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Assessment of Physicochemical Properties and Cooking Quality of Promising Rice Varieties

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ABSTRACT

The study was carried out in AC and RI, killikulam, Tamil Nadu Agricultural University, Tamil Nadu, India during *Kharif* 2017 to evaluate physiochemical and cooking properties of promising high yielding rice varieties of Tamil Nadu. Different physiochemical properties were studied in Fifty-five rice varieties. The hulling percentage varied from IR 28 (88.85) to CO 39(62.5), milling percentage ranged between IR 28(79.6) to C0 39(59.35), HRR% varied from IR 28 (73.3) to CO 43 (42.5), grain length is highest in Pusa Basmati (8.85 mm) and lowest in short grain type TN 1 (4.05 mm), The grain breadth ranged between 1.5 mm (JGL 3855) – 2.4 mm (ASD 2). L/B ratio, varied from 5.72 (Pusa Basmati) to 1.84 (TN 1), grain length after cooking ranged from Pusa Basmati (14.7mm) to BRNS (WP) 5 (5.35mm). Whereas the highest grain breadth after cooking was observed in ASD 2 (4.75 mm) and the lowest observed in Pusa Basmati (2.05 mm), linear elongation ratio is ranged from 1.67 (Pusa Basmati) to 1.04 (TPS 3), breadth wise expansion ratio was varied from TPS 3(2.49) to Pusa Basmati (1.33), ASV recorded 4 , 7, 27,11 and 7 varieties for scale-2, scale-3,scale-4, scale-5, scale-6 respectively. gel consistency ranged from 99.55 mm (JGL 3855) to 55.5 mm (Swarna) and the amylose content varied from 39.45 (Abhya) to 13.55(ASD 17). The relationship between physicochemical and cooking properties was determined using Pearson's correlation. Correlation was done for determining the nature of interaction among the characters.

KEYWORDS: Physicochemical, cooking and correlation

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1. INTRODUCTION

Rice (*Oryza sativa* L.) is the most important food in Asian countries, as about 90% of the world's rice is produced and consumed in South and Southeast Asian countries (Bollineni et al., 2014). Among Asian countries, China and India alone account for more than 55% of world production (Venmuhil et al., 2020). It plays an important role in global food security, particularly in meeting the calorie needs of Asian and African countries (Rachappanavar et al., 2018). Rice is not only used as a dietary food but also processed into various types of snacks and consumed (Kamaraddi & Prakash, 2015). There is a need to increase rice production by 40% by 2050 (Rachappanavar et al., 2018) to meet the projected consumption needs of the population, which will have to be met by land shortages, water shortages and additionally climate change. The stability of rice production is an important key factor to ensure food security (Bandumula, 2018). The grain quality of each crop, especially rice, is very important to be accepted by people for cultivation. Consumer demand for higher quality rice has increased. Today, consumer appreciation for a rice variety varies depending on the quality of the grain (Sharma and Khanna, 2020). The quality of the grain depends not only on the rice variety, but also on the growing environment, harvesting, processing and milling systems. The quality of rice grain depends on the physical properties such as grain size, grain shape, hull rate, grind recovery, freeness, cob recovery, grain appearance and physical properties. -Chemicals such as gel temperature (GT), gel consistency (GC) and amylose content (AC) (Rachappanavar et al., 2018). Qualitative attributes include appearance, grind quality, cook quality, taste and nutritional status based on location, market demand, consumer preferences etc. as shown by Juliano et al., 2019.In addition to high-quality rice, it also contains beneficial nutrients such as fiber, vitamins, minerals and phytochemicals that reduce the risk of degenerative diseases (Joshi et al., 2014). The physical and physico-chemical properties of rice are determined by its culinary and taste properties. Tang et al., 1989, reported the existence of a highly significant negative correlation between amylose content and gel consistency and between amylose content and gelatinization temperature, but v. Chr. and grain strain (GE) showed a significant positive correlation. Among various qualities, the elongation after cooking is considered the most important, and the elongation after cooking without enlarging the circumference is considered the most desirable for high-quality rice. Evaluation of the size, shape and other physicochemical properties of the grains, including cooking properties, is important in assessing the quality of rice grains. Despite their economic value and worldwide popularity, there is little information (Shahidullah et al., 2009) on the quality characteristics of rice varieties. Some prefer short grain rice, as in the High Himalayan region; Some prefer medium-grain grains, as in the South Asian region, and most people prefer long fine grains in the Indian subcontinent and international markets (Singh et al., 2000). The composition of the starch content of rice plays the role of an important element related to culinary and nutritional properties rather than physical properties (Mestres et al., 2009). An L/B ratio of 2.5 to 3.0 is sufficient and a grain length > 6 mm is more ideal (Kaul et al., 1970). The culinary quality and composition of the rice produced in the different regions of India varies greatly. Consequently, the present research was undertaken to find out the physical and chemical cooking properties of promising genotypes cultivated in Tamil Nadu.

