Quality analysis of indigenous organic Asian Indian rice variety- *Salem samba*

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Rice is the world’s most important food crop and is a primary food source for over one third of the world’s population. The current scenario in the food and agriculture sector marks the sudden increase in concern towards organic farming and conservation of genetic biodiversity in rice production. The objective was to analyze the various quality aspects in terms of proximate and nutrient composition, physical characteristics, milling characteristics and physicochemical characteristics and cooking quality of organically grown traditional indigenous Asian Indian rice variety - *Salem samba*. The nutrient content of *Salem samba* was found to be relatively higher when compared to conventional rice varieties. And based on its proximate composition it was identified to give soft and non waxy cooked rice with medium amylose content which is ideal for cooking. Based on milling characteristics it was identified that parboiled milling is highly suitable. In terms of physiochemical characteristics, the indigenous rice variety *Salem samba* was identified to have a high intermediate gelatinization temperature and also formed a hard gel in terms of its gel consistency. The cooking quality was found to be satisfactory and was identified to have close interrelationship with physicochemical characteristics.

**Keywords:** Organic Asian Indian rice, Indigenous, Physicochemical, Milling, Parboiling, Cooking, *Salem samba*

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Rice is the world’s most important food crop and is a primary food source for over one third of the world’s population. According to FAO (2005) rice is second to wheat in terms of annual production for food use. It is grown widely on all continents and under all agro climatic conditions. This wide adaptation has led to the evolution of thousands of varieties of rice having diverse cooking, eating, and product-making characteristics.

The adoption of organic rice farming is one of the reasons that led to impressive increases in rice production. Organic farming has proved to have contributed significantly to the increase in yield and productivity of the rice when compared to the productivity in conventional rice farming. On the other hand the rice legacy of India in the rice genetic resources is unparalleled. Traditional rice varieties which combine good eating qualities, low risk and less farm care are considered superior by many compared to modern rice. Although the importance and benefits of organic farming have been emphasized in various studies, there are very few which deal with the quality characteristics of rice variety based on which its end use quality can be analyzed. There is a lack of evidence to display the efficiency and quality of the indigenous organic rice varieties all over the world, which has led to the lack of demand for these varieties, which eventually led to the extinction of various traditional varieties. Popularity for crops of High Yielding Varieties have also led to the decline in market popularity of organic rice varieties.

In this context the objective of the present study was to analyze the various quality aspects in terms of proximate and nutrient composition, physical characteristics, milling characteristics and physicochemical characteristics and cooking quality of organically grown traditional indigenous Asian Indian rice variety - *Salem samba*.

**Methodology**

Rice samples of the variety - *Salem samba* were procured from Centre for Indian Knowledge Systems, Chennai.

i) **Proximate analysis**

   a) **Determination of starch**: Total starch was determined by enzyme digestion based on the total
starch assay procedure (amyloglucosidase/α-amylase method) AACC method.

b) Determination of total amylose: The amylose content in the rice was determined using colorimetry method with iodine.

c) Determination of rice moisture: The percentage moisture content of the rice variety was determined using air oven according to AACC method.

d) Determination of equilibrium moisture content: Equilibrium moisture content was determined using the method suggested by Swamy et al (1971).

ii) Nutrient analysis

a) Determination of protein: The percentage protein content of the rice variety was determined using air oven according to AACC method.

b) Determination of fat: The crude fat content was determined by using petroleum ether as a solvent in a soxhlet apparatus according to the procedure given by AACC method.

c) Determination of crude fibre: For determination of fibre content, rice sample was digested with 1.25% H₂SO₄ followed by 1.25% NaOH solution and crude fibre content was determined according to AACC method.

d) Determination of total carbohydrates: Total carbohydrate content of the rice was done using the gravimetric method.

iii) Physical analysis

a) Length, breadth and thickness: Length, breadth and thickness are used to determine the average size of the grain and were measured using a micrometer (Miutoyo, Japan) reading to 0.01mm.

b) 1000 grain weight: Thousand-grain seed weight was determined by counting 100 kernels and weighing them in electronic weighing balance and then multiplied by 10 to give the mass of 1000 grains.

c) Bulk density: The Bulk density was calculated by dividing the weight of rice in the cup by the cup volume, taken as a standard dry quart. This procedure was repeated three times with the same sub sample to obtain an estimate of the measurement error.

d) Angle of repose: The angle of repose was measured based on the method suggested by Mohsenin, 1986.

e) Cracked grains %: Percentage cracked grains was determined by counting the number of cracked grains in a 100 grain sample using a paddy crack detector, and then the percent (%) cracked grains was determined by the equation.

