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In-vitro antioxidant activity and physiochemical properties of some improved Sri Lankan red and white rice (*Oryza sativa L.*) varieties

A.G.N. Nirmali[1], U.M.C.S., Madalagama[1*], W.G.M. Hiranya[1], O.M.A.J.L. Jayarathna[1], T. Thivagaran[1], P.J. Wijekumar[1], N.D.K. Ranadeva[1]

[1]Department of Biomedical Science, Faculty of Health Science, KIU Campus, Sri Lanka

[#]Corresponding author: chamodimadalagama@gmail.com,

Abstract

Rice is a staple food providing essential nutrients to populations worldwide. In Sri Lanka, improved red and white varieties of *Oryza sativa* are widely consumed, yet limited research exists on their nutritional composition and antioxidant properties. This study aimed to evaluate the antioxidant activity and nutritional properties of selected red and white rice varieties in Sri Lanka. Six improved rice varieties (*Ld408*, *Ld371*, *Ld368*, *Ld376*, *Ld253*, and *Ld365*) were collected from the Rice Research Institute, Labuduwa, Sri Lanka. Methanolic extracts of the rice grains were analyzed for *in-vitro* antioxidant activity using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, the ferric-reducing power activity assay, and the total phenolic content (TPC) assay. Nutritional composition, including total carbohydrate, protein, and amylose contents, was determined using the phenol-sulfuric acid method, Lowry method, and iodine colorimetric method, respectively. Statistical analyses were performed using GraphPad Prism 9, with statistical significance set at $p<0.05$. The red rice variety *Ld408* exhibited the highest antioxidant activity, as indicated by ferric-reducing power, DPPH scavenging activity, and total phenolic content ($p<0.05$). Among the white rice varieties, *Ld368* had the highest carbohydrate content ($p<0.05$), while *Ld408, a* red variety, had the highest protein content ($p<0.05$). The red rice variety *Ld376* contained the highest amylose content. The results indicate that while white rice varieties often have a higher carbohydrate content, red rice variants, especially *Ld408*, possess higher protein content and stronger antioxidant potential. These findings highlight the nutritional benefits of red rice and the necessity of incorporating different types of rice varieties into daily diets to promote dietary diversity.

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*Corresponding author:
chamodimadalagama@gmail.com

https://orcid.org/0009-0000-3603-6353

1. Introduction

Rice (*Oryza sativa* L.) is a staple food that provides essential nutrients and sustains nearly half of the global population (Gunaratne et al., 2013). It plays a critical role in food security, particularly in Asian countries, Sri Lanka has a rich diversity of rice, encompassing both traditional and improved varieties, which have been selectively bred for higher yield, better adaptability, and enhanced nutritional properties. White rice is the most commonly consumed variety and is characterized by polished grains. However, pigmented rice varieties, such

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as red and black rice, contain bioactive compounds that offer significant health benefits (Abeysekera et al., 2017; Sompong et al., 2011). These pigmented varieties, especially red rice, are rich in phenolic compounds and antioxidants, which have been linked to protective effects against oxidative stress-related diseases, including cardiovascular diseases, diabetes, and cancer (Samaranayake et al., 2017; Samaranayake et al., 2018). Despite the well-documented health benefits of pigmented rice, white rice remains dominant in Sri Lankan diets due to its refined texture and familiarity among consumers.

The transition from traditional rice to improved rice varieties has been a key agricultural development in Sri Lanka. Before the 1950s, over 2,400 traditional rice varieties were cultivated and adapted to various agroecological conditions. However, from the 1960s onwards, high-yielding improved rice varieties were introduced, leading to increased productivity and food security (Abeysekera et al., 2017). Today, approximately 99% of paddy cultivation in Sri Lanka consists of new, improved rice varieties, with more than 50 varieties cultivated nationwide. Understanding the nutritional and functional properties of these improved rice varieties is crucial to promoting informed dietary choices and supporting rice breeding programs aimed at enhancing nutritional quality.