2. MATERIALS AND METHODS

The present study was carried out in AC and RI, killikulam, Tamil Nadu Agricultural University, Tamil Nadu, India during *kharif* 2017 to evaluate physicochemical and cooking characters of fifty-five high yielding popular rice varieties (Table 1) cultivated in Tamil Nadu to find out the better-quality traits. Eighteen days old seedlings were transplanted in Randomized Block Design with two replications and after harvesting the samples were cleaned carefully using winnower to remove the chaffy grains and other foreign matters. The seeds are dried in hot air oven up to 12-14% moisture content to evaluate physicochemical properties and cooking traits. Hence, the present study was conducted to evaluate the diversity of rice grain quality of promising high yielding rice varieties based on Milling, physicochemical and cooking properties which provide highly important information for future rice breeding programmes as well as for consumer preference.

2.1. Physiochemical and coking quality characters

Various physical and cooking parameters studied *viz.* hulling percentage, Milling Percentage, Head Rice Recovery, Grain length, Grain Breadth, L/B ratio, Grain Length after Cooking, Grain Breadth after Cooking, Linear Elongation Ratio, Breadth wise expansion ratio, Gelatinization temperature, Gel consistency and Amylose content. The recorded observations were analyzed by using indostat 9.2.V software; the Pearson's correlation among physicochemical and quality traits was analyzed using origin correlation plot software. The methodology of sample collection and their preparation for estimation of Physico-chemical and cooking quality parameters is as given below:

Hulling Percentage= (Weight of dehusked kernel)/(Total Paddy Weight) X 100.

Milling Percentage (%) = (total milled rice)/(total dehusked rice) multiplied by 100.

Head Rice Recovery (HRR)= (total head rice)/(total milled

Table 1: List of 55 varieties used for assessment of physicochemical properties and cooking quality

Sl. No.	Variety	Sl. No.	Variety
1.	ADT 42	29.	CO 50
2.	CO 33	30.	CO 39
3.	ASD 16	31.	ADT 46
4.	ADT 47	32.	Kavya
5.	IR 64	33.	ADT 49
6.	ASD 17	34.	JGL 3855
7.	ADT 36	35.	CO 45
8.	Pusa basmati	36.	Abhya
9.	ADT 45	37.	CR 1009
10.	Anjali	38.	CO 49
11.	ADT 37	39.	Swarna
12.	ADT 43	40.	ADT 38
13.	ADT 48	41.	JGL 3844
14.	ADT 41	42.	JGL 1798
15.	ASD 20	43.	CO 43
16.	MDU 5	44.	IR 20
17.	ASD 2	45.	ASD 14
18.	ASD 7	46.	Jaya
19.	TPS 4	47.	IR 72
20.	TN 1	48.	IR 28
21.	ASD 9	49.	POKKALI
22.	Annada	50.	IRRI 104
23.	ASD 1	51.	TPS 3
24.	ASD 18	52.	BRNS(WP) 5
25.	IR 50	53.	ASD 19
26.	BPT 5204	54.	BRNS (WP)22-2
27.	ADT 39	55.	Krishna Hemavathi (K.H)
28.	ADT 19		

rice) multiplied by 100.

Grain length (mm): Length of ten unbroken brown rice grains or kernels was measured using vernier caliper and the mean was expressed in millimeter (mm).

2.2. Grain breadth (mm)

Breadth of ten unbroken rice was measured using vernier caliper and the mean was expressed in millimeter (mm).

