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Interrelationship Among Grain Quality Characteristics in Various Egyptian Rice Cultivars

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ABSTRACT

A key goal of rice breeding initiatives is to produce new cultivars that exhibit superior grain quality. This investigation assessed the characteristics of grain quality in four rice varieties and examined their interrelations. Throughout both years of the research, the results highlighted important traits across the various genotypes, revealing substantial differences in all the traits evaluated. Egyptian Yasmin cultivar, aside from its brown rice, milling, and hardness values, declared the superior values for the majority of traits analyzed. However, Giza 177 cultivar generally had the lowest values for the majority of traits measured, except for the broken percentage. The Sakha 101 cultivar, on the other hand, had the best brown rice, milling, and hardness values as well as the lowest broken %. According to this study, many grain quality characteristics in both study seasons exhibited robust and statistically significant relations. The milling process was found to have a negative relationship with amylose, water absorption, elongation, gel consistency, gelatinization temperature, protein, fiber, fat, ash, minerals, and vitamins. In both growing seasons, hardness was negatively correlated with amylose, water absorption, elongation, gel consistency, gelatinization temperature, phosphorus, potassium, vitamin B1, vitamin B2, vitamin B3, vitamin B5, and vitamin B6. While broken rice exhibited a positive correlation with protein, fiber, fat, water absorption, elongation, gel consistency, and gelatinization temperature, phosphorus, potassium, vitamin B1, vitamin B2, vitamin B3, vitamin B5, and vitamin B6. Finally, Yasmin rice cultivar showed better quality features in terms of cooking, and nutritional value.

Keywords: rice, quality, cooking quality, nutrition

INTRODUCTION

Rice grain is an important dietary food and primarily consists of the pericarp, testa, aleurone layer, embryo, and starchy endosperm. During the milling process, the aleurone layer and germ are completely eliminated, resulting in the starchy endosperm, known as milled rice, which appears transparent. Based on consumer preferences, the brightness of rice showed different levels of superior characteristics (Zhao Yi *et al.* 2024).

The development of rice varieties and their subsequent acceptance on farms relies on the milling and cooking qualities of the rice grains. This showed a significant connection between the consistency of the gel and the presence of amylose. Furthermore, a moderate connection between the stability of the gel and the temperature of gelatinization was observed. The characteristics of grain quality traits serve as a foundation for enhancing the quality of rice grain populations (Tam *et al.* 2023). The Yasmin cultivar was clearly seen in the positive quadrant of Dim1, showing better protein, fiber, water absorption, and kernel elongation, according to the Principal Component Analysis (PCA) statement of differentiation between cultivars besides correlation were observed. Additionally, the Yasmin cultivar showed better quality features in terms of milling, cooking, and nutritional value (Abd El Salam *et al.* 2025). Egypt produces an average of 9.8 tons of rice annually, which is among the highest in the globe (RRTC, 2023). The characteristics of rice quality are crucial since they provide a foundation for the success of rice breeding in satisfying consumer needs and include aspects of nutrition, cooking, milling, and eating quality. Additionally, as the tastes of consumers evolve, the worldwide appetite for high-quality rice has risen and is expected to continue escalating. Analyzing the situation is the most practical method for enhancing rice quality. Moreover, it is essential for us to comprehend the genetic mechanisms underlying the actions of quality trait loci (Sultana *et al.* 2022). According to Liang *et al.* (2021), rice is an essential staple food across the globe that provides crucial nutrients to billions. He also noted that the production of rice has increased significantly and consistently around the world. The gelatinization temperature (G. T.) and gel consistency (G. C.) are the most important quality attributes and are strongly linked to the amylose content (Zhang *et al*., 2020) and are closely tied to cooking and eating quality. The most important nutrient in rice is protein, according to Shao (2020). Additionally, he noted that rice protein, is considered a premium source of protein for humans, is readily digested and absorbed, has enough amino acids, and is regarded as the most physiologically beneficial grain protein. Protein is thought to be a key factor influencing the texture of rice, in addition to its nutritional value. The quality of rice grains is mainly influenced by their physical characteristics (such as the shape and size of the grains, the amount of whole kernels, and the color of the grains), biochemical factors (including the temperature of gelatinization, density, amylose content, and fragrance), and nutritional aspects (like micronutrients, taste, protein, and fat content). Nonetheless, the fundamental processes that

