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Assessment of Grain Quality Characteristics in Selected Rice Varieties of PJTSAU

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ABSTRACT: Rice is grown in almost all parts of the state in all seasons and all kinds of soils, and is rightly called as "Annapurna State bowl of India and granary of South India''. In the present study five rice varieties *viz.* RNR15048, RDR1200, WGL44, JGL24423 and RNR 29325 of PJTSAU were selected and assessed the Grain Quality Characteristics. The findings of milling quality characteristics (Hulling%, Milling%, HRY%, and BRR%) were found to be no significant difference among all the selected rice varieties. While, the physical quality characteristics found a significant difference (P<0.01) in length, breadth, L/B ratio, 1000 kernel weight, and volume, whereas no significant difference was observed in bulk density among all rice varieties. Further, the chemical and nutritional characteristics showed a significant difference (p<0.01) in moisture, protein, fat, crude fibre, and amylose content, whereas the ash content of rice samples showed a significant difference (p<0.05) among them. From the study it can know that the selected rice varieties of PJTSAU had good grain quality which plays a pivotal role in uttering market price and adapting new rice varieties.

Keywords: Milling quality, physical quality, Chemical and Nutritional quality, Rice Grain quality.

INTRODUCTION

Rice is a cereal grain that supplies approximately 23% of the world's human calories Kahlon and Smith (2004). In India rice is an important source of food and income for the farming community and it is a great source of complex carbohydrates, which is an important source of fuel for our body's requirements. Grain quality is a general concept that covers many characteristics, ranging from Milling to biochemical properties.

The value of each trait, for example, the length of the grain, varies according to local cuisine and culture. Milling properties like the yield of edible and marketable polished grain, degree of milling, and marketable polished grains are important characteristics in consumer preferences. Sundaram *et al.* (2007) explained the grain quality attributes of rice include its external appearance (size, shape, colour, chalkiness, and lack of defect or decay) and internal nutritional quality (Moisture, Protein, carbohydrates, and lipid content). Grains' shape, uniformity, and translucence are crucial aspects of grain quality for consumers, millers, wholesalers, and retailers.

The main challenge for the rice industry is to maintain the quality of rice. Predictable expression of these traits across seasons and years gives the variety its reputation. The main objective of this study was to measure the Grain quality characteristics of selected rice varieties of PJTSAU in terms of milling, physical, chemical, and nutritional properties.

MATERIALS AND METHODS

The selected rice varieties were procured from the Agricultural research station (ARI) Rajendranagar, Hyderabad. All the rice varieties used in this study are belonging to the same season *i.e., Kharif.* The paddy samples collected were stored in jute bags and kept at room temperature till further analysis.

Milling quality characteristics of paddy such as Hulling%, Head rice recovery %, broken rice recovery %, and Milling % were analyzed as per the standard procedures of Sahay and Singh (2005).

Calculations

$$\text{Hulling \%} = \frac{\text{Weight of dehusked kernel (g)}}{\text{Weight of paddy (g)}} \times 100$$

$$\text{Milling \%} = \frac{\text{Weight of polished kernel (g)}}{\text{Weight of paddy (g)}} \times 100$$

$$HRR\ \% = \frac{\text{Weight of whole polished grains (g)}}{\text{Weight of paddy (g)}} \times 100$$

$$BRR\ \% = \frac{\text{Weight of polished broken grains (g)}}{\text{Weight of paddy (g)}} \times 100$$

Physical quality characteristics such as Length, breadth, L/B ratio, 1000 kernel weight, Volume, and bulk density of rice were analyzed by using standard methods Sahay and Singh (2005).

The chemical and nutritional properties of rice will be analyzed by standard procedures *viz.,* Moisture (AOAC 2005), Ash (AOAC 2005), Crude fiber (AOAC 1995), Fat (AOAC 1997), Protein (AOAC 2005), CHO (Gopalan *et al.,* 2007), and Energy (Gopalan *et al.,* 2007).

All the results were statistically analyzed to test the significance of the outcomes using percentages, means, standard deviations, and the analysis of variance (ANOVA) technique Snedecor and Cochran (1983).

RESULTS AND DISCUSSION

A. Milling quality

Milling quality characteristics such as Hulling %, Milling %, Head Rice Recovery (HRR)%, and Broken rice recovery (BRR)% of selected rice varieties were depicted in (Table 1 and Fig 1). Hulling percentage indicates the amount of brown rice yield after removing the husk. Among selected rice varieties the lowest hulling percentage was observed in the WGL 44 (78.41±0.58) and the highest in the RNR 15048 (82.26±1.64) rice varieties. while the milling percentage was found minimum in the RNR 29325 (70.49±1.66) rice variety and maximum in the RNR 15048 (74.58±0.91) rice variety followed by RDR1200 (73.44±2.20) rice variety. However, the HRR was found lowest inthe RNR29325 (63.75±0.41) rice variety and highest in the RNR 15048 (73.23±4.40) rice variety. Further, the lowest broken rice per cent was recorded in the WGL 44 (30.17±0.59) rice variety and the highest was recorded in the JGL 24423 (37.40±3.77) rice variety. Statistically, no significant difference was found in hulling percentage, head rice yield, broken rice, and milling percentage among all selected rice varieties.