2.3. Grain length: breadth (L/B) ratio

Ten sample kernels/ grains, were stacked lengthwise and then widthwise for a centimeter-long cumulative measurement. Grains were divided into Long (LB), short (SB), medium (MS), and short (LB) bold types based on the L/B ratio (Ramaiah, 1985).

2.4. Grain Length after Cooking (KLAC) & 2.1.8 Grain Breadth after Cooking (BAC)

KLAC and KBAC was measured by the method of Juliano et al. (1979).

2.5. Linear elongation ratio (LER)

By dividing the average length of the cooked kernel by the average length of the uncooked rice, the linear elongation ratio (ER) was computed (Murthy, 1965).

2.6. Breadth wise expansion ratio (BER)

Ratio of mean breadth of cooked rice/ mean breadth of milled rice.

2.7. Gelatinization temperature (GT)

It is estimated based on alkali spreading score (ASV) of milled rice given by Little et al., (1958)

2.8. Gel consistency (GC) & Amylose content (AC)

For determining the AC and gel consistency, Campang et al., 1973 and Juliano (1979 streamlined approach was applied respectively.

3. RESULTS AND DISCUSSION

In this study, variance was estimated based on mean sum of square. The treatment mean sum of square due to genotypes was found to be highly significant for all the characters studied which would ultimately indicate diverse nature of selected genotypes (Table 2). Therefore, there is an ample scope for selection of promising genotypes from the present gene pool for Physicochemical and quality traits, these findings are agreed with Dhurai et al., 2014.

Rice grain quality is the important major aspect considered by plant breeders. Even though the demand for rice is likely to increase, the rice breeding stations and institutions are trying to improve indigenous rice for yield parameters along with cooking qualities. In this present study, we performed experiment to record the physicochemical and cooking properties of promising varieties cultivated in *kharif* and *rabi* seasons in Tamil Nadu.

The hulling percentage varied from IR 28 (88.85) to CO 39(62.5). If the hulling percentage is high, then the recovery of Head rice also increases. Milling out turn is the measure of rough rice recovery during milling. It is one of the important properties to the millers. The rice millers prefer varieties with high milling and head rice recovery, where as consumers preference depends on cooking and eating qualities (Merca and Juliano, 1981). The milling percentage ranged between IR 28(79.6) to C0 39(59.35). Head rice recovery is the proportion of whole grains in milled rice. It varies depending on the variety, grain type,

Table 2: Analysis of variance (mean squares) for physicochemical and quality traits in 55 genotypes rice (*Oryza sativa* L.)

Sl. No.	Characters	Replication (d.f=1)	Treatments (d.f=54)	Error (d.f=54)
1.	Hulling percentage	39.355	70.13**	1.04
2.	Milling Percentage	2.54	70.13**	0.99
3.	Head Rice Recovery	1.42	109.34**	0.37
4.	Grain length	0.0023	0.91**	0.00
5.	Grain Breadth	0.0131	0.11**	0.00
6.	L/B ratio	0.01	0.61**	0.01
7.	Grain Length after Cooking	0.00	2.61**	0.01
8.	Grain Breadth after Cooking	0.02	0.39**	0.00
9.	Linear Elongation Ratio	0.00	0.03**	0.00
10.	Breadth wise expansion ratio	0.02	0.08**	0.01
11.	Gelatinization temperature	0.08	2.09**	0.10
12.	Gel consistency	2.37	191.13**	0.67
13.	Amylose content	0.03	61.95**	0.10

*: Significance at (p=0.05) level Probability; **: Significance at (p=0.01) level of probability

cultural practices and drying condition (Asish et al., 2006). HRR% is a heritable trait although environmental factors and post-harvest handling are known to break the grain during milling. HRR% varied from IR 28 (73.3) to CO 43 (42.5) these results were presented in Table 3. The hulling percentage showed positive significant association with Milling percentage, head rice recovery and breadth elongation ratio. Milling percentage showed positive significant association with HRR, grain breadth and GC (Figure.1). This was similar to findings of Krishna Naik et al., (2005) to Hulling Percentage.

