
	S3	M1	1.55	1.42	1.26	1.42	1.81	1.92	0.84	1.43	1.43	1.48	1.81	1.45	1.49	1.86	1.37	1.31	1.42	1.21
		M2	1.34	1.44	1.87	1.66	1.95	1.84	1.49	1.32	0.92	1.44	1.55	1.43	1.49	1.58	0.52	1.19	1.48	1.10
		M3	1.56	1.71	1.63	1.66	1.53	2.31	0.90	1.21	1.59	1.63	1.41	1.34	1.56	1.62	1.46	1.24	1.52	1.28
CD @ 0.05%			0.13			0.21			0.19			0.37			0.32			0.54		
SEM±			0.04			0.07			0.06			0.13			0.11			0.19		
Microwave	S1	M1	1.74	2.04	2.46	1.74	2.02	2.44	2.05	2.10	2.16	1.58	1.19	1.79	1.93	1.48	1.52	2.32	2.37	1.61
		M2	2.26	2.59	2.24	1.57	1.52	1.38	2.21	1.74	1.81	1.68	2.73	3.11	2.41	2.68	2.27	2.51	1.43	1.65
		M3	2.14	2.33	2.42	1.27	1.69	1.94	1.74	1.47	2.12	1.69	2.55	2.67	1.58	2.41	2.38	1.58	2.48	2.27
	S2	M1	2.66	2.60	2.46	1.82	2.05	2.15	1.64	2.36	2.38	2.62	2.55	2.35	2.56	1.32	1.56	2.53	1.77	2.15
		M2	2.55	2.70	2.15	2.13	1.78	1.85	1.48	1.50	2.71	1.96	1.51	2.51	1.36	1.83	1.32	1.57	1.36	1.70
		M3	2.25	1.64	1.93	1.58	1.59	2.59	2.53	1.24	1.29	1.43	2.47	2.72	2.38	2.53	2.30	1.92	2.33	2.19
	S3	M1	2.54	1.70	1.61	1.46	2.48	1.58	1.74	2.15	1.85	1.92	1.37	2.57	1.52	1.80	2.67	2.40	2.66	2.30
		M2	2.72	2.37	2.56	1.79	2.87	2.40	1.75	1.63	2.34	2.74	2.95	2.20	2.50	1.60	2.54	2.64	3.20	2.59
		M3	2.46	2.14	2.47	2.54	1.65	1.47	2.37	2.42	2.76	2.20	2.29	1.47	2.40	1.38	1.72	2.70	2.72	2.62
CD @ 0.05%			0.16			0.14			0.22			0.19			0.32			0.31		
SEM±			0.05			0.05			0.08			0.06			0.11			0.11		

Table 5: Effect of different processing variables, method of puffing on average carbohydrate content (%) of different paddy varieties

Processing Variables			JR-206			JRH-5			JR-81			JR-201			JRH-19			JRB-1		
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Traditional	S1	M1	71.17	7353	73.15	71.19	73.58	75.30	68.544	69.54	68.57	71.31	73.52	69.75	72.50	69.57	68.40	69.54	71.09	72.44
		M2	69.50	75.26	68.54	69.50	75.20	68.59	72.40	71.21	72.54	71.32	72.82	68.50	73.46	69.44	69.69	73.66	73.47	69.56
		M3	73.37	76.59	73.38	73.34	76.40	73.74	69.67	72.43	68.71	72.24	72.42	73.64	72.25	68.37	69.56	68.48	69.65	69.54
	S2	M1	72.30	76.47	77.70	72.28	76.36	77.84	68.65	69.34	69.78	69.65	67.53	68.60	71.14	73.46	72.42	68.48	69.54	71.09
		M2	73.61	69.68	76.39	73.36	69.56	76.34	69.11	71.22	72.50	69.68	73.72	73.35	72.61	69.64	68.63	73.49	69.63	68.59
		M3	73.53	72.42	75.14	73.44	72.46	75.18	69.72	71.17	71.86	72.33	75.29	69.76	68.50	73.51	72.18	73.37	69.77	69.75
	S3	M1	73.66	77.48	77.66	73.53	77.67	77.58	72.51	69.60	68.59	72.37	72.34	69.58	69.74	71.25	68.52	68.49	68.57	71.23
		M2	75.16	72.36	71.19	75.35	72.35	71.15	69.66	68.52	72.30	71.34	71.35	68.60	71.29	71.33	69.54	72.34	69.55	73.72
		M3	72.35	75.34	77.45	72.43	75.30	77.48	71.18	72.34	70.47	69.51	72.12	76.55	69.52	71.29	71.22	69.73	69.52	68.46
CD @ 0.05%			0.37			0.37			0.47			0.58			0.43			0.41		
SEM±			0.13			0.13			0.16			0.20			0.15			0.14		
Microwave	S1	M1	69.66	72.22	71.10	71.12	72.36	69.79	69.68	72.25	73.31	75.25	73.61	73.67	69.56	72.27	73.61	72.31	73.55	75.30

