

Comparison of milling and sensory qualities of several rice in Banjarbaru

[Perbandingan mutu giling dan mutu sensori beberapa beras di Banjarbaru]

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ABSTRACT

Rice type strongly influences the characteristics of rice grain and cooked rice because different rice types possess distinct chemical compositions, physical and physicochemical properties, cooking quality, and sensory attributes. This study aimed to compare the milling and sensory quality of several rice types available in Banjarbaru and to identify the rice types with the most favorable characteristics and consumer acceptance. Six rice types were evaluated, comprising three local rice varieties (Mutiara, Jambun, and Mayang), one nationally improved variety (Ciherang), and two packaged rice products (Cianjur and Lopo Ijo). Milling quality was evaluated based on head rice, broken rice, and groat percentages, while sensory quality was assessed based on taste, aroma, texture, and appearance. Based on the results, the packaged rice samples, particularly Lopo Ijo and Cianjur, showed the most favorable milling characteristics, with head rice percentages of 85.02% and 76.68%, respectively, and broken rice contents below 15%. However, neither sample fully complied with Indonesian National Standard (SNI) requirements because of their relatively high groat contents. In contrast, the local rice varieties and Ciherang failed to meet several SNI criteria, particularly for head rice and broken rice contents. The superior milling characteristics of the packaged rice were generally consistent with their more favorable sensory acceptance, particularly for taste (3.48–3.88), aroma (3.64–4.12), and texture (3.48–3.60), compared with the local rice samples (2.76–3.12). Overall, these findings indicate that better milling characteristics were associated with more favorable sensory quality and consumer acceptance, highlighting the important roles of raw material characteristics and postharvest handling, although the relationship between individual milling parameters and sensory responses requires further statistical investigation.

Keywords: rice quality, local rice, superior rice, packaged rice

ABSTRAK

Jenis beras sangat memengaruhi karakteristik beras dan nasi karena jenis beras yang berbeda memiliki komposisi kimia, sifat fisik dan fisikokimia, mutu tanak, serta atribut sensoris yang khas. Penelitian ini bertujuan untuk membandingkan mutu giling dan mutu sensoris dari beberapa jenis beras yang beredar di Banjarbaru serta mengidentifikasi jenis beras dengan karakteristik dan penerimaan konsumen yang paling baik. Enam jenis beras dievaluasi, yang terdiri dari tiga varietas lokal (Mutiara, Jambun, dan Mayang), satu varietas unggul nasional (Ciherang), dan dua produk beras kemasan (Cianjur dan Lopo Ijo). Mutu giling dievaluasi berdasarkan persentase beras kepala, beras patah, dan menir, sedangkan mutu sensoris dinilai berdasarkan rasa, aroma, tekstur, dan kenampakan. Berdasarkan hasil penelitian, sampel beras kemasan, khususnya Lopo Ijo dan Cianjur, menunjukkan karakteristik mutu giling paling baik, dengan persentase beras kepala masing-masing sebesar 85,02% dan 76,68%, serta kadar beras patah di bawah 15%. Namun, kedua sampel tersebut tidak sepenuhnya memenuhi persyaratan Standar Nasional Indonesia (SNI) karena kadar menir yang relatif tinggi. Sebaliknya, varietas beras lokal dan Ciherang gagal memenuhi beberapa kriteria SNI, terutama terkait kadar beras kepala dan beras patah. Karakteristik mutu giling yang unggul pada beras kemasan secara umum sejalan dengan penerimaan sensoris yang lebih baik, khususnya untuk rasa (3,48–3,88), aroma (3,64–4,12), dan tekstur (3,48–3,60), dibandingkan dengan sampel beras lokal (2,76–3,12). Secara keseluruhan, temuan ini menunjukkan bahwa mutu giling yang lebih baik berkaitan dengan mutu sensoris dan penerimaan konsumen yang lebih tinggi, serta menegaskan pentingnya peran karakteristik bahan baku dan penanganan pascapanen, meskipun hubungan antara masing-masing parameter giling dan respons sensoris masih memerlukan investigasi statistik lebih lanjut.