The grain length is highest in Pusa Basmati (8.85 mm) which shows long grain length and lowest in short grain type TN 1 (4.05 mm), among 55 varieties Pusa Basmati is under extra long, TPS 3 and remaining 53 varieties are medium long grain types. The grain breadth ranged between 1.5 mm (JGL 3855) – 2.4 mm (ASD 2). L/B ratio, varied from 5.72 (Pusa Basmati) to 1.84 (TN 1), 14 varieties viz; Pusa Basmati, Kavya, TPS 3, IRRI 104, CR 1009, JGL 3855, ADT 43, ADT 19, ADT 41, ADT 46, CO 49, CO 39, ADT 48 and ADT 37 having slender grain type, 40 varieties having medium slender grain type and only the varieties TN 1 is a short bold type. The value for each character for each variety is given in Table 3. Consumer affinity to size and shape is highly variable. Grain shape, size and appearance are very important characters and determine the consumer's acceptability. The Grain length recorded significant positive correlation with L/B ratio, grain length after cooking, and Alkali spreading value. Grain breadth recorded highly significant positive correlation with grain breadth after cooking, L/B ratio showed significantly positive correlation with grain length after cooking and Alkali spreading value (Figure.1). These associations were similar to the findings of Krishnaveni and Shobarani (2006) and Mahalingam (2007) for grain length.

The grain length after cooking ranged from Pusa Basmati (14.7mm) to BRNS (WP) 5 (5.35mm). Whereas the highest grain breadth after cooking was observed in ASD 2 (4.75 mm) and the lowest observed in Pusa Basmati (2.05 mm). Linear elongation ratio is an important parameter for cooked rice. If rice elongates length wise, it gives finer appearance and it expands girth wise, it gives coarse look. Out 55 varieties tested the linear elongation ratio is highest in improved Pusa Basmati (1.67) and lowest in TPS 3(1.04) these results are furnished in Table 3. The breadth wise expansion ratio was varied from TPS 3(2.49) to Pusa Basmati (1.33) the value for each character for each variety is given in Table 3. High breadth wise expansion ratio is not a desirable quality attributes in high quality rice required to command premium in the market. Grain length after cooking showed positive significant associated with Linear Elongation Ratio and Alkali spreading value (Figure.1). These findings were in concurrence with Danbaba et al., 2011, Mathure et al., 2011 and Singh et al., 2012).

Alkali digestion (ASV) is one of the important indicators of the eating, cooking and processing quality of rice starch reported by Nishi et al., 2001. In this study, determination of the alkali digestion classified the rice genotypes into three groups namely; low, intermediate and high alkali digestion. Similar classifications have been reported by Prathepha et al., 2005. The alkali digestion value and gelatinization temperature for all the variety were examined and presented in Table 4. The intermediate alkali digestion varieties are the most preferred worldwide. The ASV showed positive significant associated with amylose content (Figure 1).

Gel consistency test was developed as an indirect method

Table 3: Mean and descriptive statistics for various physicochemical and quality traits of 55 rice varieties