Similar observations were reported by Pandey and Gupta (2000), brown rice yield varied from 75.1% to 79.60 % whereas, the milling yield ranged from 67.01 % to 75.45 % at a constant time of polishing among eighteen varieties of paddy grown in India. Ravindra *et al.* (2009) also reported the head rice yield of brown rice ranges from 67.0 to 73.0 % and from 48.7 to 67.9 % after polishing. Hulling per cent ranged from 76.52% to 71.44% and the milling per cent ranged between 66.21-58.28 observed in pigmented rice varieties (Ponnappan *et al.,* 2017).

Table 1: Milling quality characteristics of selected rice varieties of PJTSAU.

Sample name	Hulling %	Head rice recovery %	Broken rice recovery %	Milling %
RNR15048	82.26±1.64	73.23±4.40	32.70±2.04	74.58±0.91
RNR29325	78.74±1.09	63.75±0.41	36.48±4.58	70.49±1.66
RDR 1200	79.57±3.17	71.24±7.40	33.64±3.12	73.44±2.20
JGL 24423	79.11±2.26	66.92±1.32	37.40±3.77	70.62±2.59
WGL 44	78.41±0.58	64.51±0.38	30.17±0.59	72.28±0.39
C.V.%	3.494	8.126	13.058	3.417
Mean	79.68±0.79	67.93± 1.79	34.076± 1.36	72.28±0.78
C.D	7.1513	14.189	11.438	6.349
F value	0.61	1.14	0.86	1.04
P-value	0.67 ^{NS}	0.43 ^{NS}	0.54 ^{NS}	0.47 ^{NS}

Note: Values are expressed as mean ± standard deviations, NS-no significant

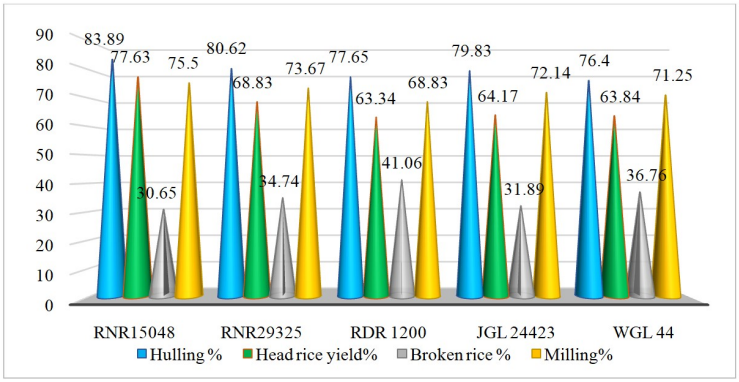

Fig. 1. Mean values of Milling quality characteristics of selected rice varieties of PJTSAU.

B. Physical quality

Physical quality characteristics such as kernel length, breadth and L/B ratio, 1000 kernel weight, volume, and bulk density of all selected rice varieties were analyzed and expressed in (Table 2 and Fig. 2). Grain size, shape, and L/B ratio are important characteristics that determine consumer preference and the commercial success of any paddy variety Krishnaveni and Shobha (2008). The length and breadth of the rice kernels were measured using Dial Micrometer by placing the kernels horizontally and vertically.

The highest grain length was observed in the RNR 29325 (6.92±0.31mm) rice variety and the lowest was recorded by the WGL 44 (5.04±0.08 mm) rice variety,

and the statistical analysis showed a significant difference ($p<0.01$) between them. The higher grain breadth was recorded in the RNR 29325 (3.01±0.03) rice variety, and the lower grain breadth was recorded by the RNR 15048 (1.39±0.06) rice variety and the statistical analysis revealed a significant difference ($p<0.01$) among all the selected rice varieties. While, the L/B ratio was found to be highest in the RNR 15048 (3.32±0.28) rice variety, followed by the WGL 44 (3.08±0.07) and RNR 29325 (3.07±0.07) rice varieties, and the lowest was recorded by the RDR 1200 (1.77±.21) rice variety. Statistically, significant difference was found ($p<0.01$) among all the selected rice varieties. Based on the L/B ratio classification, the selected rice varieties were categorized into three different classes such as long slender (LS) - RNR 29325; long bold (LB) - JGL 24423; short slender (SS)- RNR 15048, RDR 1200, and WGL 44.

Table 2: Physical quality characteristics of selected rice varieties of PJTSAU.