Rice is a key source of carbohydrates, proteins, vitamins, minerals, and dietary fiber, with most of its bioactive compounds concentrated in the bran. However, the milling process, especially in white rice, removes a significant portion of these nutrients, reducing its overall nutritional value (Sen et al., 2020; Sinthuja et al., 2021). Despite this, rice remains a major source of dietary protein in many developing countries, contributing nearly 40% of daily protein intake. The presence of high-quality protein, including essential amino acids like lysine, further highlights its nutritional importance. Given the rising concerns over malnutrition and the prevalence of non-communicable diseases, evaluating the nutritional composition and antioxidant potential of different rice varieties is essential for guiding healthier consumption patterns.

This study aimed to compare the total phenolic content, antioxidant capacity, and key nutritional components (carbohydrate, protein, amylose, and moisture content) of six improved red and white rice varieties cultivated under similar climatic and agronomic conditions in Sri Lanka. Investigating these parameters is crucial for identifying nutritionally superior rice varieties, as those with higher antioxidant activity and superior nutritional content can inform dietary recommendations and encourage the consumption of nutrient-rich rice. Additionally, increased knowledge of the health benefits of red rice varieties may aid in the prevention of diet-related non-communicable diseases. Understanding the nutritional variations among improved rice varieties is also critical for guiding rice breeding programs, as it supports the selection of parental materials to develop future rice varieties that meet both yield and health requirements. By providing scientific insights into the functional properties of Sri Lankan improved red and white rice, this study contributes to both consumer awareness and agricultural advancements, ultimately promoting dietary diversity and improved public health.

2. Materials and Methods

2.1 Sample Collection

Six improved red (Ld408, Ld368, Ld365) and white rice varieties (Ld376, Ld371, Ld253) were obtained from the Rice Research Institute, Labuduwa, Galle, Sri Lanka. The samples were air-dried and stored at room temperature until the experiments. Rice grains were dehusked manually and the bran was removed by nearly 8% of the total weight of the grains. Rice flour (with bran) was obtained and stored in a sealed plastic box at room temperature until use.

2.2 Antioxidant properties of improved red and white rice varieties

2.2.1. Methanolic extraction of rice grains

One gram of rice flour from each rice variety was extracted with 10 times the sample weight of methanol overnight at room temperature (28±2 ^{0}C). Rice flour extracts were then centrifuged (825 g) for 10 minutes and the obtained supernatants were evaporated at 45 ^{0}C. The resulting residues were stored at 4 ^{0}C in a refrigerator in an air-tight container until evaluation of antioxidant activity.

Determination of Total Phenolic Content (TPC)

The TPC of rice extracts was determined using the Folin-Ciocalteu reagent as previously described (Abeysekera et al., 2017). Briefly, 0.5mL of rice extract solution (20-200 µg/mL) in methanol was added to 2.5 mL of 10 times diluted freshly prepared Folin-Ciocalteu reagent. Then 2.5 mL of 2% sodium carbonate was added and incubated at 25±2 ^{0}C for 30 minutes. The absorbance was measured at 765 nm using a UV spectrophotometer. Gallic acid was used as the standard and TPC was expressed as mg Gallic acid equivalent per g dry extract (mg GAE/g) of rice. All measurements were performed in triplicate.

Determination of 2,2-diphenyl-1-picrylhydrazy l (DPPH) free radical scavenging antioxidant activity

The radical scavenging activity of the crude extracts was used to measure the antioxidant activity using the DPPH assay as previously described (Aryal et al., 2019). Briefly, 2 ml of rice extract solution (20-200µg/ml) in methanol was added to 2 mL of DPPH (0.1 mM) solution. The mixtures were kept in a dark place for 30 minutes and finally, the DPPH-radical scavenging activity was estimated by the decrease in absorbance at 517 nm against an equal amount of DPPH and methanol as a blank. Ascorbic acid was used as the standard. All measurements were performed in triplicate. The DPPH scavenging percentage (RSA%) was calculated using the following equation:

$$\% \text{ Scavenging of DPPH} = [(A_0 - A_1)/A_0] \times 100$$

Where A_0 is the absorbance of the control and A_1 is the absorbance of the test extracts.