Sl. No.	Variety	HR	MR	HRR	GL	GB	LB	GLAC	GBAC	LER	BER	ASV	GC	AC
1.	ADT 42	73.2	63.95	57.2	5.7	2.1	2.76	7.95	3.5	1.41	1.71	4	93.55	24.3
2.	CO 33	71.15	61.9	55.5	5	1.9	2.63	7.25	2.95	1.44	1.555	4	99.365	31.55
3.	ASD 16	83.3	74.05	66.1	5.1	2.3	2.20	7.15	3.9	1.415	1.7	4	90	14.45
4.	ADT 47	81.4	72.15	66.85	5.15	1.85	2.79	7.5	3.25	1.455	1.755	3	97.5	27.55
5.	IR 64	77.6	68.35	61.95	5.2	1.85	2.82	7.8	3.05	1.5	1.65	4	96.3	25.5
6.	ASD 17	85.15	75.9	68.15	5.3	2.15	2.47	7.7	3.7	1.45	1.72	4	81	13.55
7.	ADT 36	74.73	65.48	58.6	4.9	2	2.45	7.35	3.45	1.5	1.725	3	87.5	17.85
8.	Pusa Basmatii	71.05	61.8	45.65	8.85	1.5	5.72	14.7	2.05	1.67	1.325	6	93.85	25.1
9.	ADT 45	80.2	70.95	64.05	5.35	2.05	2.61	7.5	3.45	1.405	1.735	5	97.55	29.55
10.	Anjali	72.75	63.5	60.25	5.5	1.85	2.98	7.55	3.05	1.375	1.57	4	96.5	33.15
11.	ADT 37	78.6	69.35	68.25	5.25	1.75	3.01	7.15	3.15	1.365	1.8	5	96.5	23.65
12.	ADT 43	71.65	62.4	56.45	5.4	1.65	3.28	7.85	3.05	1.46	1.93	4.5	97.85	29.9
13.	ADT 48	81.35	72.1	62.75	5.6	1.85	3.06	7.7	3.2	1.36	1.66	3.5	85	17.45
14.	ADT 41	77.5	68.25	62	5.4	1.65	3.25	7.7	2.85	1.44	1.8	4	98.35	27.45
15.	ASD 20	65	55.75	50.15	5.3	2	2.63	7.4	3.4	1.41	1.7	6	99.005	28.35
16.	MDU 5	78.15	68.9	60.35	5.9	2.05	2.86	8.25	3.65	1.41	1.78	5	91	22.15
17.	ASD 2	67.95	58.7	53.5	5.2	2.4	2.17	7.15	4.75	1.375	1.98	4.5	82.5	19.5
18.	ASD 7	70.55	61.3	56.3	5.2	2.2	2.36	7.15	3.55	1.375	1.615	5	97.7	35.25
19.	TPS 4	75.55	66.3	61.9	5.45	2.25	2.42	7.55	3.75	1.395	1.67	4.5	98.35	27.65
20.	TN 1	78.55	69.3	61.95	4.05	2.2	1.84	6	3.7	1.485	1.68	2.5	86.5	21.5
21.	ASD 9	68.15	58.9	51.7	5.35	2.3	2.33	7.85	3.85	1.465	1.675	4.5	98.13	26.4
22.	Annada	69.05	59.8	54.35	5.45	2.3	2.37	7.45	3.35	1.365	1.455	4.5	98.35	28.4
23.	ASD 1	83.5	74.25	65.65	5.3	2.25	2.33	7.35	3.55	1.41	1.58	3.5	87.25	21.75
24.	ASD 18	67.7	58.45	53.9	5.35	2.1	2.55	7.75	3.55	1.445	1.69	4.5	97.2	33.45
25.	IR 50	66.2	56.95	44.25	5.2	2.05	2.54	7.35	3.35	1.41	1.635	4.5	96.5	31.6
26.	BPT 5204	82.7	73.45	69.7	4.95	1.75	2.83	7.85	2.85	1.585	1.635	4.5	96.55	28.45
27.	ADT 39	78.65	69.4	62.35	5.25	2.1	2.50	7.45	3.55	1.42	1.69	5	94.55	27.2
28.	ADT 19	85.25	76	72.15	5.3	1.65	3.25	7.75	3.05	1.45	1.85	4	59	14.8
29.	CO 50	76.55	67.3	51.45	4.9	2	2.45	7.45	3.35	1.52	1.675	4	81	19.7
30.	CO 39	62.5	53.25	48	5.2	1.7	3.09	7.55	3.05	1.44	1.79	4	84	20.65
31.	ADT 46	71.95	62.7	53.85	5.8	1.85	3.24	8.35	3.15	1.425	1.7	6	98.5	29.45
32.	Kavya	75.55	66.3	52.2	5.75	1.65	3.49	7.85	2.9	1.365	1.76	3	91	23.5
33.	ADT 49	70.475	61.225	54.6	4.95	2.1	2.36	7.35	3.7	1.485	1.76	5	94.55	28.4
34.	JGL 3855	75.55	66.3	61.9	5	1.5	3.30	7.3	2.85	1.475	1.9	4	99.55	29.35
35.	CO 45	70.95	61.7	55.05	4.4	2.05	2.15	6.8	3.45	1.545	1.685	4	92	33.5
36.	Abhya	71.95	62.7	57.85	4.9	1.9	2.56	7.6	3.15	1.565	1.655	4	93.65	39.45
37.	CR 1009	74.85	65.6	59.8	5.5	1.65	3.31	7.5	2.85	1.395	1.73	6	83.5	21.45
38.	CO 49	68.65	59.4	51.5	5.6	1.8	3.14	7.85	3.15	1.4	1.75	6	89.6	31.55

Table 3: Continue...