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influence food and the quality of eating experiences are often complex, with certain genes affecting them and others being influenced by external factors (Sharma *et al.*, 2019). The two kinds of characteristics that researchers, producers, and consumers are most curious about are physicochemical (amylose concentration, gelatinization temperature, gel consistency, and scent) and milling (head rice and chalkiness), according to Misra *et al.*, 2019. For various Egyptian rice varieties, Abd El Salam and colleagues in 2016, a connection was identified between the quality traits of grains during the growing seasons of 2013 and 2014. Most of the examined features in both seasons showed a strong relationship with the gelatinization temperature (spreading and clearing). The relationship among spreading and each of hulling, milling, grain length, and grain width showed a positive and significant relation in both seasons. This investigation sought to identify different quality attributes of rice grains and the relationship among them for certain Egyptian rice varieties.

MATERIALS AND METHODS

During the 2022 and 2023 growing seasons, seeds were supplied by the Rice Research Program (RRTC) in Kafr El-Sheikh. The research took place at the Rice Technology Training Center (RTTC) located in Alexandria, Egypt. The goal was to examine the relationship between milling quality, cooking properties, and eating quality, as well as the levels of minerals and vitamins in four different rice varieties: Sakha 101, Sakha 102, Giza 177, and Egyptian Yasmin. The experiment laid in a completely randomized block design with three repetitions, utilizing the SAS software (version eight) for statistical evaluation and calculation of simple correlation coefficients, following the approach outlined by Gomez and Gomez in 1984. The means were assessed using the least significant difference (L. S. D) method at a significance level of 0. 05. A mixing mechanism combined and separated the paddy rice samples, running them through 36 channels before dividing them into two similar groups. Samples of paddy rice were automatically cleaned using a Dockage apparatus (XT3, USA) to remove dust, foreign substances, mud balls, and empty grains, dead and immature green grains, in order to make hulling and milling easier. The samples were put through a grain thickness Satake device, which consists of perforated cylinders, to ensure consistent grain size. Three random samples of rough rice (100 g each) were collected at random, and their moisture content was then reduced to 14% by drying them in hot air using a rotary dryer Schule device from Germany. After that, the samples were purified and dehusked using Satake huller machine. Brown rice % was measured according to Bhattacharya (2011), milling percentage was estimated by Sanusi *et al.* (2017), and broken % was removed from milled rice by using a rice-sizing Satake electric device and determined according to IRRI (1996). The hardness of milled grains was recorded by Radwan, 2001. Amylose % was analyzed by using iodine reagent method Williams *et al.* (1958) and modified by Juliano (1971). Uptake of water was estimated for milled rice samples, as methodology described by Simpson *et al* (1965). Elongation % was measured by Azeez and Shafi (1966) method. Consistency of Gelatinization was recorded according to the methodology described by Cagampang *et al.* (1973). The temperature of Gelatinization was determined according to Little *et al.* 1958. The appearance and disintegration of the endosperm were visually rated on the basis of the following numerical scale: 1- 3 High gelatinization temperature (> 75 º C), 4 –5 medium gelatinization temperature (70 – 75 º C) and 6 – 7 minimum gelatinization temperature (< 70 º C). Protein content percentage: It was determined for brown rice samples according to the standard semi-micro Kieldahl method as outlined by Egan, *et al.* (1981) using a solution containing boric acid (4%) and tashiro indicator to receive ammonia which was then titrated with 0.02 N hydrochloric acid. The percentage of nitrogen content was multiplied by 5.95 factor to convert into crude protein. Determination of Fiber content and Fat content were determined according to (AOAC 1990). Minerals content of rice samples were recorded according to AOAC 2005. Vitamins content were determined according to (Kyritsi *et al.* 2011).