		M2	72.58	75.04	73.58	71.13	73.53	72.38	75.10	73.65	65.72	72.44	69.77	69.67	68.54	69.68	74.11	75.31	75.44	73.52
		M3	72.45	73.53	75.37	71.04	73.46	69.72	71.14	71.18	72.49	71.24	73.60	72.50	75.29	77.59	75.05	69.79	71.22	76.51
	S2	M1	71.11	72.46	72.42	72.35	69.83	71.12	73.76	69.58	73.57	75.15	76.61	68.50	77.49	69.59	69.72	75.41	69.75	72.55
		M2	71.21	73.56	73.68	72.36	73.38	73.54	71.18	72.52	73.56	69.68	68.51	72.43	68.47	71.33	69.66	68.66	69.79	71.22
		M3	72.25	73.57	71.09	71.23	69.51	69.74	69.74	73.60	73.61	73.62	73.59	72.45	73.38	72.30	75.24	75.61	72.55	69.67
	S3	M1	71.10	72.34	73.77	73.61	72.37	71.05	72.44	71.11	71.18	75.47	71.41	71.42	72.42	75.36	72.53	69.84	71.17	68.65
		M2	71.90	71.11	72.56	72.34	73.68	69.84	73.56	72.42	69.86	70.44	69.58	75.13	75.58	72.52	75.59	73.59	69.83	71.22
		M3	71.10	73.51	72.51	72.39	72.34	75.02	72.43	69.72	73.59	73.76	72.41	69.75	69.64	75.25	68.63	72.44	71.25	72.42
CD @ 0.05%			0.38			0.22			1.19			0.61			0.45			0.37		
SEM±			0.13			0.07			0.41			0.21			0.16			0.13		

Table 6: Effect of different processing variables, method of puffing on average fibre content (%) of different paddy varieties