Sample name	Length (mm)	Breadth (mm)	L/B ratio	1000 kernel weight	volume (ml)	Bulk density	Grain type
RNR15048	5.16±0.12	1.39±0.06	3.32±0.28	9.00±0.02	10.25±0.25	0.87±0.20	Short slender
RNR29325	6.52±0.4	3.01±0.03	3.07±0.07	20.09±0.05	23.83±0.16	0.84±0.01	Long slender
RDR1200	5.23±0.08	1.75±0.15	1.77±.21	12.00±0.40	13.67±0.17	0.88±0.005	Short slender
JGL24423	6.30±0.23	2.57±0.28	2.57±0.28	21.35±0.21	25.02±0.02	0.85±0.10	Long bold
WGL 44	5.14±0.10	1.53±0.06	3.08±0.07	12.25±0.18	14.45±0.4	0.84±0.35	Short slender
C.D	0.80	0.51	0.75	0.464	0.85	0.069	
F -Value	9.46	24.64	8.96	1821.92	775.92	0.97	
P- value	0.0149 *	0.0017 **	0.0168 *	0.000**	0.000 **	0.4993^{NS}	

Note: Values are expressed as mean ± standard deviations, *Significant ($p<0.05$); **Significant ($p<0.01$); NS- No significant

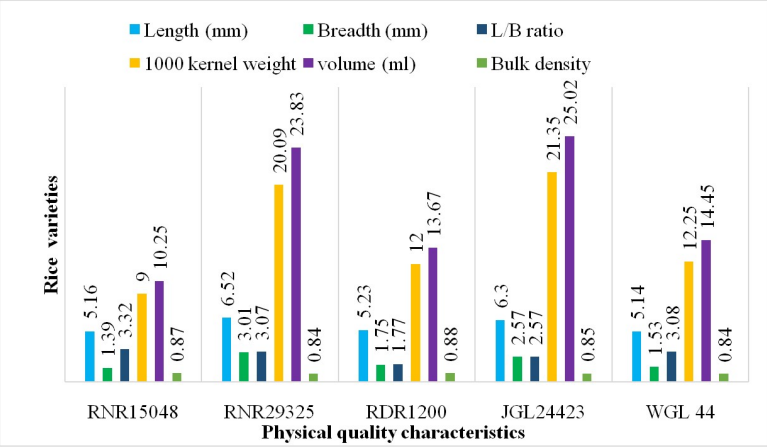

Fig. 2. Physical quality characteristics of selected rice varieties of PJTSAU

The weight of 1000 kernels ranged between 9.00±0.02g (RNR 15048) to 21.35±0.21 g (JGL 24423). While, the volume of 1000 kernels ranged between 10.25±0.25ml (RNR 15048) to 25.02±0.02 ml (JGL 24423) and the density of rice varieties ranged from 0.84±0.01 g/ml (RNR 29325) to 0.88±0.005 g/ml (RDR 1200) and Statistical analysis showed a significant difference ($P<0.01$) among all selected rice varieties. However, no significant difference was observed in bulk density.

C. Chemical and Nutritional quality

Chemical and nutritional quality characteristics such as moisture, fat, protein, crude fibre, and ash, CHO and Energy were analyzed in triplicates, and the data were presented in (Table 3 and Fig. 3).

Generally, moisture content plays an important role in storage as well as shelling and milling. The moisture content of the selected rice varieties ranged from 10.44±0.16 (RNR 29325) to 12.48±0.11 (RDR 1200). The results showed a significant difference in moisture content of all the selected rice varieties ($p<0.01$). Moisture levels commonly accepted for safe storage of rice are 13% for storage duration of fewer than 6 months and 12% for long-term storage Rosniyana *et al.* (2004). Therefore, the moisture content of all selected varieties was within the acceptable range indicating that the grains will have good keeping quality/shelf life.

The results of protein estimation of selected rice varieties ranged from 15.89±0.14 (RDR 1200) to 9.37±0.07 (RNR 15048). A statistically significant difference ($p<0.01$) was found among all the selected rice varieties.

The fat percentage among all selected rice varieties highest was found in the WGL44 rice variety (3.19±0.20) and the lowest was found in the RNR 15048 (1.37±0.10) rice variety and observed statistical difference ($p<0.01$) among them. The higher the fat content in food grains generally results in the desirable palatability of cooked form. Okaka (2005) stated that higher fat content exposes the grains to spoilage during storage due to oxidation.

Table 3: Chemical and Nutritional quality characteristics of selected rice varieties of PJTSAU.