RESULTS AND DISCUSSION

Rice quality:

Enhancing the physicochemical properties of rice and its significance in human nutrition and health are also highly desired. Numerous characteristics, such as milling, physicochemical, nutritional, cooking, and eating qualities, determine the quality of rice grains (Zahra *et al.* 2022). Additionally, genetic background rather than environmental factors account for the differences in nutritive, cooking, and eating quality between rice cultivars (Abd El Salam *et al.* 2014, Abd El Salam 2016, Abd El Salam 2017a, Abd El Salam 2017b, Abd El Bary *et al.* 2018 as well as Abd El Salam and Tabl (2020).

Milling Characteristics:

In cases where the interaction is not significant, data pertaining solely to the main effects of the factors under study will be presented and analyzed. As people's living standards rise and more focus is placed on producing high-quality rice to meet their demands, optimal rice milling enhances the rice's appearance, palatability, texture, and ease of digestion for consumers (Hu *et al.* 2022). Data in Table 1 indicated that during both study seasons, there was a significant impact on all milling Characteristics. In 2022 and 2023, respectively, the Egyptian Yasmin (Indica long grain) rice cultivar was found to have the lowest values for brown rice (77.48 and 77.30 %), milling (67.96 and 67.61 %), and hardness (4.53 and 4.25 Kg/cm^2). Sakha 101 rice variety exhibited the highest percentages for brown rice (80. 65 and 80. 78%), milling (71. 62 and 71. 42%), and hardness (5. 73 and 5. 96 Kg/cm^2). During both seasons of research, the Yasmin rice variety demonstrated greater percentages of broken grains (8. 84% and 8. 51%), whereas the Sakha 101 variety (short grain) exhibited the lowest percentages for the same trait (5. 18% and 4. 89%). Grain breakage, which impacts both the income of producers and the quality of customers, is accurately forecasted by hardness. Moreover, the optimal hardness for long-grain varieties is lower than that of short-grain types because of the variations in grain length. In comparison to short grain cultivars with thicker edges that exhibit a limited decrease in length, width, and thickness, long cultivars are more likely to exhibit greater reductions in hardness, width, and length after rice polishing (Shruti *et al.* 2014). These outcomes were consistent with (Abd El Salam *et al.* 2014, Abd El Salam *et al.* 2016, Abd El Salam 2017a, Abd El Salam

2017b, Abd El Bary *et al.* 2018, Abd El Salam and Tabl (2020) and Abd El Salam *et al.* 2022.

Table 1. Mean values for milling characteristics and hardness in 2022 and 2023, seasons

Cultivars	Brown rice %		Milling %		Broken %		Hardness (Kg/cm^2)	
	2022	2023	2022	2023	2022	2023	2022	2023
Sakha 101	80.65	80.78	71.62	71.42	5.18	4.89	5.73	5.96
Sakha 102	80.48	80.35	71.43	71.30	5.41	5.23	5.57	5.40
Giza 177	80.17	80.26	71.18	71.03	6.45	6.72	5.68	5.51
Yasmin	77.48	77.30	67.96	67.61	8.84	8.51	4.53	4.25
L.S.D $_{0.05}$	0.117	0.054	0.062	0.085	0.134	0.211	0.081	0.064

Cooking and eating quality Characteristics:

Data in table 2 and 3 declared that the Yasmin rice cultivar gave the highest values for amylose (22.86 and 22.52 %), water uptake (428.5 and 432.6 ml water/100gm milled grains), elongation (62.63 and 62.11 %), Gel consistency (94.32 and 93.56 mm) while, Giza 177 declared lowest values for amylose (18.23 and 17.84 %), water uptake (411.4 and 407.5 ml water/100gm milled grains), elongation (55.61 and 53.38 %), , Gel consistency (90.2° and 88.64 mm) in both study seasons respectively. Furthermore, the highest scale for gelatinization temperature spreading (5.16 and 4.82) and clearing (4.78 and 4.61) were noticed with Sakha 101 rice cultivar but this scale is inversely proportional to gelatinization temperature which indicates that Sakha 101 rice cultivar had medium gelatinization temperature which is between 70 to 75 o C.

Table 2. Mean values for amylose, water uptake and elongation characteristics in 2022 and 2023, seasons.