Kata kunci: mutu beras, beras lokal, beras unggul, beras kemasan

Introduction

Rice is one of the major cereal crops and a staple food for more than half of the world's population, particularly in Asia, including Indonesia. Rice is a major source of dietary carbohydrates, containing nearly 90% starch, and plays an important role in meeting energy and nutritional requirements (Millati et al., 2025). Rice belongs to the cereal group and is generally consumed as a whole grain after cooking with water to produce cooked rice. Therefore, the physical properties and appearance of rice, as well as the sensory characteristics of cooked rice, play important roles in determining its quality and consumer acceptance. Rice quality is determined by various aspects, ranging from nutritional, physical, and physicochemical quality to sensory quality, which is associated with the characteristics of the cooked rice consumed (Babu et al., 2023). Suhada and Afgani (2024) stated that rice quality is influenced by three major components: physical, cooking, and eating quality. Physical and cooking quality are generally assessed objectively using instrumental methods, whereas eating quality can be evaluated both objectively and subjectively through panelist assessment.

In Indonesia, rice quality is regulated by the Indonesian National Standard (SNI) 6128:2020, which classifies rice into several grades based on physical parameters, including head rice percentage, degree of milling, broken rice percentage, groat content, chalky grain content, and foreign matter content (BSN, 2020). This quality standard serves as an important reference in rice trading because it is directly associated with market value. Rice with high milling quality generally yields a high proportion of head rice and an optimal degree of milling, thereby improving its physical quality and market value. According to Babu et al. (2023), the percentages of head rice, broken rice, and groats are important parameters for determining rice quality. Rice containing a high proportion of broken grains is generally considered to be of lower quality and consequently has a lower market price. Rice milling quality is largely determined by the proportions of head rice, broken rice, and groats; a higher proportion of head rice accompanied by lower proportions of broken rice and groats indicates higher milling quality (Millati et al., 2017). Other general characteristics that strongly influence the quality of rice available in the market include cleanliness, damaged grains, groats, grain color, and head rice content, while differences in rice quality contribute to differences in the market prices of various rice types (Sulistyo & Ardiansyah, 2021).

Sensory quality is also a critical factor determining consumer acceptance. One of the considerations influencing consumers when selecting rice is its sensory characteristics. The appearance of rice, as well as the taste and textural properties of cooked rice, particularly its degree of softness and cohesiveness, are among the main factors influencing consumer choice (Barokah & Daenuri, 2022). Sensory quality is associated with the organoleptic characteristics of cooked rice, including color, aroma, taste, texture, and appearance after cooking. According to Guadamuz-Manyorga et al. (2022), consumers tend to consider sensory characteristics, particularly taste and hedonic attributes, more strongly than nutritional benefits when purchasing rice. Consumer preferences for cooked rice vary and are strongly influenced by the amylose and amylopectin contents of rice. Rice with a high amylose content tends to produce less cohesive and firmer cooked rice, whereas rice with low to moderate amylose content generally produces softer and stickier cooked rice (Li et al., 2024; Yi et al., 2024). Other factors, such as protein and lipid contents and cooking conditions, also influence the sensory quality of cooked rice (Chen et al., 2021). According to Myint et al. (2021), consumer preferences for rice of different quality grades are influenced by various factors, including the physical appearance of rice, the texture and cohesiveness of cooked rice, cultural background, and consumers' socioeconomic status.

Previous studies have evaluated rice quality based on the Indonesian National Standard (SNI) and sensory characteristics of various rice varieties. However, most have focused separately on milling or sensory quality and on specific rice groups (Suryana et al., 2022; Indrasari et al., 2024). Meanwhile, the Indonesian rice market comprises local rice varieties traditionally cultivated within specific

agroecosystems, improved varieties developed for higher productivity and uniformity, and packaged rice with more consistent physical quality achieved through modern sorting, milling, and packaging processes (Fahroji et al., 2025). These differences may result in variations in both milling and sensory quality, raising the question of whether superior physical quality is necessarily associated with greater consumer preference. Myint et al. (2021) reported that grain shape, aroma, and packaging are important characteristics considered by consumers when selecting rice. Therefore, this study aimed to compare the milling and sensory quality of local rice, improved rice varieties, and packaged rice. The findings are expected to provide information on the relationship between milling quality and sensory acceptance across different rice groups available in the market.