% cracked grains = \( \frac{\text{No of cracked grains}}{100 \text{ grains}} \times 100 \)

g) Color value: Whiteness of the rice samples was measured using a kett digital whiteness meter (Model C-300, Japan) and color was measured using color difference meter (Model JC801, Japan).

h) Chalkiness: A visual rating of the chalky proportion of the grain was used to measure chalkiness based on the standard Evaluation System SE. On selecting and segregating the chalky grains (% area of chalkiness greater than 20) the % chalky grain was determined using the equation:

% chalky grains = \( \frac{\text{Wt of chalky grains}}{\text{Wt of milled rice}} \times 100 \)

iv) Milling characteristics

a) Husk percentage: The husking index of paddy was calculated based on the method suggested by Roohi, 2002.

Husk percentage was calculated using the equation:

\[ H = 100 \left( 1 - \frac{w_2}{w_1} \right) \left( \frac{w_3}{w_1} - w_2 - w_4 \right) \]

Where; \( H \) = Husking index, %; \( w_1 \) = Mass of sample before husking, gm; \( w_2 \) = Mass of unhusked paddy in the final product, gm; \( w_3 \) = Mass of brown rice in the final product, gm; \( w_4 \) = Mass of husks in the final product, gm.

b) Broken percentage: Using the grain grader, the broken grains were separated from the whole grains. The percentage of the broken rice was calculated using the following equations:

% brokens = \( \frac{\text{Wt of broken grains}}{\text{Wt of paddy samples}} \times 100 \)

c) Shelling breakage percentage: From the broken rice percentage the shelling performance was determined by calculating the ratio of the weight of shelled kernels to the total weight of the rice sample.

d) Head rice yield percentage: Using the grain grader, the broken grains were separated from the whole grains. The percentage of the head rice was calculated using the following equations:

% head rice yield = \( \frac{\text{Wt of whole grains}}{\text{Wt of paddy samples}} \times 100 \)
v) Physicochemical analysis

a) Gelatinization temperature: Gelatinization temperature was determined following the method of Patindol and Wang.

b) Alkali spreading value: Alkali spreading value was estimated by the extent of alkali spreading and clearing of milled rice soaked in 1.7% KOH at room temperature or at 39°C for 23 hrs.

c) Gel consistency: The Gel consistency was measured using the method suggested by Cagampang et al (1973).

d) Water uptake ratio: A 2 gm sample of rice was taken in a small beaker and cooked with 20 ml of water for a cooking time of 5 minutes under pressure. On cooling the water uptake ratio was determined by decanting the unabsorbed water and calculating the water taken up by rice in ml. It was expressed as gm of water used/gm of rice.

vi) Rapid Visco analysis: Paste viscosity of rice was determined using a Rapid Visco TM Analyzer according to the AACC method.

vii) Cooking characteristics

a) Solid gruel loss: Head rice samples (2 gm) in 20 ml distilled water were cooked for minimum cooking and the gruel was transferred on several washings and made to volume with distilled water. The aliquot having leached solids was evaporated at 110°C in an oven until completely dry. The solids were weighed and percent gruel solids were reported.

b) Optimum cooking time: Head rice (2 gm) samples were taken in a test tube from each variety and cooked in 20 ml distilled water in a boiling water bath. The cooking time was determined by removing a few kernels at different time intervals during cooking and pressing them between two glass plates until no white core was left.

c) Cooked length–breadth ratio, L: B: Cooked length–breadth ratio was determined by dividing the cumulative length of 10 cooked kernels by the breadth of 10 cooked kernels. A mean of 10 replications was reported.

d) Elongation ratio: Cumulative length of 10 cooked rice kernels was divided by length of 10 uncooked raw kernels and the result was reported as elongation ratio.

vii) Statistical analysis: The statistical analysis of physicochemical characteristics of the indigenous rice variety - Salem samba were evaluated by calculating the standard deviation and arithmetic mean of the test values. Interrelation between the physicochemical characteristics and association with the cooking and grain dimensions were analysed using correlation analysis.