Processing Variables			JR-206			JRH-5			JR-81			JR-201			JRH-19			JRB-1		
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Traditional	S1	M1	1.52	1.60	1.67	2.60	2.35	1.68	2.73	2.48	1.74	2.55	2.28	2.74	2.87	2.67	2.49	2.72	2.63	2.32
		M2	1.51	1.86	2.17	1.74	2.54	2.65	2.17	2.52	2.59	2.44	2.54	1.69	2.53	2.47	1.67	1.40	1.40	2.47
		M3	2.11	1.86	2.56	2.38	2.51	1.68	1.62	3.20	1.60	1.84	3.08	1.38	3.43	2.55	1.83	1.78	2.49	2.50
	S2	M1	2.07	1.41	2.37	1.66	2.47	2.47	2.51	1.47	2.71	1.93	2.49	2.38	2.61	1.86	2.47	2.48	1.66	1.39
		M2	1.62	1.75	2.44	1.53	2.32	2.59	2.58	1.87	2.37	1.71	1.42	2.49	2.39	2.65	2.50	2.43	1.58	2.52
		M3	1.86	1.47	2.19	1.85	1.61	2.48	1.55	1.76	1.75	2.47	1.82	2.54	1.64	1.79	2.47	2.49	2.49	2.42
	S3	M1	1.71	1.56	1.87	2.44	1.77	1.49	2.48	2.25	2.54	2.69	1.94	2.58	2.60	2.54	2.45	1.52	2.49	3.25
		M2	2.22	1.83	1.27	2.44	1.45	2.46	1.80	2.47	1.56	2.52	3.44	2.70	2.78	2.46	1.69	2.42	1.36	2.55
		M3	1.50	2.35	1.87	2.30	2.29	2.30	1.37	2.24	2.25	1.73	1.66	2.65	2.59	1.53	1.97	3.27	2.53	1.67
CD @ 0.05%			0.21			0.29			0.23			0.60			0.58			0.31		
SEM±			0.07			0.10			0.08			0.21			0.20			0.11		
Microwave	S1	M1	2.36	2.54	1.63	2.26	1.48	2.44	1.41	1.25	1.36	2.48	2.46	2.69	2.78	2.59	1.56	1.60	1.61	2.60
		M2	1.90	2.52	2.26	2.30	2.52	2.46	1.53	1.38	1.74	2.58	1.73	2.55	1.52	2.59	2.32	2.65	2.81	2.48
		M3	3.30	3.38	2.45	3.16	1.80	2.43	2.58	1.31	1.55	2.68	2.81	2.34	2.58	3.30	2.76	1.51	1.38	1.77
	S2	M1	1.84	2.53	2.49	2.87	2.49	2.53	1.75	1.52	1.39	2.48	2.60	3.32	1.76	2.66	2.46	2.55	2.47	2.75
		M2	2.44	1.42	2.55	2.48	2.08	1.47	1.22	2.26	1.40	2.49	2.73	1.76	2.62	2.76	2.92	1.37	1.65	2.50
		M3	2.69	1.77	1.88	2.63	2.73	2.74	1.41	2.35	1.50	2.38	2.47	2.82	1.66	3.64	1.64	2.72	1.70	2.6.
	S3	M1	2.46	2.04	2.37	1.95	3.04	2.84	1.67	2.57	2.37	2.75	2.94	2.67	2.72	3.26	2.75	2.55	2.60	2.59
		M2	1.93	2.78	3.16	1.47	2.46	2.58	1.47	2.59	1.39	2.56	2.55	2.52	2.42	2.62	2.77	1.54	2.76	1.65
		M3	2.70	1.55	2.54	1.92	1.77	2.42	1.32	1.30	1.31	2.78	2.34	1.95	2.59	1.77	2.53	1.93	2.72	2.58
CD @ 0.05%			0.15			0.33			0.21			0.30			0.27			0.33		
SEM±			0.05			0.11			0.07			0.10			0.09			0.11		

Table 7: Effect of different processing variables, method of puffing on average ash content (%) of different paddy varieties

Processing Variables			JR-206			JRH-5			JR-81			JR-201			JRH-19			JRB-1		
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Traditional	S1	M1	1.50	1.26	1.58	1.48	1.40	1.40	2.46	2.58	1.93	1.48	1.56	1.73	1.67	1.99	2.26	1.72	1.79	1.71
		M2	1.60	1.80	2.42	2.43	1.68	2.34	1.53	1.45	2.44	1.47	2.22	2.31	1.52	2.35	1.51	2.41	1.64	1.56
		M3	1.62	1.58	1.61	2.52	1.64	1.39	1.53	2.48	1.87	1.62	1.56	2.21	2.24	2.43	1.48	2.55	2.56	2.33
	S2	M1	2.37	2.37	1.61	1.47	1.66	1.36	1.75	2.56	2.40	1.80	1.44	2.33	1.50	1.45	2.51	2.49	1.75	1.61
		M2	1.49	2.39	2.56	1.48	2.34	1.32	1.92	2.34	1.64	2.17	2.21	1.29	2.42	1.58	1.57	1.76	1.77	2.46
		M3	1.66	1.31	1.49	1.54	2.46	1.69	2.51	1.61	2.38	1.41	1.81	2.21	1.99	2.25	2.35	2.49	1.66	1.68
	S3	M1	1.56	2.52	2.66	1.67	2.39	2.64	1.49	1.31	2.57	1.83	2.33	1.42	1.64	1.67	1.71	2.31	2.19	1.43
		M2	1.72	2.66	2.62	1.65	1.51	1.93	2.32	1.65	1.81	1.73	2.56	1.51	1.66	1.42	2.42	1.41	2.41	2.34
		M3	2.12	1.61	1.55	2.35	1.84	2.38	1.53	2.44	2.51	2.23	2.38	2.30	1.55	1.45	1.75	2.72	1.66	1.27
CD @ 0.05%			0.24			0.27			0.30			0.27			0.38			0.33		
SEM±			0.08			0.09			0.10			0.09			0.13			0.11		
Microwave	S1	M1	2.56	2.67	2.56	2.93	2.58	2.94	2.60	2.42	2.61	2.54	2.46	2.85	2.40	2.59	3.57	2.33	2.52	2.42
		M2	2.80	3.42	3.49	2.64	3.16	2.81	3.27	2.42	2.59	3.09	3.33	3.29	2.83	2.55	3.40	2.77	3.48	2.64
		M3	3.15	3.17	2.49	2.96	2.49	3.04	2.81	2.56	2.54	3.55	2.61	3.37	3.20	2.51	2.79	3.19	2.71	2.74
	S2	M1	2.77	2.87	2.71	3.51	3.55	2.75	2.87	3.37	3.52	2.65	3.32	3.43	3.54	3.49	2.64	2.59	3.37	2.81
		M2	3.03	2.43	2.99	2.34	2.85	2.61	3.33	2.83	2.48	3.48	2.85	2.68	2.66	2.76	2.54	3.36	2.77	2.78
		M3	3.11	3.53	2.06	2.49	2.88	2.94	2.73	3.18	2.53	3.37	3.54	3.68	3.51	2.65	3.49	2.66	3.53	3.45
	S3	M1	2.12	2.30	2.49	2.64	2.38	2.59	3.57	3.60	2.77	2.72	2.47	2.63	2.55	3.49	3.49	2.83	2.92	3.43
		M2	2.77	3.15	3.38	3.15	3.26	3.32	2.91	3.58	3.24	3.47	3.47	3.53	2.92	2.59	2.71	3.54	2.51	3.46
		M3	2.86	2.29	2.79	2.54	2.78	2.65	2.79	2.77	3.32	3.40	2.76	2.55	3.41	3.57	3.25	3.43	2.65	2.55
CD @ 0.05%			0.25			0.12			0.15			0.24			0.28			0.25		
SEM±			0.09			0.04			0.05			0.08			0.09			0.09		