Materials and methods

Materials and equipment

The materials used in this study consisted of six types of rice: three local rice varieties (Mutiarra, Jambun, and Mayang, local Banjar rice), one nationally improved rice variety (Ciherang), and two packaged rice products (Cianjur and Lopo Ijo). The rice samples were obtained from several rice vendors in Banjarbaru. The equipment used included stationery, plastic bags, plates, a steamer, a thermometer, an analytical balance, and questionnaires for sensory evaluation.

Research methods

The study employed a Completely Randomized Design (CRD) with a single factor (six rice varieties: Mutiarra, Jambun, Mayang, Ciherang, Cianjur, Lopo Ijo) and three replications. The observations included rice milling quality and the sensory quality of cooked rice. Milling quality parameters included head rice, broken rice, groats, red kernels, damaged kernels, chalky kernels, foreign matter, and paddy grains. Sensory quality was evaluated using scoring and hedonic (preference) tests, with color, taste, aroma, texture, and appearance as the assessed attributes. Both sensory tests involved 25 untrained panelists. Sensory data were analyzed using the Kruskal-Wallis test, and when a significant effect was found, the analysis was followed by Dunn's post hoc test at the 5% significance level.

Research procedures

(1) Milling quality assessment

The study began with the assessment of rice milling quality. Milling quality was determined according to the specific requirements of the Indonesian National Standard (SNI) 6128:2020 (BSN, 2020), as presented in Table 1. For the analysis, a 100-g rice sample was weighed and manually separated into the respective quality components, including head rice, broken rice, groats, red kernels, chalky kernels, damaged kernels, foreign matter, and paddy grains. Each component was then weighed, and its percentage was calculated. The milling quality grade was subsequently determined according to SNI 6128:2020.

Table 1. Milling quality standards for rice according to SNI 6128:2020 (BSN, 2020)

Quality component	Unit	Premium	Medium 1	Medium 2
Head rice (minimum)	%	85.00	80.00	75.00
Broken rice (maximum)	%	14.50	18.00	22.00
Groats (maximum)	%	0.50	2.00	3.00
Red ^a /white ^b /black ^c kernels (maximum)	%	0.50	2.00	3.00
Damaged kernels (maximum)	%	0.50	2.00	3.00
Chalky kernels (maximum)	%	0.50	2.00	3.00
Foreign matter (maximum)	%	0.01	0.02	0.03
Paddy grains (maximum)	grains/100 g	1.00	2.00	3.00

^a For white rice or glutinous rice (black and white glutinous rice).

^b For red rice and black rice.

^c For red rice.

2) Sensory quality assessment

After the milling quality assessment, sensory analysis of the cooked rice was conducted. All six rice samples were cooked simultaneously by steaming for 30 min in boiling water at a rice-to-water ratio of 1:1.5. Sensory quality was evaluated using scoring and hedonic tests, both on a five-point scale, covering color, taste, aroma, texture, and appearance, with 25 untrained panelists.

For the scoring test, the evaluation criteria were as follows:

- Color : 1 = yellow, 2 = yellowish-white, 3 = slightly white, 4 = white, 5 = very white
- Taste : 1 = very bland, 2 = bland, 3 = slightly sweet, 4 = sweet, 5 = very sweet
- Aroma : 1 = very musty, 2 = slightly musty, 3 = normal, 4 = fragrant, 5 = very fragrant
- Texture : 1 = very firm and non-cohesive, 2 = firm and non-cohesive, 3 = slightly soft and cohesive, 4 = soft and cohesive, 5 = very soft and cohesive (mushy)
- Appearance : 1 = very unattractive, 2 = unattractive, 3 = neutral, 4 = attractive, 5 = very attractive

For the hedonic test, the five-point scale was defined as follows: 1 = strongly dislike, 2 = dislike, 3 = slightly like, 4 = like, and 5 = strongly like

Research parameters

The quality of milled rice is determined in accordance with SNI 6128:2020. Sensory data were analyzed using the Kruskal-Wallis test, and when a significant effect was found, the analysis was followed by Dunn's post hoc test at the 5% significance level.