Results and discussion

The quality of the organic, Indian rice variety- Salem samba to assess based on various parameters such as proximate analysis, nutrient analysis, Rapid Visco Analysis and analysis of physicochemical and cooking characteristics. The results are presented and discussed as follows:

Proximate composition of Salem samba

Selective proximate analysis was carried out to estimate the composition of rice. The proximate composition of Salem samba is given below in Table 1.

The starch percentage in the rice variety Salem samba was estimated to be 76.8% and did not have a significant difference from the amount of starch in normal polished raw rice which was found to be 78.2%.

Salem samba was identified to be a medium amylose rice variety with amylose content of 21.2% (Insoluble amylose – 14.6% and soluble amylose – 6.6%). Based on the amylose percentage it can be established that Salem samba gives soft cooked rice as amylose influences the texture of cooked rice. The percentage of amylpectin in Salem samba was estimated to be 55.6% based on which Salem samba can be classified as a non-waxy starch variety.

Ratio of amylose and amylpectin in Salem samba was determined to be 2.33. According to Leloup et al (1991) when the ratio of amylose and amylpectin exceeds 2.5 it can have a strong influence on the swelling index based on which it can be concluded that the ratio does not affect the swelling index of Salem samba.

Salem samba was identified to be a low moisture rice variety with moisture content of 9.3%. This was low when compared to moisture in standard milled rice (13.5%), which substantiates the fact that Salem samba has a longer shelf life. The equilibrium moisture content, which is a measure of hydration capacity of rice varieties, was identified to be 38.6 % on dry basis.

Nutrient Composition of Salem samba

The organically grown Salem samba rice was analyzed for its nutrient composition. The result of the nutrient analysis are tabulated in Table 2.
Nutrient analysis for protein revealed that organically grown *Salem samba* rice had 0.7% higher protein content when compared to normal Raw milled rice. This higher amount of protein content could be attributed to the fact that this rice variety is organically grown.

The amount of fat present in bran and rice for *Salem samba* rice variety was estimated to be 22.6% and 1.18%, whereas for normal raw rice the fat content in bran and rice was found to be 16.2 and 0.5%. From the obtained values for fat it is evident that there is relatively a two-fold increase in the fat content of organically grown rice. This also makes it evident that the bran of *Salem samba* rice has a high fat composition and hence can be used in rice bran oil extraction.

It is noted that fiber present in the bran of organically grown *Salem samba* also had a two fold increase (8.5%) when compared to the normal raw rice (4.3%). The fiber content in rice was found to be similar in both *Salem samba* and normal polished raw rice, which was 0.2%.

**Physical characteristics of *Salem samba***

The length, breadth, thickness and LB ratio was calculated for *Salem samba*. The values are as shown in Table 3.

The reduction in the L, B, T value of brown rice from paddy could be attributed to dehusking factor, as husk removed affects the grain dimensions due to milling loss. *Salem samba* can be classified as a medium slender rice grain based on the L: B ratio of 2.5.

The whiteness % for *Salem samba* rice was 22.7%. The whiteness percentage of *Salem samba* (40.0) on milling is similar to the standard USDA value for raw polished rice (43.7%).

The thousand grain weight of paddy and brown rice was found to be 16.9gm and 13.5gm respectively. According to Luh (1980), values below 20gm indicate the presence of immature, damaged or unfilled grains thus *Salem samba* has a very low 1000 grain weight. This could be attributed to low moisture content in *Salem samba*, which increases the probability of more damaged grains in milling.

The bulk density of *Salem samba* was estimated to be 575.45 (gm/l). According to Bhattacharya *et al* (1972) bulk density is related to the kernel shape (i.e.) L:B ratio; the more round the kernel the greater the bulk density and since *Salem samba* was classified under medium slender variety the bulk density can be claimed to be slightly low.

Angle of repose of *Salem samba* was recorded to be 36.5°. In general according to Mohsenin (1986) the standard value of angle of repose for paddy was identified to be 35.83°. This slight increase in the angle of repose value may be attributed to increase in the internal friction due to increase in the moisture content during the storage period of paddy.

The chalkiness percentage (Table 4) of *Salem samba* (48%) establishes the fact that nearly 50% of the rice kernel was chalky and based on the grading system *Salem samba* was determined to be a chalky grain variety. This can also be attributed to the fact that *Salem samba* is an immature grain based on its 1000 grain weight as mentioned above.