Table 8: Effect of different processing variables, method of puffing on average amylose content (%) of different paddy varieties

Processing Variables			JR-206			JRH-5			JR-81			JR-201			JRH-19			JRB-1		
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Traditional	S1	M1	18.54	18.87	19.92	19.12	22.94	21.43	19.02	19.12	20.38	18.54	19.02	19.32	20.08	18.42	21.43	21.58	18.15	21.43
		M2	21.58	27.62	22.49	22.49	23.70	21.43	21.74	23.09	20.83	22.04	21.74	22.94	22.19	21.74	22.94	22.34	19.47	20.38
		M3	28.68	19.12	17.21	21.74	20.38	19.47	17.21	18.87	19.12	22.19	20.83	19.47	19.32	21.89	17.36	22.49	19.32	18.42
	S2	M1	21.89	22.94	22.19	17.04	20.68	18.15	19.32	18.15	17.37	18.42	17.76	20.68	19.02	22.64	22.34	20.53	23.40	23.55
		M2	20.53	19.47	20.38	20.98	17.81	20.38	22.49	19.17	20.83	22.79	22.49	21.58	20.98	20.83	19.71	20.83	20.83	19.47
		M3	18.73	22.04	20.53	19.32	19.47	20.08	23.80	17.17	17.95	18.15	22.34	21.74	17.37	19.32	22.04	19.32	22.49	20.08
	S3	M1	18.72	20.83	20.23	20.98	21.89	22.04	21.58	17.51	27.12	19.32	20.83	20.88	21.74	22.19	19.12	20.23	21.89	20.23
		M2	18.75	19.32	19.12	19.02	22.94	17.37	20.08	19.32	22.49	18.42	20.98	22.64	16.20	18.87	18.57	17.95	22.94	17.37
		M3	16.98	22.79	18.15	18.72	20.08	18.26	20.68	19.02	25.76	20.68	19.02	21.66	22.04	17.17	20.34	19.47	18.42	18.26
CD @ 0.05%			0.43			3.26			1.15			0.06			0.07			0.28		
SEM±			0.15			1.12			0.39			0.02			0.02			0.10		
Microwave	S1	M1	18.87	21.43	20.38	19.47	24.45	25.06	20.83	21.89	22.34	19.02	21.58	21.74	21.74	19.17	18.73	18.42	27.71	20.38
		M2	17.51	18.87	22.49	22.49	21.74	17.37	21.74	20.53	17.21	21.43	22.94	19.47	22.49	18.26	19.77	20.53	20.08	21.58
		M3	20.23	19.32	22.49	18.73	20.08	24.30	18.72	22.49	21.74	28.83	22.02	22.34	18.72	18.42	22.04	18.73	17.37	20.43
	S2	M1	20.08	19.74	17.96	20.68	19.32	28.10	18.93	21.43	18.34	21.74	19.12	17.95	19.47	17.36	19.47	22.19	21.58	17.96
		M2	22.19	20.83	185.54	20.23	17.76	19.32	14.79	18.73	21.89	20.38	20.53	21.58	18.54	19.77	18.72	19.32	18.42	21.89
		M3	22.04	18.72	19.32	19.32	21.89	23.85	22.34	22.04	22.05	17.95	20.68	21.74	21.58	21.58	21.58	26.34	20.83	20.23
	S3	M1	19.12	21.58	17.96	22.49	23.40	19.32	22.19	21.74	21.66	19.32	20.08	22.94	17.96	19.32	22.08	18.26	20.68	18.73
		M2	19.32	17.37	22.04	21.89	18.15	23.25	19.73	18.15	17.37	17.17	20.83	22.79	20.98	18.87	19.17	19.47	20.98	19.32
		M3	22.79	21.89	18.72	17.69	18.42	20.68	18.87	22.04	21.58	20.08	19.02	20.68	22.34	18.57	22.79	18.34	20.08	18.57
CD @ 0.05%			0.41			0.07			0.10			0.06			1.02			0.13		
SEM±			0.14			0.02			0.03			0.02			0.35			0.04		