Cultivars	Amylose %		Water uptake (ml water/ 100gm milled grains)		Elongation %	
	2022	2023	2022	2023	2022	2023
Sakha 101	18.72	18.36	421.6	417.2	59.12	58.62
Sakha 102	18.43	18.14	418.5	412.3	58.33	56.45
Giza 177	18.23	17.84	411.4	407.5	55.61	53.38
Yasmin	22.86	22.52	428.5	432.6	62.63	62.11
L.S.D $_{0.05}$	0.173	0.142	3.281	3.683	0.541	0.310

Table 3. Mean values for G.C and G.T. characteristics in 2022 and 2023, seasons.

Cultivars	Gel consistency G.C (mm)		Gelatinization temperature G.T(Spreading)		Gelatinization temperature G.T (Clearing)	
	2022	2023	2022	2023	2022	2023
Sakha 101	92.82	92.40	5.16	4.82	4.78	4.61
Sakha 102	92.11	91.35	4.85	4.66	4.52	4.36
Giza 177	90.25	88.64	4.52	4.37	4.28	4.13
Yasmin	94.32	93.56	2.96	2.70	2.55	2.32
L.S.D $_{0.05}$	0.617	0.453	0.154	0.112	0.105	0.064

However, the lowest scale for spreading (2.96 and 2.70) and clearing (2.55 and 2.32) were recognized with Yasmin rice cultivar which indicates higher G.T (greater than 75 o C) in both study seasons respectively. Differences in the properties of rice varieties are connected to grain length, as long grains contain more amylose. This leads to a greater need for water absorption, resulting in an increase in elongation and gel consistency due to a larger surface area in contact with water while cooking, which also raises the gelatinization temperature. In contrast, short grains exhibit the least elongation because they have lower amylose and less surface area available for water absorption, leading to reduced elongation, gel consistency, gelatinization temperature, and water absorption during cooking. These findings align with the research of El Dalil 2017 and Abd El Salam *et al.* 2022.

Proximate chemical composition:

Data in Table 4 declared that Yasmin rice cultivar gave the highest values for protein (8.51 and 8.33 %), fiber (0.328 and 0.319 %), and fat (0.917 and 0.903 %). While, the minimum results for protein (7.40 and 7.16 %), fiber (0.259 and 0.251 %) and fat (0.730 and 0.712 %) were noticed with Giza 177 rice cultivar in both study seasons respectively. Most protein, fiber and fat are mainly located in bran and germ of rice grain which separated during milling process and the rest of them after polishing is very few. Additionally, cultivar differences impact the percentages of protein and fat, with long-grain cultivars having higher values than short-grain cultivars (Abd El Salam *et al.* 2022). Because bran and germ are entirely removed during polishing so fats, fibers, and proteins that are normally good for human health decrease (Reddy *et al.* 2017).

Table 4. Mean values for proximate chemical composition characteristics in 2022 and 2023 seasons.

Cultivars	Protein %		Fiber %		Fat %	
	2022	2023	2022	2023	2022	2023
Sakha 101	8.19	8.10	0.289	0.284	0.833	0.817
Sakha 102	8.02	7.85	0.275	0.269	0.756	0.740
Giza 177	7.40	7.16	0.259	0.251	0.730	0.712
Yasmin	8.51	8.33	0.328	0.319	0.917	0.903
L.S.D $_{0.05}$	0.035	0.051	0.009	0.011	0.014	0.008

Minerals and vitamins:

Minerals found in food are considered essential elements for developing our body and maintaining vital process to function normally. Phosphorus is an essential element to keep strong bones. Additionally, it enhances the functioning of muscles and blood vessels. Muscles, cells and nerves are promoted properly by intake potassium in our daily meals. Moreover, minerals intake daily in your food controls the amount of water in your cells, your blood pressure, and your heart beats. Additionally, it aids in digestion (N. I. H. 2022). Vitamin B complex promotes various functions in body and composed of pantothenic acid, pyridoxine, niacin, riboflavin, and thiamine. A healthy and well-balanced lifestyle depends on vitamin B. A Healthy body needs B vitamins in dietary food daily to promote energy levels, brain function, and cell metabolism, (N. I. H. 2022). Tables 5 and 6 data showed that the Yasmin rice cultivar had the highest values for phosphorus (1112 and 1105 mg/kg rice), potassium (1147 and 1141 mg/kg rice), vitamin B1 (1.61 and 1.52 mg/kg rice), vitamin B2 (0.153 and 0.145 mg/kg rice), vitamin B3 (53.21 and 52.77 mg/kg rice), vitamin B5 (9.92 and 9.76 mg/kg rice), and vitamin B6 (5.15 and 5.08 mg/kg rice). However, the Giza 177 rice cultivar had the lowest values for phosphorus (1028 and 1015 mg/kg rice), potassium (1108 and 1101 mg/kg rice), vitamin B1 (1.15 and 1.08 mg/kg rice), vitamin B2 (0.112 and 0.105 mg/kg rice), vitamin B3 (43.59 and 42.80 mg/kg rice), vitamin B5 (8.26 and 8.19 mg/kg rice), and vitamin B6 (4.11 and 4.04 mg/kg rice) in both research seasons, respectively. The rice bran contains the greatest concentration of minerals and vitamins (61.0%), followed by the outer endosperm (23.7%), the core endosperm (11.6%), and the middle endosperm (33.7%), according to Lamberts *et al.* 2007. Minerals and vitamins are lost because they are concentrated in rice bran which is removed completely during milling process. The main important source of vitamins and minerals, rice is a wonderful method for providing nutrients to growing communities (Nile *et al.*, 2016; Sompong *et al.*, 2011).

Table 5. Mean values for phosphorus, potassium and vitamin B1 characteristicsin 2022 and 2023 seasons.

Cultivars	Phosphorus (mg/kg rice)		Potassium (mg/kg rice)		Vitamin B1 (mg/kg rice)	
	2022	2023	2022	2023	2022	2023
Sakha 101	1065	1058	1131	1124	1.42	1.36
Sakha 102	1049	1036	1117	1113	1.31	1.25
Giza 177	1028	1015	1108	1101	1.15	1.08
Yasmin	1112	1105	1147	1141	1.61	1.52
L.S.D $_{0.05}$	7.122	5.461	7.235	5.482	0.024	0.012

Table 6. Means values for vitamin B2, vitamin B3, vitamin B5 and vitamin B6 characteristics in 2022 and 2023 seasons.

Cultivars	Vitamin B2 (mg/kg rice)		Vitamin B3 (mg/kg rice)		Vitamin B5 (mg/kg rice)		Vitamin B6 (mg/kg rice)	
	2022	2023	2022	2023	2022	2023	2022	2023
Sakha 101	0.136	0.131	47.55	46.23	8.79	8.71	4.46	4.38
Sakha 102	0.127	0.122	45.20	44.61	8.57	8.48	4.25	4.17
Giza 177	0.112	0.105	43.59	42.80	8.26	8.19	4.11	4.04
Yasmin	0.153	0.145	53.21	52.77	9.92	9.76	5.15	5.08
L.S.D $_{0.05}$	0.005	0.002	1.122	1.231	0.134	0.153	0.017	0.053

Correlation between milling, broken, hardness, and cooking and eating Characteristics:

Data in Table 7 revealed that milling showed negative and significant correlation with amylose (-0.674 and -0.712), water uptake (-0.722 and -0.763), elongation (-0.649 and -0.714), Gel consistency (-0.657 and -0.773), G.T. spreading (-0.812 and -0.738) and G.T. clearing (-0.665 and -0.715) in both study seasons respectively. Broken % showed positive and significant correlation with amylose (0.559 and 0.617), water uptake 0.586 and 0.534), elongation 0.630 and 0.711), Gel consistency (0.569 and 0.639), G.T. spreading (0.668 and 0.763) and G.T. clearing (0.622 and 0.597) in both study seasons respectively. Hardness showed negative and significant correlation with amylose (-0.580 and -0.624), water uptake (-0.613 and -0.681), elongation (-0.714 and -0.635), Gel consistency (-0.604 and -0.652), G.T. spreading (-0.531 and -0.566) and G.T. clearing (-0.637 and -0.591) in both study seasons respectively. Similar results were reported by Abd El Salam 2016 and Abd El Salam *et al.* 2025.

Table 7. Correlations between milling, broken, hardness and cooking and eating quality characteristics in 2022 and 2023 seasons.