Sample Name	Moisture%	Protein%	Fat%	Crude fibre%	Ash%	CHO %	Energy (Kcal)
RNR15048	10.90±0.09	9.37±0.07	1.37±0.10	0.49±0.0022	0.78±0.01	64.79±0.14	308.97±0.05
RNR29325	10.44±0.16	13.99±0.12	1.61±0.05	0.39±0.0006	0.96±0.05	72.61±0.08	360.89±0.12
RDR1200	12.48±0.11	15.89±0.146	2.92±0.15	0.39±0.0007	1.21±0.19	67.11±0.13	358.28±0.07
JGL24423	11.46±0.17	10.66±0.075	1.94±0.53	0.29±0.0003	0.87±0.03	74.78±0.01	359.22±0.14
WGL 44	11.30±0.17	10.68±0.072	3.19±0.20	0.29±0.0012	1.22±0.10	73.32±0.16	364.71±0.09
C.V.	2.26 %	1.48 %	21.00 %	0.55%	17.51 %	27.78 %	1.042
F value	26.38	68.30	9.07	4885.62	3.88	75.44±0.42	357.24
P- Value	0.00**	0.00**	0.00 **	0.00**	0.05 *	0.00**	0.00**

Values are expressed as mean ± standard deviations, *Significant (p<0.05); **Significant (p<0.01)

The amount of ash present in a food sample plays an important role in determining essential minerals' levels (Bhat and Sridhar 2008). The ash content of all the selected rice varieties ranged from 1.22±0.10 per cent (WGL 44) to 0.78±0.01 per cent (RNR15048) and was found statistically significant difference (p<0.05).These values are within the range 0.18±0.028 to 0.97±0.028 percentage reported by Shayno *et al.* (2011).

Among all the selected rice varieties highest crude fibre content was identified in RNR 15048 (0.49±0.0022) rice variety followed by the RDR1200 (0.39±0.0007), RNR 29325 (0.39±0.0006) rice varieties and the lowest content was found in JGL 24423 (0.29±0.0003) rice variety. Among all the selected rice varieties, a highly significant difference was found (p<0.01).The fiber content affects the rice digestibility (WHO, 1985) where by high fiber content in rice lowers its digestibility. In this case, the RNR 15048 rice variety with high fiber content had lower digestibility while the JGL 24423 rice variety with least fiber content would be higher digestible.

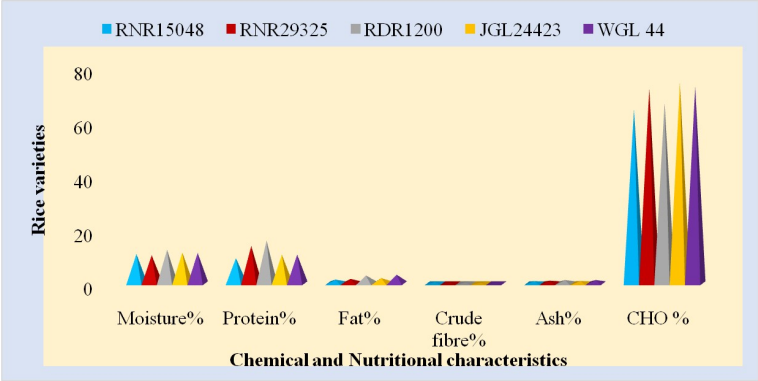

Fig. 3. Chemical and nutritional quality characteristics of selected rice varieties of PJTSAU.

Among all the selected rice varieties the highest CHO content was observed in JGL 24423(74.78±0.01) followed by RDR 1200 (73.32±0.16) and the least CHO content was found in RNR 15048 (64.79±0.14) and statistically a highly significant difference (p<0.01) was observed among all of them. The mean energy values of all selected rice varieties ranged from 364.71±0.09 (WGL 44) to 308.97±0.05 (RNR 15048) and a statistically highly significant difference (p<0.01) was noticed among them. The results reported are in agreement with those reported earlier by OKo and Ugwu (2011). The high percentage of carbohydrate contents in the rice varieties make it a good source of energy.

CONCLUSION

The present study concluded that the selected rice varieties were not shown a significant difference in all the milling quality characteristics such as percentage of hulling, head rice, broken rice and milling recovery. While in terms of kernel length highest was found in the RNR29325 variety and lowest in WGL 44 variety and highest breadth in the JGL24423 variety and the lowest in the 15048 variety and the L/B ratio was highest in the RNR15048 variety and the lowest was found in RDR1200 variety. Further, chemical and nutritional quality showed a significant difference (p<0.01) between all selected rice varieties of PJTSAU. Then all the varieties are having preferable grain quality characteristics. Hence, the selected PJTSAU rice varieties can be popularised among the farmers.

FUTURE SCOPE

Further research can be done on effect on the degree of milling on the availability of nutrients in different rice varieties which will help the farmers and consumers to select the ideal degree of milling. Improved pre- and post-harvest technologies such as optimization of moisture,and development of value-added products of commercial importance to prevent the quantitative and qualitative losses in rice can be developed.

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Conflict of Interest. None.

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