Determination of Ferric Reducing Power

The ferric-reducing power assay was evaluated as previously described (Priyanthi and Sivakanesan, 2021). Briefly, a concentration series (20–200 µg/mL) of rice extracts was prepared, with the total solution volume maintained at 1 mL. Each sample was mixed with 1 mL of phosphate buffer (0.3 M, pH 6.6) and 1 mL of 1% $K3[Fe (CN)_6]$. All samples were incubated at 50 ^{0}C for 20 minutes. Then 2.5 mL of 10% TCA was added to each sample and centrifuged at 3000 rpm for 10 minutes. From these centrifuged samples, 2.5 mL of supernatant was transferred into separate test tubes. To each tube, 2.5 mL of deionized water and 0.5 mL of 1% FeCl3·6H2O were added and the absorbance was measured at 700 nm after 30 minutes. Trolox was used as the standard and all measurements were performed in triplicate.

2.3. Proximate analysis

2.3.1. Determination of Total Carbohydrate content

The phenol-sulfuric acid method was used to estimate the carbohydrate content in improved red and white rice varieties as previously described (Ilyas et al., 2014). Powder of each rice variety (0.1 g) was mixed in 5 mL of 2.5N HCl and the samples were heated in a water bath for 3 hours. Boiling tubes were kept in a water bath for 3 h and then removed and allowed to cool to room temperature. After cooling, the solution was neutralized by adding solid sodium carbonate until effervescence ceased. The final volume was adjusted to 100 mL with distilled water, followed by centrifugation, and the supernatant was used for subsequent analysis. An aliquot of each sample (0.2 mL) was mixed with 1 mL of 5% phenol solution and 5 mL of 96% sulphuric acid solution and the mixtures were incubated at 30 ^{0}C for 20 minutes. The absorbance was measured at 490 nm using a UV spectrophotometer.

2.3.2. Determination of Total Protein Content

The total protein content was determined using Lowry's method (Rizvi et al., 2022). Lowry's reagent A (2% Na_2CO_3 in 0.1 N NaOH) was prepared by the addition of 2 g of NaOH and 10 g of Na_2CO_3 in 5 mL of distilled water followed by dilution to 500 mL with distilled water. Lowry's reagent B1 was prepared with the addition of 1 g $CuSO_4$ and 5 mL of distilled water, diluted to 100 mL with distilled water. Lowry's reagent B2 was prepared with the addition of 2 mL sodium potassium tartrate and 5 mL of distilled water, diluted to 100 mL with distilled water. Lowry's reagent C was freshly prepared by adding 2 mL each of Lowry's reagent B1 and B2 to Lowry's reagent A (200 mL) with continuous stirring. Subsequently, 2 g of the extracted protein sample was added to reagent C and incubated for 45 min with continuous stirring in the dark at room temperature. Reagent E (1 mL) was then added to the sample, followed by a further incubation for 45 min. Protein content in the sample was finally determined by measuring absorbance at 660 nm using a spectrophotometer. The standard curve was prepared using different concentrations of bovine serum albumin prepared as per the same method of protein solution preparation and their absorbance values were measured. All samples and readings were prepared and measured in triplicate.

2.3.3. Determination of Amylose Content

Amylose content was determined based on a simplified colorimetric method (Abeysundara et al., 2017). Each rice flour sample was weighed (100.0 ± 0.5 mg) and transferred into clean and dry Erlenmeyer flasks. For each rice variety, three replicate samples of 100.0 ± 0.5 mg were prepared in separate flasks. Then 9 mL of 1N NaOH was added to the samples followed by 1 mL of 95% ethanol. The samples were kept overnight (24 hours) to completely gelatinize the starch and obtain a clear viscous solution. The flasks were washed several times with distilled water and transferred to 100 mL volumetric flasks, which were then brought to volume with distilled water. The solutions were shaken well to dissolve the starch completely. Subsequently, 5 mL of each freshly prepared solution was transferred to separate 100 mL volumetric flasks, which was covered with aluminum foil. Another volumetric flask was also covered with aluminum foil, and 5 mL of 0.09 N NaOH was added. To each flask, 1 mL of 1 N acetic acid and 2 mL of 0.2% Iodine solution were then added. Then all the flasks were topped up with distilled water and shaken well. The flasks were kept in the dark for 20 minutes and absorbance was measured at 620 nm using a UV spectrophotometer. The final solution prepared with 0.09 N NaOH in place of flour samples was used as the blank solution. The total amylose content in the rice starch was derived from a standard curve generated from potato starch.