Characteristics	Milling		Broken		Hardness	
	2022	2023	2022	2023	2022	2023
Amylose	-0.674	-0.712	0.559	0.617	-0.580	-0.624
Water uptake	-0.722	-0.763	0.586	0.534	-0.613	-0.681
Elongation	-0.649	-0.714	0.630	0.711	-0.714	-0.635
Gel consistency	-0.657	-0.773	0.569	0.639	-0.604	-0.652
G.T. spreading	-0.812	-0.738	0.668	0.763	-0.531	-0.566
G.T. clearing	-0.665	-0.715	0.622	0.597	-0.637	-0.591

Correlation between brown, milling, broken, hardness and proximate chemical components Characteristics:

Table 8 declared that brown rice % showed a negative and significant correlation with protein (-0.581 and -0.534), fiber (-0.560 and -0.583) and fat (-0.650 and -0.675) in both study seasons respectively. Moreover, data in Table 8 revealed that milling showed negative and significant correlation with protein (-0.617 and -0.634), fiber (-0.544 and -0.615) and fat (-0.673 and -0.589) in both study seasons respectively. Broken showed positive and significant correlation with protein (0.654 and 0.682), fiber (0.688 and 0.637) and fat (0.635 and 0.711) in both study seasons respectively. Hardness showed a negative and significant correlation with protein (-0.676 and -0.710), fiber (-0.722 and -0.636) and fat (-0.615 and -0.533) in both study seasons respectively, Abd El Salam *et al.* 2025 reported identical results.

Table 8. Correlations between brown rice, milling, broken, hardness and proximate chemical components quality characteristics in 2022 and 2023 seasons.

characteristics	Brown rice		Milling		Broken		Hardness	
	2022	2023	2022	2023	2022	2023	2022	2023
Protein	-0.581	-0.534	-0.617	-0.634	0.654	0.682	-0.676	-0.710
Fiber	-0.560	-0.583	-0.544	-0.615	0.688	0.637	-0.722	-0.636
Fat	-0.650	-0.675	-0.673	-0.589	0.635	0.711	-0.615	-0.533

Correlation between brown rice, milling, broken, hardness, minerals and vitamins Characteristics:

Table 9 declared that brown rice % showed negative and significant correlation with phosphorus (-0.661 and -0.625), potassium (-0.634 and -0.581), vitamin B1 (-0.611 and -0.524), vitamin B2 (-0.703 and -0.667), vitamin B3 (-0.628 and -0.577), vitamin B5 (-0.653 and -0.615) and vitamin B6 (-0.639 and -0.751) in both study seasons respectively. Moreover, data in table 9 revealed that milling showed negative and significant correlation with phosphorus (-0.562 and -0.591), potassium (-0.610 and -0.586), vitamin B1 (-0.627 and -0.683), vitamin B2 (-0.614 and -0.571), vitamin B3 (-0.664 and -0.636), vitamin B5 (-0.645 and -0.624) and vitamin B6 (-0.698 and -0.569) in both study seasons respectively.

Table 9. Correlations between brown rice, milling, hardness, minerals and vitamins characteristics in 2022 and 2023 seasons.

characteristics	Brown rice		Milling		Broken		Hardness	
	2022	2023	2022	2023	2022	2023	2022	2023
Phosphorus	-0.661	-0.625	-0.562	-0.591	0.553	0.616	-0.565	-0.594
Potassium	-0.634	-0.581	-0.610	-0.586	0.537	0.564	-0.547	-0.615
Vitamin B1	-0.611	-0.524	-0.627	-0.683	0.597	0.623	-0.631	-0.672
Vitamin B2	-0.703	-0.667	-0.614	-0.571	0.612	0.668	-0.687	-0.638
Vitamin B3	-0.628	-0.577	-0.664	-0.636	0.688	0.617	-0.611	-0.642
Vitamin B5	-0.653	-0.615	-0.645	-0.624	0.639	0.564	-0.614	-0.597
Vitamin B6	-0.639	-0.751	-0.698	-0.569	0.632	0.663	-0.663	-0.641