**Milling Characteristics of *Salem samba***

Milling characteristics of *Salem samba* were analyzed both in raw and parboiled rice (Table 5).

Husk percentage of raw and parboiled *Salem samba* rice was similar and was 23.04% and 23.52% respectively as shown in Table 5. According to Sample *et al* (1992) presence of excessive amounts of...
immature grains in paddy lowers milling yield and increases the husk production and ranges between 30-40 % of the grain weight. Therefore, husk % in Salem samba both in raw and parboiled milling was satisfactory.

The polish percent of raw Salem samba rice was estimated to be 7.0% and 4.8% for parboiled Salem samba rice (Table 5). The degree of polishing was decreased when the rice was parboiled. This is because on parboiling rice polishing is difficult.

The shelling breakage of raw Salem samba rice was 4.95% and 0.90% for raw and parboiled Salem samba rice respectively (Table 5). There was a significant decrease in shelling breakage of Salem samba on parboiling which can be attributed to the fact that rice toughens on parboiling which on excessive parboiling can increase the shelling breakage.

The polished rice yield% (PRY%) of raw and parboiled Salem samba rice were estimated to be 67.69% and 72.51% respectively (Table 5). The PRY% increased by 4.82% on parboiling the rice this can again be attributed to the fact that parboiled rice is tough in texture when compared to raw rice and hence milling yield is considerably higher.

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Broken rice percentage of raw Salem samba rice was 39.95% and the percentage of broken rice on parboiling resulted in only 0.50% of broken rice (Table 5). Keeratipibul (2008) identified that incorporation of the rice variety with high broken percentage influences the final products significantly with greater amylose content, harder gel, less swelling, lower volume expansion and harder texture. Similar alkali spreading values have been recorded by Nayak and Reddy (2004) in their study on scented rice varieties. The alkali spreading value was determined to have a strong significant negative correlation with the gelatinization temperature (r: -0.82; p <0.05).

Physicochemical characteristics of Salem samba

Salem samba was determined to have high gelatinization temperature (76.52°C) based on IRRI classification (Table 6). Similar high gelatinization temperature was identified in Mahsuri variety and Pajang variety.

In terms of alkali spreading value Salem samba was determined to have a high intermediate gelatinization temperature with an alkali spreading value of 2.27. Similar alkali spreading values have been recorded by Nayak and Reddy (2004) in their study on scented rice varieties. The alkali spreading value was determined to have a strong significant negative correlation with the gelatinization temperature (r: -0.82; p <0.05).

Table 5—Raw milling and parboiled milling performances of Salem samba rice

<table>
<thead>
<tr>
<th>Salem samba</th>
<th>Husk%</th>
<th>Polished Rice yield%</th>
<th>Polish%</th>
<th>Shelling Breakage%</th>
<th>Broken%</th>
<th>Head Rice Yield%</th>
<th>Moisture Content% Paddy</th>
<th>Rice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw</td>
<td>23.04</td>
<td>67.69</td>
<td>7</td>
<td>4.95</td>
<td>39.95</td>
<td>40.65</td>
<td>8.68</td>
<td>12.9</td>
</tr>
<tr>
<td>Parboiled</td>
<td>23.52</td>
<td>72.51</td>
<td>4.8</td>
<td>0.90</td>
<td>0.50</td>
<td>72.15</td>
<td>9.3</td>
<td>13.6</td>
</tr>
</tbody>
</table>
Salem samba was identified to have a hard gel consistency (25.43mm) based on IRRI classification of gel consistency. Various other varieties recorded having high gel consistencies in the past studies were Taichung native 1 and IR42\cite{38,39}. Gel consistency of Salem samba had a strong significant positive correlation (r:0.97) with alkali spreading value similar to the results of Choudhry et al (1991)\cite{40} and with gelatinization temperature which was similar to the findings of Khatun et al (2003) and Nkori (2007)\cite{41,42}.

The water uptake ratio of Salem samba at 60°C was found to be 0.15 and at 90°C it was found to be 1.42. Various studies have revealed correlations between water uptake ratio and other physicochemical parameters.

Water uptake ratio was determined to have a strong significant negative correlation (r: -0.98) with gelatinization temperature and gel consistency (r: -0.57) similar to the results obtained by Khatun et al (2003)\cite{41}.