3. Statistical analysis

All experiments were done in triplicate, and data were reported as the mean ± standard deviation. Data was analyzed using Graph Pad Prism 9.5.1. Descriptive statistics, inferential statistics (One-way ANOVA) and linear analysis were applied, with p value < 0.05 considered statistically significant.

4. Results

4.1 DPPH Free Radical Scavenging Antioxidant Activity

The results of the DPPH radical scavenging activity for improved red and white rice varieties are presented in Table 1. The scavenging activity was measured as the concentration of extract required to inhibit 50% of DPPH radicals (IC_{50}). The DPPH radical scavenging activity of red and white rice varieties at different concentrations is shown in *Figure 1*. The mean DPPH scavenging activity of the selected red and white rice varieties ranged from 27.36 ± 12.84% to 52.80 ± 5.775%. Among the tested varieties, the red rice variety LD408 exhibited the highest scavenging activity, with an IC_{50} value of 45.586 ± 0.035 µg/mL, followed by LD365 (IC_{50}: 50.942 ± 0.003 µg/mL). The white rice variety LD253 showed the lowest scavenging activity, with an IC_{50} value of 185.80 ± 0.075 µg/mL.

4.2 Ferric Reducing Power Assay

The mean reducing power ranged from 2.13±0.02 to 28.17±1.04 µg/mL, with red rice varieties demonstrating significantly higher reducing power than white rice varieties ($p < 0.05$). The ferric reducing power of red and white rice varieties at different concentrations is shown in *Figure 2*. Results are stated as the concentration of the extract required to inhibit 50% of reducing power (Table 2).

4.3 Total Phenolic Content (TPC)

The mean TPC ranged from 19.83±0.11 to 34.05±0.20 mg GAE/g. The highest TPC was observed in the red rice variety LD408 (97.61±4.38 mg GAE/g), whereas the white rice variety LD371 had the lowest TPC (19.83±0.11 mg GAE/g).

Table 1: DPPH radical scavenging capacity of red and white improved rice varieties.

Rice variety	Pericarp color	Mean % RSA of DPPH Assay	IC_{50} (µg/mL)
Ld408	Red	52.80±5.78	45.586±0.035
Ld253	White	27.36±12.84	185.80±0.075
Ld371	White	49.38±0.32	110.204±0.015
Ld376	White	47.49±1.40	137.971±0.032
Ld365	Red	51.38±0.45	50.942±0.003
Ld368	Red	50.04 ±0.05	77.921±0.002

Results presented as mean ± standard deviation (n = 3) on a dry weight basis.

Table 2: Ferric reducing power and Total phenolic content of red and white improved rice varieties.

Rice variety	Pericarp color	Reducing power assay (µg TE / mL)	TPC (mg GAE/g)
Ld408	Red	34.05±0.20	97.61±4.38
Ld253	White	5.77±0.13	19.83±0.11
Ld371	White	3.63±0.21	25.92±5.65
Ld376	White	2.13±0.10	37.30±8.76
Ld365	Red	18.81±0.15	77.93±8.90
Ld368	Red	6.28±0.1	81.68±8.83

Results presented as mean ± standard deviation (n = 3) on dry weight basis.

Table 3: Nutritional properties of whole grains of selected Sri Lankan improved rice.