Furthermore, data in Table 9 declared that broken showed a positive and significant correlation with phosphorus (0.553 and 0.616), potassium (0.537 and 0.564), vitamin B1 (0.597 and 0.623), vitamin B2 (0.612 and 0.668), vitamin B3

(0.688 and 0.617), vitamin B5 (0.639 and 0.564) and vitamin B6 (0.632 and 0.663) in both study seasons respectively. Hardness showed negative and significant correlation with phosphorus (-0.565 and -0.594), potassium (-0.547 and -0.615), vitamin B1 (-0.631 and -0.672), vitamin B2 (-0.687 and -0.638), vitamin B3 (-0.611 and -0.642), vitamin B5 (-0.614 and -0.597) and vitamin B6 (-0.663 and -0.641) in both study seasons respectively, Abd El Salam *et al*. 2025 reported identical results.

CONCLUSION

Optimum rice grain quality such as milling quality and physicochemical quality must be provided for the paddy after harvest until it is needed for consumption ware critical for varietal development and subsequent farm acceptance. Among rice grain quality, cooking and eating traits appear to be very important as it is directly regulate consumer demand as well as market price. Also, investigations revealed that rice grain quality characteristics are governed by a number of factors, including appearance, nutrition, cooking and eating features. Moreover, the relations between grain quality Characteristics are considered the most important factor that governs the acceptance of cultivars to consumers and also defines market price. The main objective of this study was to highlight the strong relations between various grain quality characteristics to determine optimum grain quality characteristics for consumers. This research declared strongly and significant correlations between most grain quality Characteristics and also revealed that rice cultivars differ in their grain quality characteristics in both study seasons.

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العلاقة بين صفات جودة الحبوب في أصناف الأرز المختارة

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الملخص

يتمثل أحد الأهداف الرئيسية لبرنامج تربية النباتات فى أنتاج أصناف أرز جديدة ذات جودة حبوب عالية . وقد تم تقييم خصائص جودة الحبوب لأربعة أنماط وراثية مختلفة من الأرز فى هذه الدارسة، إلي جانب علاقتها ببعضها البعض . فى كلا موسمي البحث كشفت النتائج عن خصائص مهمة لمختلف الأنماط الدراسية ، مما يدل على وجود نطاق واسع من التباين بين الأنماط الوراثية لجميع الصفات قيد الدراسة. فنجد ان صنف الياسمين المصرسجل أعلى القيم لمعظم الصفات التى تمت دراستها بأستثناء الأرز البني والتبيض والصلابة. كما اعطي صنف الأرز جيزة ١٧٧ أقل القيم لمعظم الصفات التى تم فحصها ما عدا النسبة المئوية للكسر. ومن ناحية أخرى فقد حقق صنف الأرز سخا ١٠١ أفضل القيم للأرز البني والتبييض والصلابة، مع تسجيل أقل نسبة مئوية للكسر. ووفقاً لهذه الدراسة فقد أظهرت غالبية خصائص جودة الحبوب فى كلا موسمي الدراسة علاقات قوية إحصائياً. وجد أيضا أن لعملية تبييض الأرز علاقة سلبية مع الأميلوز، امتصاص الماء، والأستطالة، وقوام الجل، ودرجة حرارة الجلتنة، والبروتين، والالياف، والدهون، والرماد، والمعادن، والفيتامينات. اما الصلابة فى كلا موسمي النمو فقد أرتبطت سلباً مع الأميلوز، وامتصاص الماء، والأستطالة، وقوام الجل، ودرجة حرارة الجلتنة، والفوسفور، والبوتاسيوم، وفيتامين ب١، وفيتامين ب٢، وفيتامين ب٣، وفيتامين ب٥، وفيتامين ب٦. أما عن الكسر فقد أظهر علاقة إيجابية مع البروتين، والألياف، والدهون، وأمتصاص الماء، والاستطالة، وقوام الجل، ودرجة حرارة الجلتنة والفوسفور، والبوتاسيوم، وفيتامين ب١، وفيتامين ب٢، وفيتامين ب٣، وفيتامين ب٥، وفيتامين ب٦. نستنتج من هذه الدراسة أن صنف الأرز ياسمين يتميز بصفات جودة عالية من حيث الطهي والقيمة الغذائية.