Table 9: Effect of different processing variables, method of puffing on average starch content (%) of different paddy varieties

Processing Variables			JR-206			JRH-5			JR-81			JR-201			JRH-19			JRB-1		
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Traditional	S1	M1	73.13	73.59	76.05	75.57	74.51	76.63	74.47	73.33	75.59	75.31	78.22	74.53	75.60	74.41	77.18	76.60	75.54	73.32
		M2	77.68	78.31	74.11	78.59	73.33	75.50	76.72	78.30	77.90	76.63	75.56	73.34	75.52	78.34	76.75	74.47	77.85	74.62
		M3	76.10	77.61	74.67	74.54	73.33	77.23	76.36	75.58	74.45	78.13	77.90	75.92	73.17	77.60	78.08	75.54	73.52	78.05
	S2	M1	76.71	78.08	73.30	74.79	75.63	76.64	73.13	78.51	77.79	76.12	77.49	75.27	74.48	75.54	76.64	74.21	76.83	78.08
		M2	78.20	77.49	74.53	77.45	78.35	78.05	76.64	74.53	73.30	74.62	75.64	77.59	77.55	74.72	73.83	76.25	76.33	74.90
		M3	75.51	77.68	78.32	74.50	76.65	77.56	75.62	74.12	75.42	73.28	74.51	76.29	75.91	76.68	74.62	78.27	76.63	77.15
	S3	M1	74.47	73.30	75.54	73.29	74.49	75.60	77.32	74.10	73.38	77.36	78.17	75.65	76.12	77.79	75.61	75.32	74.48	78.47
		M2	73.95	76.60	75.50	75.54	76.64	78.25	75.65	78.22	77.87	74.51	74.94	74.61	73.43	74.42	75.61	76.61	74.77	77.60
		M3	77.80	78.06	73.19	77.79	75.84	76.34	76.66	75.62	74.51	75.65	73.68	77.90	78.28	76.88	77.78	78.11	75.53	76.34
CD @ 0.05%			0.21			0.07			13.89			0.57			0.08			14.06		
SEM±			0.07			0.02			4.78			0.19			0.03			4.84		
Microwave	S1	M1	74.58	75.53	77.26	77.80	74.53	75.59	73.40	74.48	76.68	76.65	75.62	77.80	78.08	74.37	75.59	75.52	74.38	77.30
		M2	73.34	78.51	73.23	73.29	78.15	77.51	77.29	78.24	75.28	76.59	74.51	73.83	76.86	74.21	73.43	73.44	78.25	77.18
		M3	76.63	74.42	73.14	73.34	74.38	75.60	75.66	74.51	76.36	75.79	74.71	73.64	76.87	73.81	74.42	73.34	74.46	78.22
	S2	M1	75.27	77.61	78.15	73.07	75.26	77.41	77.83	76.25	74.50	77.16	76.25	75.47	77.72	73.10	75.07	73.18	76.56	77.68
		M2	75.55	74.52	73.34	76.63	75.43	76.62	73.24	76.95	77.32	74.27	73.38	74.60	74.47	73.43	76.62	76.56	78.06	75.11
		M3	78.27	76.61	77.71	78.29	74.15	76.29	74.10	75.22	78.08	78.05	73.28	78.12	77.17	78.50	75.53	77.56	73.22	75.56
	S3	M1	73.31	75.63	77.31	77.79	78.36	74.24	75.39	74.83	76.17	74.70	75.59	76.92	73.56	78.47	76.41	74.45	76.63	74.58
		M2	74.08	74.43	77.44	74.12	78.22	74.68	73.31	75.48	74.28	74.83	73.91	75.59	74.84	77.40	78.07	73.59	77.81	78.28
		M3	76.60	78.42	76.22	76.88	77.87	73.81	73.78	73.10	74.76	77.56	74.33	73.33	74.43	77.61	78.08	73.66	76.69	74.74
CD @ 0.05%			0.07			0.20			0.07			0.09			0.20			0.07		
SEM±			0.03			0.07			0.02			0.03			0.07			0.02		