Nutritional parameters (% dry basis)	Ld408	Ld365	Ld368	Ld371	Ld376	Ld253
Moisture content	11.89±0.1 9	13.07± 0.40	11.43± 0.11	13.06± 0.37	13.4±0.30	13.1±0.62
Carbohydrates	79.25± 0.010	82.40±0.0 12	81.80± 0.009	87.68± 0.001	88.23±0.0 02	88.30±0.01 1
Proteins	8.46±0.02 8	7.22±0 .028	8.32±0 .025	6.89±0 .036	6.32±0.06 4	6.79±0.025

Results presented as mean ± standard deviation (n = 3) on dry weight basis.

Table 4: Amylose content and amylose classification of improved rice varieties.

Rice variety	Amylose content (%)	Amylose classification
Ld408	21.80±0.3 8	Moderate amylose
Ld253	31.80± 0.42	High amylose
Ld371	22.77± 0.40	Moderate amylose
Ld376	20.67± 0.16	Moderate amylose
Ld365	31.96±0.1 6	High amylose
Ld368	20.51±0.32	Moderate amylose

Results presented as mean ± standard deviation (n = 3) on dry weight basis

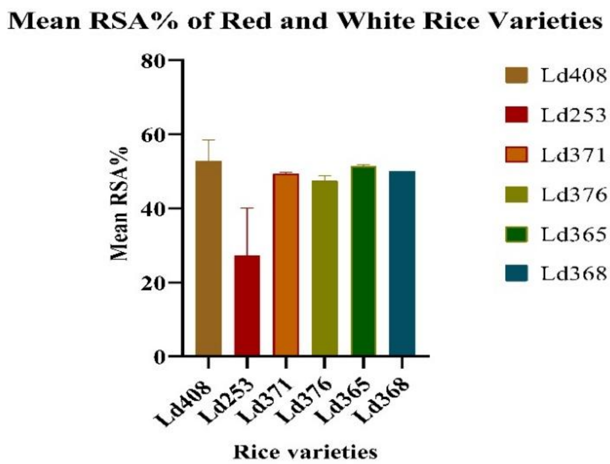

Figure 1: Mean RSA % (DPPH radical scavenging activity) of red and white rice variety extracts

4.4 Moisture Content

The mean moisture content of the selected rice varieties ranged from 11.43±0.11% to 13.4±0.30% (Table 3).

4.5 Carbohydrate Content

The total carbohydrate content of the improved red and white rice varieties ranged from 79.25±0.010% to 88.30±0.011% on a dry weight basis (Table 3). White rice varieties exhibited a higher carbohydrate content compared to red rice varieties.

4.6 Protein Content

The protein content of the selected rice varieties ranged from 6.32±0.064% to 8.46±0.028%.

The red rice variety LD408 exhibited the highest protein content (8.46±0.028%), whereas the white rice variety LD376 had the lowest (6.32±0.064%).

7.Amylose Content

The amylose content of the selected rice varieties ranged from 20.51±0.32% to 31.96±0.16% (Table 4). White rice variety LD253 and red rice variety LD365 had the highest amylose content (>31%), while moderate amylose content was observed in LD408, LD371, LD376, and LD368.

8. Discussion

8.1 DPPH Free Radical Scavenging Antioxidant Activity

Numerous studies have used the DPPH radical scavenging capability to measure the antioxidant capabilities of samples. DPPH, a stable free radical, changes its absorption at 517 nm when it interacts with compounds. This interaction, especially with the pigmented components in red and white samples, is measured as the percentage of inhibition, indicating their ability to scavenge the DPPH radical. The efficacy of antioxidants against DPPH depends primarily on their capacity to donate hydrogen atoms, which is the key mechanism behind their scavenging activity. The brown color typical to free DPPH radicals decays in the presence of antioxidant (Mishra et al., 2012). Antioxidants are of great significance in terms of reducing oxidative stress, which is thought to damage biological molecules. The ability of improved rice to reduce DPPH was thus determined spectrophotometrically by measuring the decrease in absorbance at 517 nm, a change induced by antioxidants. The percentage of DPPH radical scavenging activity in the improved rice samples was observed to correlate with an increase in total phenolic content (Chim et al., 2019; Mishra et al., 2012).