The cooking behavior of starches and the viscosity of the resulting pastes can be studied with an instrument called Rapid Visco Analyser (RVA).\cite{43} The RVA profile is generally used as one of the indirect indicators for eating quality in rice sensory evaluation. The results of the RVA analysis of Salem samba is tabulated in Table 7 and graphically represented in the Fig 1.

Viscosities at the start of the holding period and during cooling reflect the ease of cooking starch and paste stability, respectively\cite{44}. Each viscosity is used to identify a particular characteristic of the rice variety. Zobel (1984) explained that increase in paste viscosity, when a hot paste is cooled, is governed by the tendency of the starch to undergo retrogradation. Breakdown viscosity measures the tendency of swollen starch granules to rupture when held at high temperatures and continuous shearing\cite{45}. Setback viscosity indicates the degree of retrogradation\cite{46}.

**Cooking Characteristics of Salem samba**

The various cooking characteristics analyzed and the results obtained are tabulated in Table 8. The interrelationship between the cooking characteristics and physicochemical characteristics of Salem samba was evaluated by correlation coefficients (Table 9). Also the influence of cooking characteristics on each other was evaluated based on their correlation coefficients as shown in Table 10.

During cooking, the starch content of the milled rice kernel absorbs moisture and swells due to its gelatinization. Also, some solid content of the milled rice is dissolved into the cooking gruel. The solid gruel loss on the organic Indian rice variety Salem samba was determined as 7%. Kernel elongation ratio means the proportionate change of rice grain after cooking in terms of both length and breadth.

The elongation ratio of the organic rice variety Salem samba has been identified to be 1.54. The optimum cooking time of Salem samba was identified to be 18 min. In terms of grain dimensions after cooking it was identified to be 8.4mm in length, 3.5mm in breadth and the ratio L: B was identified to be 2.3.

Solid gruel loss was also determined to have a strong positive correlation with gel consistency optimum cooking time, length and breadth on cooking and a negative correlation with gelatinization temperature, alkali spreading value, water uptake ratio, L: B ratio and L: B ratio on cooking.

Elongation ratio has a significant interrelationship with other cooking characteristics. Elongation ratio was identified to have a strong positive correlation with alkali spreading value, water uptake ratio, kernel length and L: B ratio after cooking and negative correlation with gelatinization temperature, gel consistency, optimum cooking time and kernel breadth after cooking.

| Table 7—Rapid Visco Analysis of Salem samba |
| Parameters | Value |
| Moisture Content % | 10.4 |
| Viscosity RVU |
| 1. Peak | 3326 |
| 2. Hot paste | 3050 |
| 3. Cold paste | 8405 |
| 4. Breakdown | 276 |
| 5. Setback | 5079 |
| 6. Consistency | 5355 |
| Rate of heating °C | 12.9 |
| Rate of cooling °C | 11.6 |
| RPM |
| 1. 1-10\textsuperscript{th} second | 960 |
| 2. after 10\textsuperscript{th} second | 160 |

| Table 8—Cooking characteristics of Salem samba |
| Cooking Characteristics | Value |
| 1. Gruel loss % | 5.7 |
| 2. Elongation ratio | 1.54 |
| 3. Optimum cooking time, mins | 8.9 |
| 4. Cooked Rice Volume m/10g | 380 |
| 5. Length of cooked rice mm | 8.4 |
| 6. Breadth of cooked rice mm | 3.5 |
| 7. L: B of cooked rice | 2.57 |
Optimum cooking time had a positive correlation with gelatinization temperature, gel consistency, alkali spreading value, water uptake ratio, solid gruel loss and kernel breadth after cooking and had a negative correlation with elongation ratio, cooking time and kernel length and L: B after cooking.

Length of cooked rice had a positive correlation with gruel loss and breadth of cooked rice and a negative correlation with optimum cooking time, elongation ratio and L: B ratio on cooking. Breadth of cooked rice has a positive correlation with gruel loss, optimum cooking time and length on cooking and a negative correlation with elongation ratio and L: B ratio on cooking, L: B on cooking had a positive correlation with elongation ratio and a negative correlation with all the other cooking characteristics. Similar correlation results were obtained by Choudhury et al. (1991) and Khatun et al., (2003).