Sl. No.	Variety	HR	MR	HRR	GL	GB	LB	GLAC	GBAC	LER	BER	ASV	GC	AC
39.	Swarna	75.35	66.1	59.5	4.8	1.8	2.67	6.95	3.05	1.45	1.695	2	55.5	18.4
40.	ADT 38	84.2	74.95	69.6	5.3	1.95	2.70	7.75	3.25	1.485	1.665	5	91.655	32.25
41.	JGL 3844	72.9	63.65	57.95	4.15	1.75	2.38	6.7	3.05	1.64	1.74	4	90.3	20.75
42.	JGL 1798	73.15	63.9	59.45	4.55	1.65	2.76	7.15	2.8	1.57	1.7	2	98.25	21.65
43.	CO 43	71.6	62.35	42.5	4.65	2.05	2.27	6.85	3.65	1.465	1.78	4	96.6	31.35
44.	IR 20	75.4	66.15	60.55	4.8	1.7	2.82	7.3	2.95	1.52	1.735	3	92.5	22.55
45.	ASD 14	75	65.75	56.1	5.4	1.9	2.84	7.65	3.25	1.42	1.71	6	98.25	31.55
46.	Jaya	77.55	68.3	61.9	5.4	1.85	2.92	7.95	3.05	1.46	1.65	4	89.5	21.5
47.	IR 72	75.95	66.7	61.9	5.65	2	2.83	8	3.5	1.42	1.75	6	91.8	27.4
48.	IR 28	88.85	79.6	73.3	5.85	2.15	2.73	7.85	3.85	1.34	1.795	3	99.425	28.35
49.	POKKALI	83.5	74.25	68.25	5.45	2.05	2.66	7.7	3.55	1.415	1.73	5	86.1	27.5
50.	IRRI 104	76.45	67.2	62.45	6.15	1.85	3.33	8.75	3.2	1.425	1.73	5	99.2	28.5
51.	TPS 3	82.1	72.85	69.5	6.8	2.1	3.35	7.15	2.75	1.04	2.49	5	56.35	33.15
52.	BRNS(WP) 5	84.2	74.95	70.6	4.85	2.2	2.31	5.35	2.35	1.1	2.04	4	88.3	24.9
53.	ASD 19	78.4	69.15	66.35	6.1	2.25	2.72	7.15	2.55	1.16	2.41	4	92.6	23.3
54.	BRNS (WP)22-2	82	72.75	69.75	4.95	2.35	2.11	5.65	2.75	1.14	1.795	2	88.5	24.65
55.	Krishna Hemavathi (K.H)	85.15	75.9	72.75	5.65	2.25	2.51	6.55	2.65	1.155	2.455	5	89.4	27.35
Max		88.9	79.6	73.3	8.85	2.4	5.715	14.7	4.75	1.67	2.49	6	99.55	39.45
Min		62.5	53.25	42.5	4.05	1.5	1.84	5.35	2.05	1.04	1.325	2	55.5	13.55
SEm±		0.7	0.70	0.43	0.03	0.04	0.07	0.07	0.04	0.02	0.06	0.22	0.58	0.23
SEd		0.99	0.99	0.61	0.05	0.05	0.10	0.10	0.06	0.02	0.09	0.32	0.82	0.32
C.V%		1.31	1.49	1.01	0.86	2.56	3.44	1.36	1.89	1.53	4.90	7.40	0.90	1.23
CD (p=0.05)		1.99	1.99	1.22	0.09	0.10	0.19	0.21	0.12	0.04	0.17	0.64	1.64	0.64
CD (p=0.01)		2.65	2.65	1.63	0.12	0.13	0.25	0.27	0.16	0.06	0.23	0.85	2.18	0.86