The DPPH radical scavenging assay is widely used to evaluate the antioxidant potential of different samples. A lower IC50 value indicates a higher antioxidant capacity. The improved red rice varieties exhibited significantly higher ($p < 0.05$) antioxidant activity compared to improved white rice varieties. Previous studies have also reported higher DPPH radical scavenging activity in traditional red rice varieties due to the presence of a bran layer rich in antioxidant compounds (Abeysekera et al., 2017).

8.2 Ferric Reducing Power Assay

The Ferric Reducing Power (FRP) assay measures the electron-donating ability of antioxidants in reducing Fe^{3+} to Fe^{2+} (Abeysekera et al., 2020). The results indicate significant differences ($p < 0.05$) in reducing power among the selected rice varieties. This is consistent with previous findings on Sri Lankan rice varieties, where red rice exhibited greater ferric reducing power ($p < 0.05$) compared to white rice (Samaranayake et al., 2018).

8.3 Total Phenolic Content (TPC)

Phenolic compounds, abundant in plants such as grains, vegetables, and fruits (Daiponmak et al., 2014), serve various biological functions, notably as antioxidants. Colored rice varieties in particular are rich in phenolic antioxidants, which contribute significantly to their health-promoting properties (Kang et al., 2013). The total phenolic content of the investigated improved red and white rice varieties is given in Table 2. Significant differences ($p< 0.05$) were observed for TPC among the improved rice varieties. The mean TPC of the selected rice varieties ranged from 19.83±0.11 to 97.61±4.38 mg GAE/g. Improved red rice variety Ld408 exhibited the highest TPC with 97.61±4.38 mg GAE/g, while a white rice variety Ld371 showed the lowest TPC content of 19.83±0.11 mg GAE/100 g. The TPC values in red rice were consistently higher compared to white rice, suggesting that the improved red rice varieties exhibit a greater concentration of phenolic compounds. The genetic differences between improved red and white rice can be the cause of the observed variance in total phenolic content. The rich pigmentation of red rice is mainly attributed to the presence of phenolic compounds called anthocyanins. These antioxidants are essential for improving the nutritional value of red rice in addition to giving it its characteristic color. Given that phenolic compounds are known for their antioxidant properties and potential health-promoting effects, the elevated phenolic content in red rice suggests that its consumption may confer positive health effects (Kang et al., 2013; Gunaratne et al., 2013).The findings of this study are consistent with previous research demonstrating a positive correlation between pigmented rice varieties and elevated phenolic content (Wisetkomolmat et al., 2023). Furthermore, the cultivation environment and agricultural practices in Sri Lanka may have contributed to the phenolic composition of the rice varieties examined.

Overall, these three assays showed that improved red rice varieties had significantly higher antioxidant properties than improved white rice varieties. Among the improved red rice varieties, LD408 exhibited the higher antioxidant properties, indicating significant potential to combat chronic diseases associated with oxidative stress. Previous studies have reported that red rice possesses significantly superior antioxidant properties compared to white rice (Samaranayake, et al., 2018; Gunaratne et al., 2013; Samaranayake et al., 2017). Further studies are essential to harness the full potential of these varieties and to support their successful integration into the agricultural landscape of Sri Lanka.

8.4 Moisture Content

Moisture content is a key parameter affecting rice quality, storage stability, and processing characteristics. These values fall within the recommended range for safe storage, preventing microbial growth and maintaining grain quality (Bhat et al., 2023; Samaranayake et al., 2017).

8.5 Carbohydrate Content

Rice grains consist mainly of carbohydrates. According to reports, rice in Sri Lanka provides roughly 45% of a person’s daily calorie needs (Sinthuja et al., 2021). The total carbohydrate content of the improved red and white rice varieties varied from 79.25± 0.010% to 88.30± 0.011% on a dry basis (Table 3). This study demonstrated that improved white rice varieties have higher carbohydrate content than red rice varieties. Carbohydrate content can also be increased with increasing rate of grain polishing during milling (Samaranayake et al., 2017; Sinthuja et al., 2021).