Results and discussion

Milling quality

Milling quality is one of the main indicators of rice quality and is determined by the proportions of head rice, broken rice, and groats, as well as the presence of chalky kernels, damaged kernels, foreign matter, and paddy grains. Previous studies have shown that rice milling quality is strongly influenced by variety, particularly in terms of head rice, broken rice, and groat percentages (Millati et al., 2021). The milling quality of the rice samples based on SNI 6128:2020 is presented in Table 2.

Table 2. Milling quality of different rice varieties based on SNI 6128:2020

Quality parameter	Mutiara	Jambun	Mayang	Ciherang	Cianjur	Lopo ljo
Moisture content (%)	11.19 ± 0.26	12.18 ± 0.28	12.51 ± 0.48	12.07 ± 0.23	11.79 ± 0.62	11.46 ± 0.09
Head rice (%)	71.22 ± 6.84	64.49 ± 0.86	65.23 ± 2.16	43.94 ± 2.68	76.68 ± 8.84	85.02 ± 4.75
Broken rice (%)	12.57 ± 1.76	25.20 ± 0.29	28.48 ± 3.21	34.23 ± 2.05	11.61 ± 2.12	6.50 ± 1.28
Groats (%)	15.95 ± 8.36	9.78 ± 0.33	5.45 ± 1.45	13.87 ± 5.66	9.86 ± 4.87	8.18 ± 2.56
Red kernels (%)	0.00	0.00	0.00	0.00	0.00	0.00
Chalky kernels (%)	0.28 ± 0.20	0.26 ± 0.06	0.32 ± 0.12	4.74 ± 1.85	1.23 ± 0.97	1.53 ± 0.69
Damaged kernels (%)	0.25 ± 0.11	0.63 ± 0.08	0.84 ± 0.15	3.53 ± 0.45	0.92 ± 0.32	0.44 ± 0.07
Foreign matter (%)	0.00	0.00	0.01 ± 0.00	0.02 ± 0.009	0.00	0.00
Paddy grains (grains/100 g)	0.00	0.00	0.00	0.03 ± 0.01	0.00	0.00
Quality grade	< SNI	< SNI	< SNI	< SNI	Medium 2	Premium

Values are presented as mean ± standard deviation.

Moisture content

The moisture content of the rice samples ranged from 11.19% to 12.51%, with no significant differences among rice types. According to SNI 6128:2020, all rice samples met the moisture content requirement for the Premium category, which specifies a maximum moisture content of 14%. Rice moisture content is strongly influenced by the moisture content of milled dry paddy (GKG) (Wibowo & Purwanto, 2022). The moisture content of GKG plays an important role in determining milling yield and quality, with optimal milling performance generally achieved at approximately 14% moisture (Wijaya et al., 2024; Alamsyah et al., 2025). During storage, moisture content is also an important determinant of rice quality because levels above 14% may increase the risk of deterioration, including yellowing, reduced water uptake, and increased proportions of broken rice and groats (Putri et al., 2023). High moisture content may also promote undesirable color and odor changes, thereby reducing storage stability (Yuriyah et al., 2024). Moisture content is therefore a critical factor governing food deterioration through microbiological activity and chemical and enzymatic reactions (Talib et al., 2024).