used in screening cooked rice for its hardness were determined by measuring gel length and furnished in Table 3. Among 55 rice varieties maximum gel length of 99.55 mm was noticed in JGL 3855 The lowest gel consistency was observed in Swarna (55.5 mm) The gel consistency was measured into soft (>60 mm), medium (40-60 mm) and hard (<40 mm) a total of 52 varieties are having soft gel consistency and ADT 19, TPS 3 and Swarna varieties having medium gel consistency. Amylose content is considered to be the single most important trait to predict rice cooking qualities and considered as major factor for eating quality reported by Juliano, 1993. It determines the hardness or stickiness of cooked rice, cohesiveness, tenderness, colour of cooked rice. Higher amylose content (>25.0%) gives non sticky soft or hard cooked rice. The amylose content varied from 39.45 (Abhya) to 13.55(ASD 17). Rice varieties with 20-25% amylose content give soft and flaky cooked rice. It is an indicator of volume expansion and water absorption during cooking. Intermediate amylose content (20-25%) is usually preferred by Indians. In this study, 35 varieties consist of high, 16 varieties consist of medium and 3 varieties consist of low amylose content the value for each character for each variety is given in Table 3. The gel consistency recorded highly significant positive association with amylose content and amylose content had showed positive significant correlation with alkali spreading value and gel consistency (Figure.1)., which is similar to the research findings of Vanaja and Babu, (2006), Krishnaveni and Shobarani (2006).

Table 4: Alkali digestion value and gelatinization temperature for milled grain of rice varieties

Feature	Alkali digestion value		Gelatinization value		Varieties
	Interference	Scale	Interference	GT	
1. Not affected but chalky	Low	1	High	75-79	-
2.Kernel swollen	Low	2	High	75-79	Swarna, JGL 1798,BRNS (WP)22-2 and TN 1
Kernel swollen, collar incomplete or narrow	Low to intermediate	3	High to Intermediate	70-74	ADT 47, ADT 36, Kavya, IR 20, IR 28, ADT 48 and ASD 1
Kernel swollen, collar complete or wide	Intermediate	4	Intermediate	70-74	ADT 42, CO 33, ASD 16, IR 64, ASD 17, Anjali, ADT 41, ADT 19, CO 50, CO 39, JGL 3855, CO 45, Abhya, JGL 3844, CO 43, Jaya, BRNS(WP) 5, ASD 19,ADT 43, ASD 2, TPS 4, ASD 9, Annada, ASD 18, IR 50 and BPT 5204
Kernel split or segmented collar complete and wide	Intermediate	5	Intermediate	70-74	ADT 45, ADT 37, MDU 5, ASD 7, ADT 39, ADT 49, ADT 38, POKKALI, IRRI 104, TPS 3 and Krishna Hemavathi (K.H)
Kernel dispersed, merged with collar	High	6	Low	65-69	Pusa basmathi, ASD 20, ADT 46, CR 1009, CO 49, ASD 14 and IR 72
Kernel completely dispersed	High	7	Low	65-69	-

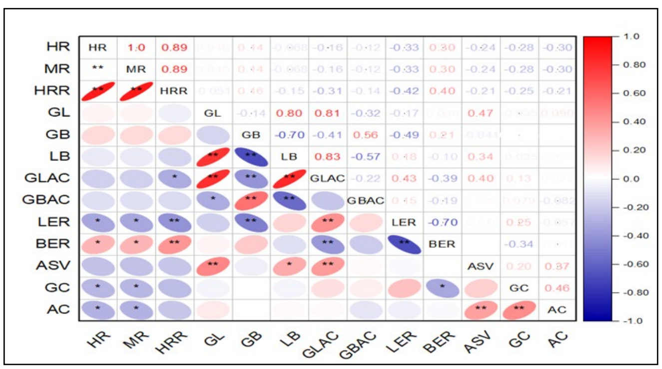

Figure 1: Pearson Correlation coefficients between various physicochemical and cooking properties of 55 rice varieties; GL: Grain length; GB: Grain breadth; HL: Hulling recovery; MR: Milling recovery; HRR: Head rice recovery; L/B: Length/ width ratio; GLAC: grain length after Cooking; GBAC: grain breadth after cooking; LER : Linear elongation ratio; BER: Breadth wise expansion rtio; AC: Amylose content; GC: Gel consistency; ASV: Alkali Spreading Value

4. CONCLUSION

Classification of 55 varieties showed considerable variation based on physical and chemical properties. Hulling %, milling %, head rice recovery high for IR 28, Pusa Basmati for grain length, L/B ratio, grain length after cooking and linear elongation ratio. Pearson's correlation showed positively significant correlations of hulling %, milling % and grain length with 3 traits, Grain breadth with 4 traits, ASV & GC with amylose content and amylose with alkali spreading value and gel consistency.

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