Foods that score high on the glycemic index often contain significant carbohydrates. With the increasing occurrence of diabetes and prediabetes, it is crucial to identify rice varieties that have lower glycemic indices. The presence of high dietary fiber, amylose content, and carbohydrate digestion enzyme inhibitors lowers a food's glycemic index (Abeysekera et al., 2017).

8.6 Protein Content

Rice grain protein content is an important grain quality parameter. In this study, the protein content was appreciably high (>6%) for all tested varieties. The second major constituent next to starch in the rice grain is protein (Kowsalya et al., 2022). In Sri Lanka, rice is reported to provide nearly 40% of the recommended daily protein requirement (Samaranayake et al., 2017). The protein content of the improved red and white rice varieties is in the range of 6.32 ± 0.064 %– 8.46 ± 0.028 % (Table 3). Analysis of 2674 rice varieties by the International Rice Research Institute (IRRI) showed that the protein content of *Oryza sativa* varieties ranged from 4.5% to 15.9%. The red variety Ld408 showed the highest protein content (8.46±0.028) while the Ld376 white rice variety showed the lowest protein content (6.32±0.064) among the selected improved rice varieties. According to the study, red rice varieties have higher protein content than the white rice varieties. Consumption of especially whole grains of Ld408, Ld368, and Ld365 rice varieties may be beneficial in obtaining a significant amount of the recommended daily protein requirement. Sinthuja et al., 2021, reported that red-pigmented rice has comparatively higher protein content than polished white rice varieties due to the presence of some amount of bran layer even after milling.

The nutritional assessment indicated that red rice types offer specific nutritional benefits in contrast to white rice. These findings highlight the potential of red rice as a nutritious food option that can contribute to a balanced and healthy diet.

8.7 Amylose Content

Rice contains a significant amount of starch, determining its cooking and eating characteristics. The endosperm, the inner part of the rice kernel, primarily comprises carbohydrates, mainly consisting of 85-90% starch, 2% pentose, and 1% sugars. Starch, comprising amylose and amylopectin, is crucial in defining the sensory and cooking qualities of rice. The amylose and amylopectin fractions within the rice kernel are crucial in determining these characteristics. Common rice varieties in Sri Lanka generally contain an amylose content ranging from 25% to 30%, resulting in firm, non-sticky cooked rice. Rice types with amylose levels below 6% tend to remain sticky post-cooking. Rice is divided into many classes based on its amylose content. Rice is classified as waxy (1-2%), very low amylose (2-12%), low amylose (12-20%), moderate amylose (20-25%), or high amylose (25-33%) (Abeysundara et al., 2017; Sompong et al., 2011).

9. Conclusion

The present study revealed that carbohydrate, protein, moisture, amylose content and antioxidant activity varied among the improved red and white rice varieties. Among the improved rice varieties, Ld408, Ld368, Ld365 have the highest antioxidant activity, total phenolic content, protein and the lowest carbohydrate content. The results indicate that Sri Lankan improved red rice varieties are more effective than the improved white rice varieties. Plant pigments and phytochemicals present in grains have garnered recent attention for their potential positive impact on nutrition, specifically in the prevention of cardiovascular diseases and cancer. This study focused on exploring the physiochemical content and total antioxidant properties of red and white rice varieties. Our findings elucidate the diverse range of phytochemicals present in these rice varieties and underscore a seamless transition between the two groups. Significantly, variations in phenolic acids and antioxidant properties were identified within the set, establishing each as a distinct source of phytochemicals.

This research contributes valuable insights for rice producers and food technologists, providing an understanding of the specific physiochemical composition and antioxidant capacities of red and white rice. Notably, the observed differences in phenolic acids and antioxidant properties emphasize the potential of these rice varieties as rich sources of bioactive compounds. The results have practical implications for promoting the consumption of rice products and for raising consumer awareness of the health benefits associated with grain consumption.

Looking ahead, further studies expect to investigate the impact of food processing on the functional properties of both red and white rice. This approach aims to identify recommended applications in food production, thereby contributing to the development of functional rice products with enhanced health-promoting properties.

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