Head rice

The results showed that Lopo Ijo had the highest head rice percentage (85.02%), followed by Cianjur (76.68%). These values met the minimum head rice requirements for the Premium and Medium 2 categories, respectively, based on SNI 6128:2020. The local rice varieties Mutiara (71.22%), Mayang (65.23%), and Jambun (64.49%) had head rice percentages above 60% but below the minimum requirement of 75% for Medium 2. Ciherang exhibited the lowest head rice percentage (43.94%). According to BSN (2020), head rice refers to rice kernels with a length of ≥ 0.8 of a whole kernel, whereas a whole kernel has no broken portion. Head rice percentage is a key parameter of rice milling quality because it determines milling yield and economic value. Variation in head rice percentage is influenced by several factors, including variety, chalky kernels, cultivation practices, environmental conditions, and postharvest handling from harvesting, threshing, and drying to storage and milling (Millati et al., 2021).

Agronomic factors, including day and night temperatures during the vegetative and grain-filling stages, nitrogen fertilization during critical growth stages, harvest moisture content, grain storage conditions, and moisture content before milling, can also affect head rice percentage (Ali et al., 2023). The optimum moisture content of paddy for milling is approximately 14%; moisture levels that are either too high or too low may promote kernel cracking and consequently increase broken rice (Martina et al., 2024). In this study, the higher head rice percentages observed in the packaged rice samples may reflect more controlled postharvest handling and milling processes, including selection, cleaning, sorting, and standardized processing. These practices can reduce kernel breakage and increase the proportion of intact kernels, thereby improving the visual quality and market value of rice. However, based on the complete set of SNI 6128:2020 criteria, the overall quality classification of Lopo Ijo and Cianjur should also consider other parameters, particularly groat content.

Broken rice and groats

Broken rice refers to kernels with a length of >0.2 to <0.8 of a whole kernel. Lopo Ijo had the lowest broken rice percentage (6.50%), followed by Cianjur (11.61%) and Mutiara (12.57%), whereas Ciherang had the highest percentage (34.23%). Based on the broken rice criterion of SNI 6128:2020, the values for Lopo Ijo, Cianjur, and Mutiara were within the Premium limit ($\leq 14.50\%$), while Jambun, Mayang, and Ciherang exceeded the applicable limit. Groats are kernels with a length of <0.2 of a whole kernel. None of the rice samples met the maximum groat content specified in SNI 6128:2020 ($\leq 3\%$); all had groat percentages exceeding this limit. The relatively high proportions of broken rice and groats may be associated with low paddy moisture content ($<13\%$), varietal characteristics, harvest timing, suboptimal drying conditions, milling equipment, and prolonged milling or polishing (Lestari & Kurniawan, 2021; Martina et al., 2024).

These factors can increase kernel breakage during postharvest handling and milling, thereby reducing head rice yield

Red kernels, chalky kernels, damaged kernels, foreign matter, and paddy grains

Red kernels were not detected in any of the rice samples. The chalky kernel content ranged from 0.26% to 4.74%. Based on the corresponding SNI criteria, Mutiara, Jambun, and Mayang were within the Premium limit ($\leq 0.5\%$), whereas Lopo Ijo and Cianjur were within the Medium 1 limit ($\leq 2\%$), and Ciherang exceeded the Medium 2 limit ($> 3\%$). Damaged kernel content ranged from 0.25% to 3.53%, with Lopo Ijo and Mutiara within the Premium limit ($\leq 0.5\%$), Jambun, Mayang, and Cianjur within the Medium 1 limit ($\leq 2\%$), and Ciherang exceeding the Medium 2 limit ($> 3\%$).

All samples met the Premium limit for foreign matter and paddy grains, except Ciherang, which fell within the Medium 1 limit for foreign matter. Chalky kernels are whitish rice kernels with a relatively soft texture, generally formed when paddy is harvested before full maturity or when starch accumulation is disrupted by genetic factors, environmental conditions, or disease (Martina et al., 2024). Damaged kernels are kernels with white, yellow, or red discoloration or spots resulting from physical, chemical, or biological damage (BSN, 2020). High proportions of chalky and damaged kernels may result from non-uniform grain maturation, fermentation caused by delayed drying, and poor initial grain quality (Nakamura et al., 2022; Wang et al., 2022).