Table 9—Correlation of Physicochemical and cooking characteristics of Salem samba

<table>
<thead>
<tr>
<th></th>
<th>Temperature</th>
<th>Consistency</th>
<th>Value</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>L:B on cooking</td>
<td>0.87*</td>
<td>0.25*</td>
<td>-0.44</td>
<td>0.97*</td>
</tr>
<tr>
<td>Solid Gruel Loss</td>
<td>-0.29*</td>
<td>0.48*</td>
<td>-0.29</td>
<td>-0.99</td>
</tr>
<tr>
<td>Elongation Ratio</td>
<td>-0.2*</td>
<td>-0.55*</td>
<td>0.37*</td>
<td>0.98*</td>
</tr>
<tr>
<td>Optimum Cooking Time</td>
<td>0.53*</td>
<td>0.63*</td>
<td>0.99*</td>
<td>0.26*</td>
</tr>
<tr>
<td>Length on cooking</td>
<td>0.99</td>
<td>-0.32*</td>
<td>0.5*</td>
<td>0.96*</td>
</tr>
<tr>
<td>Breadth on cooking</td>
<td>0.99</td>
<td>-0.31*</td>
<td>0.5</td>
<td>0.95*</td>
</tr>
</tbody>
</table>

* Significant at the level $p \leq 0.05$

Table 10—Correlation between cooking characteristics of Salem samba

<table>
<thead>
<tr>
<th></th>
<th>Gruel Loss</th>
<th>Elongation Ratio</th>
<th>Optimum Cooking Time</th>
<th>Length on cooking</th>
<th>Breadth on cooking</th>
<th>L:B on cooking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gruel Loss</td>
<td>1</td>
<td>-0.99*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elongation Ratio</td>
<td>-0.99*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimum Cooking Time</td>
<td>0.98*</td>
<td>-0.99*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length on cooking</td>
<td>0.67*</td>
<td>-0.6*</td>
<td>-0.44*</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breadth on cooking</td>
<td>0.68*</td>
<td>-0.61*</td>
<td>0.53*</td>
<td>0.99*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>L:B on cooking</td>
<td>-0.72*</td>
<td>0.66*</td>
<td>-0.58*</td>
<td>-0.99*</td>
<td>-0.99</td>
<td>1</td>
</tr>
</tbody>
</table>

* Significant at the level $p \leq 0.05$

Fig. 1—Rapid Visco Analysis of Salem samba

Optimum cooking time had a positive correlation with gelatinization temperature, gel consistency, alkali spreading value, water uptake ratio, solid gruel loss and kernel breadth after cooking and had a negative correlation with elongation ratio, cooking time and kernel length and L: B after cooking.

Length of cooked rice had a positive correlation with gruel loss and breadth of cooked rice and a negative correlation with optimum cooking time, elongation ratio and L: B ratio on cooking. Breadth of cooked rice has a positive correlation with gruel loss, optimum cooking time and length on cooking and a negative correlation with elongation ratio and L: B ratio on cooking, L: B on cooking had a positive correlation with elongation ratio and a negative correlation with all the other cooking characteristics. Similar correlation results were obtained by Choudhury et al. (1991) and Khatun et al., (2003).

**Conclusion**

From the above results it can be concluded that the organic indigenous rice variety *Salem samba* is ideal for consumption and further utilization in rice by-products. The nutrient content of organically grown *Salem samba* rice was found to have a relatively higher nutrient content when compared to conventional rice varieties. It can be concluded that *Salem samba* results in soft and relatively sticky cooked rice with medium amylose content which is ideal for cooking. It is non-waxy rice with a low moisture content.

The physical analysis revealed that this variety has good physical quality traits that are in acceptable levels by exporters and consumers and ideal for a good milling output. Based on the milling characteristics it can be concluded that milling on parboiling was highly beneficial in terms of milling characteristics when compared to raw milling.

In terms of physiochemical characteristics, the indigenous rice variety *Salem samba* was identified to have a high intermediate gelatinization temperature and also formed a hard gel in terms of its gel consistency. The cooking quality was found to be satisfactory. The cooking characteristics of *Salem*
Salem samba made it evident that these properties were highly beneficial and was of good quality similar to various other commercial and traditional rice varieties. It was also identified that there was a close interrelationship between the physicochemical and cooking characteristics of Salem samba.

Based on the above conclusions it can be claimed that Salem samba is a highly beneficial organic variety, which can serve as a healthy substitute for the various conventional rice varieties available in the market.

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