Table 10: Effect of different processing variables, method of puffing on average sensory profile of selected treatments of paddy varieties

Sensory attributes	Varieties					
	JRH-5 (S2M3T3)	JRB-1 (S2M3T3)	JR-81 (S2M3T3)	JR-206 (S2M3T3)	JRH-19 (S3M3T3)	JR-201 (S1M2T3)
Colour	7.41	7.23	7.21	8.41	8.78	7.47
Flavour	7.39	7.37	7.49	6.37	7.65	7.41
Texture	6.47	6.42	6.38	8.42	8.28	8.38
Taste	7.52	8.35	7.29	7.44	8.71	7.34
Overall acceptability	7.54	7.41	7.37	7.55	7.67	7.26

Conclusions

Advances in post-harvest unit operations and value addition technologies have made it possible to process and prepare value added products acceptable in both rural and urban community. Puffing of rice important unit operation for conversion of pre-gelatinized milled rice in to ready-to eat snacks, paddy rice can be puffed by microwave heating, producing puffed rice that has expansion volume, expansion ratio and bulk density similar to the general standard for cereal grain that has been puffed. On the basis of findings it

was concluded that traditional puffing of rice at 2.5% salt soaking, 17% moisture and 260 0C (S3M3T3) treatments in JRH-19 variety found best on the basis of puffing yield, chemical attributes as well as sensory analysis.

References

1. Amerine MA, Pangborn RM and Rosseier EB. Principle of sensory evaluation of food. Academic press, New York and London 1965, p 5.
2. AOAC. Official methods of analysis 16 edition. Association of official Analytical Chemistry Inc. Arlington VA. Chemists, Washington, DC 1992.
3. Ghose RLM, Ghatge MB and Subrahmanyam V. Rice in India. Revised Edn. Indian Council of Agricultural Research, New Delhi 1960.
4. Jaybhaye RV, Pardeshi IL, Vengaiah PC, Srivastav PP. Processing and Technology for Millet Based Food Products: A Review, Journal of Ready to Eat Food 2014;1(2):32-48.
5. Knutson CA, Cluskey JE, Dintzis FR. Properties of amylose-iodine complexes prepared in the presence of excess iodine. Carbohydrates Research 1982;101:117.
6. Maisont S, Narkrugsa W. Effects of some physicochemical properties of paddy rice varieties on puffing qualities by microwave. Kasetsart J. (Nat. Sci.) 2009;43(3):566-575.
7. Malleshi NG, Desikachar HSR. Varietal differences in puffing quality of ragi (*Eleusinecoacana*). Journal of Food Science and Technology 1981;18:30-32.
8. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers, 4th ed., ICAR, New Delhi 1985, 347 pp.
9. Pordesimo LO, Anantheswaran RC, Fleischmann AM, Lin YE, Hanna MA. Physical properties as indicators of popping characteristics of microwave popcorn. J Food Sci 1990;(55):1352-1355.
10. Rangana S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products, 9780074518519, Mc Graw Hill Education publication 2001.