Overall, the results indicate an inverse relationship between head rice percentage and the proportions of broken rice and groats, consistent with Millati et al. (2021). Lopo Ijo showed the most favorable milling characteristics, with the highest head rice percentage and the lowest broken rice percentage, whereas Ciherang exhibited the poorest milling performance. However, none of the samples met the SNI requirement for groat content, indicating the need for improved postharvest handling and milling practices. Among the physical quality parameters, head rice percentage and degree of milling are particularly important determinants of rice market value and may influence rice color (Millati et al., 2021). The overall comparison of rice milling quality based on SNI 6128:2020 is presented in Table 3.

Table 3. Comparison of rice milling quality based on SNI 6128:2020

Rice sample	Head rice	Broken rice	Groats	Chalky kernels	Damaged kernels	Foreign matter	Paddy grains
Lopo ijo	P (85.02%)	P (6.50%)	NM (8.18%)	M1 (1.53%)	P (0.44%)	P (0.00%)	P (0.00)
Cianjur	M2 (76.68%)	P (11.61%)	NM (9.86%)	M1 (1.23%)	M1 (0.92%)	P (0.00%)	P (0.00)
Mutiara	NM (71.22%)	P (12.57%)	NM (15.95%)	P (0.28%)	P (0.25%)	P (0.00%)	P (0.00)
Mayang	NM (65.23%)	NM (28.48%)	NM (5.45%)	P (0.32%)	M1 (0.84%)	P (0.01%)	P (0.00)
Jambun	NM (64.49%)	NM (25.20%)	NM (9.78%)	P (0.26%)	M1 (0.63%)	P (0.00%)	P (0.00)
Ciherang	NM (43.94%)	NM (34.23%)	NM (13.87%)	NM (4.74%)	NM (3.53%)	M1 (0.02%)	P (0.03)

P = Premium; M1 = Medium 1; M2 = Medium 2; NM = Not meeting the SNI requirement.

Sensory quality based on scoring and hedonic tests

Sensory evaluation showed that rice type significantly affected both scoring and hedonic responses. Post hoc analysis revealed significant differences among rice samples for color, taste, aroma, texture, and appearance. These differences may be associated with variations in the physicochemical and chemical characteristics of the rice, including amylose and protein contents, as well as volatile compounds. The results of the post hoc analysis for the scoring and hedonic tests are presented in Tables 4 and 5.

In the scoring test, the local rice varieties (Mutiara, Jambun, and Mayang) and packaged rice (Cianjur and Lopo Ijo) produced comparable white-colored cooked rice, with scores ranging from 3.16 to 3.52. In contrast, Ciherang produced slightly white cooked rice, with the lowest color score (2.76). However, the hedonic test showed no significant difference in panelists' preference for rice color, with scores ranging from slightly liked to nearly liked (3.15–3.80). Color is the first sensory attribute directly perceived by

consumers and is an important determinant of food quality and consumer perception (Mahyudi et al., 2025; Muchtar et al., 2022). White color is also a characteristic attribute of cooked white rice (Guadamuz-Mayorga et al., 2022). Overall, the cooked rice samples exhibited relatively similar colors, ranging from white to slightly white. Although Ciherang received the lowest color score in the scoring test, its hedonic score was comparable to those of the other samples. The lower score for Ciherang may be associated with its relatively high chalky kernel content, which can reduce the visual appeal.

Table 4. Scoring test results for different rice types

Attribute	Mutiara	Jambun	Mayang	Ciherang	Cianjur	Lopo Ijo
Color	3.16 ± 0.69 ^{ab}	3.52 ± 0.82 ^b	3.52 ± 0.82 ^b	2.76 ± 0.83 ^a	3.32 ± 1.03 ^{ab}	3.44 ± 0.92 ^{ab}
Taste	2.08 ± 0.70 ^a	2.16 ± 0.80 ^a	2.16 ± 0.75 ^a	2.48 ± 0.92 ^{ab}	2.88 ± 1.01 ^b	2.00 ± 0.00 ^a
Aroma	3.08 ± 0.70 ^{ab}	2.76 ± 0.72 ^a	3.00 ± 0.82 ^{ab}	3.20 ± 0.82 ^{ab}	3.48 ± 0.87 ^{bc}	4.08 ± 0.95 ^c
Texture	2.00 ± 0.65 ^a	2.12 ± 0.88 ^a	2.08 ± 0.64 ^a	2.84 ± 0.75 ^{bc}	3.36 ± 0.91 ^c	3.60 ± 0.87 ^c
Appearance	3.40 ± 0.58 ^b	3.44 ± 0.65 ^b	3.60 ± 0.76 ^b	2.68 ± 0.75 ^a	3.48 ± 1.00 ^b	3.56 ± 0.77 ^b

Values are presented as mean ± standard deviation. Different superscript letters within the same row indicate significant differences ($p < 0.05$) based on Dunn's post hoc test following the Kruskal-Wallis test.

Scoring scale: Color : 1 = yellow; 2 = yellowish-white; 3 = slightly white; 4 = white; 5 = very white.

Taste : 1 = very bland; 2 = bland; 3 = slightly sweet; 4 = sweet; 5 = very sweet.

Aroma : 1 = very musty; 2 = slightly musty; 3 = normal; 4 = fragrant; 5 = very fragrant.

Texture : 1 = very firm and non-cohesive; 2 = firm and non-cohesive; 3 = slightly soft and cohesive; 4 = soft and cohesive; 5 = very soft and cohesive (mushy).

Appearance: 1 = very unattractive; 2 = unattractive; 3 = neutral; 4 = attractive; 5 = very attractive.

Table 5. Hedonic test results for different rice types

Attribute	Mutiara	Jambun	Mayang	Ciherang	Cianjur	Lopo Ijo
Color	3.20 ± 0.91 ^a	3.40 ± 0.87 ^a	3.60 ± 0.82 ^a	3.15 ± 0.85 ^a	3.80 ± 0.87 ^a	3.80 ± 0.96 ^a
Taste	2.84 ± 0.75 ^a	2.88 ± 0.78 ^a	3.12 ± 0.83 ^a	3.08 ± 0.91 ^a	3.48 ± 1.30 ^b	3.88 ± 0.78 ^b
Aroma	2.88 ± 0.73 ^a	3.00 ± 0.87 ^{ab}	2.84 ± 0.75 ^a	3.24 ± 0.78 ^{ab}	3.64 ± 0.86 ^{bc}	4.12 ± 1.05 ^c
Texture	2.76 ± 0.83 ^a	2.84 ± 0.90 ^a	2.76 ± 0.83 ^a	3.16 ± 0.85 ^{ab}	3.48 ± 1.05 ^{ab}	3.60 ± 0.87 ^b
Appearance	3.64 ± 0.57 ^b	3.60 ± 0.71 ^b	3.56 ± 0.77 ^b	2.68 ± 0.56 ^a	3.52 ± 0.71 ^b	3.92 ± 0.76 ^b

Values are presented as mean ± standard deviation. Different superscript letters within the same row indicate significant differences ($p < 0.05$) based on Dunn's post hoc test following the Kruskal-Wallis test.

Hedonic scale: 1 = strongly dislike; 2 = dislike; 3 = slightly like; 4 = like; 5 = strongly like.

The color of cooked rice is influenced by the color of the raw rice, degree of milling, storage conditions, and starch composition. Higher milling degrees generally produce whiter rice by removing more of the aleurone layer (Millati et al., 2021). Color changes may also result from lipid oxidation, Maillard reactions, and pigment migration from the bran and husk layers into the endosperm (Millati et al., 2021). In the present study, the scoring test showed that cooked rice ranged from slightly white to white, with Ciherang receiving the lowest score (2.76). However, color preference did not differ significantly among samples in the hedonic test (3.15–3.80), indicating that the differences in perceived color did not substantially affect consumer acceptance.

For taste, Cianjur had the highest scoring value (2.88), corresponding to a slightly sweet taste, whereas Lopo Ijo, Mayang, Jambun, and Mutiara tended to be bland (2.00–2.16). The hedonic test showed that Lopo Ijo and Cianjur were significantly more preferred in taste, with scores of 3.88 and 3.48, respectively, compared with the other samples (2.84–3.12). Taste is an important determinant of rice acceptance and includes inherent taste, palatability, and undesirable off-flavors (Mahyudi et al., 2025). Milling quality may

also influence eating quality, as rice with a higher proportion of intact kernels tends to provide better taste and texture (Zhao et al., 2023).

Aroma showed the clearest advantage for Lopo Ijo. In the scoring test, Lopo Ijo had the highest aroma score (4.08), corresponding to a fragrant aroma, followed by Cianjur (3.48). The other samples were generally characterized by normal aroma (2.76–3.20). Similarly, Lopo Ijo received the highest hedonic score (4.12), followed by Cianjur (3.64), whereas the local rice samples received lower scores (2.84–3.00). Rice aroma is determined by numerous volatile compounds, including 2-acetyl-1-pyrroline, which contributes the characteristic pandan-like aroma of aromatic rice, and aldehydes such as hexanal, which may contribute to musty odors (Lu et al., 2023; Li et al., 2024). The formation and perception of rice aroma involve thermal degradation, Maillard reactions, oxidation, and interactions among starch, proteins, lipids, and volatile compounds (Kusbianoro & Handoko, 2024). The higher aroma scores of packaged rice, particularly Lopo Ijo, may therefore reflect better raw-material selection and postharvest handling that help preserve desirable volatile compounds.

Texture also differed among the rice samples. Lopo Ijo, Cianjur, and Ciherang produced slightly cohesive to cohesive rice, whereas Mutiara, Jambun, and Mayang tended to produce firmer, less cohesive rice. Lopo Ijo and Cianjur had the highest texture preference scores (3.60 and 3.48), followed by Ciherang (3.16), while the local rice samples received lower scores (2.76–2.84). Rice texture is strongly influenced by amylose content; high-amylose rice generally produces firmer and less cohesive cooked rice, whereas lower-amylose rice tends to produce softer rice (Sailendra et al., 2024). Local rice from South Kalimantan has been reported to contain relatively high amylose levels (29.84–33.53%), whereas Ciherang contains approximately 22.92% amylose (Millati et al., 2025). Differences in starch structure and other components, particularly protein, may also contribute to the final texture of cooked rice (Guadamuz-Mayorga et al., 2022).

For appearance, Mutiara, Jambun, Mayang, Cianjur, and Lopo Ijo received relatively similar scoring values (3.40–3.60), whereas Ciherang had the lowest score (2.68). The hedonic test showed that appearance was generally slightly liked to liked (3.52–3.92), except for Ciherang (2.68). The lower appearance score of Ciherang may be associated with its relatively high proportions of broken kernels, groats, chalky kernels, and damaged kernels, which can reduce the visual quality of cooked rice.

Overall, packaged rice, particularly Lopo Ijo and Cianjur, showed a more favorable sensory profile than the local rice varieties and Ciherang, especially in terms of taste, aroma, and texture. Lopo Ijo consistently achieved the highest sensory scores, particularly for aroma and texture. These findings suggest that differences in rice type, milling quality, and physicochemical characteristics collectively contribute to sensory quality and consumer acceptance.

Conclusion

Based on the results, the packaged rice samples, particularly Lopo Ijo and Cianjur, showed the most favorable milling characteristics, with head rice percentages of 85.02% and 76.68%, respectively, and broken rice contents below 15%. However, neither sample fully complied with all SNI requirements because of their relatively high groat contents. In contrast, the local rice varieties and Ciherang failed to meet several SNI criteria, particularly for head rice and broken rice contents. The superior milling characteristics of the packaged rice were generally consistent with their more favorable sensory acceptance, particularly for taste (3.48–3.88), aroma (3.64–4.12), and texture (3.48–3.60), compared with the local rice samples (2.76–3.12). These findings indicate that better milling characteristics were associated with more favorable sensory quality and consumer acceptance, although the relationship between individual milling parameters and sensory responses requires further statistical investigation.

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