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Characterization and End-Use Qualities of Rice Varieties in Kogi State, Nigeria

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ABSTRACT

Background and Objective: *Oryza glaberrima* (*Oje-igbale*) and *Oryza sativa* L. *Oryza glaberrima* hybrid (*Adede-agidi)* are two rice varieties cultivated in Ibaji LGA of Kogi State, Nigeria and each of them is used for only a singular purpose. Studies were carried out to find out the characteristics of these grains and further processes they could be subjected to contribute to the strive for food security. **Materials and Methods:** Three samples of each, of the two different rice varieties' paddy, were procured, cleaned, 2 kg portion parboiled, milled and thereafter analyzed for their physical and cooking, attributes. Un-parboiled paddy (500 g) of the two rice varieties were de-husked, milled into flour and samples were used to determine their physicochemical properties. **Results:** For the physicochemical properties, the starch content of *Oje-igbales* was of hard gel consistency (29.32-38.11 mm) and intermediate-amylose content (20.78-24.68 %) depicting it will be a good variety for a long time and high-temperature treatment processes. The starch content of the *Adede-agidis*' was of soft gel consistency (66.43-72.52 mm), low-and intermediate-amylose content (18.47-20.23%) depicting it will be suitable for breakfast cereals, fermented rice cakes and baby foods. **Conclusion:** This research provides knowledge on the characteristics and other end-use qualities of *Oje-igbale* and *Adede-agidi* for value addition.

KEYWORDS

Rice, end-use quality, O*je-igbale, Adede-agidi, Oryza glaberrima, Oryza sativa,* dumplings

INTRODUCTION

Rice is a staple food in Nigeria, generally considered a semi-aquatic annual grass plant, although it survives as a perennial plant in the tropics. Rice is grown in all ecological and dietary zones of Nigeria, with different varieties possessing adaptation traits of each ecology[1]. A hybrid of *Oryza sativa-Oryza glaberrima* species named *Adede-agidi* in Ibaji dialect which is high yielding and able to withstand biotic and abiotic stresses of African ecology is the most common variety grown in Ibaji Nigeria. *Adede-agidi is* used solely in preparing whole cooked rice grains for consumption. A small amount of the *Oryza glaberrima* species named *Oje-igbale* in Ibaji dialect is also grown in Ibaji, which is used solely for preparing dumplings. Ibaji, a local government area in Kogi State, Nigeria has headquarters in Onyedega with an area of 1,377 km² and a population of 128,129. Over 90 percent of the inhabitants are farmers who feed their families with their products and make proceeds from them[2]. *Adede-agidi* is strictly consumed as cooked whole grains

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eaten accompanied with sauce while *Oje-igbale* is strictly consumed by milling the de-husked grain into flour and processed into rice dumpling which is eaten accompanied by local soups. Both have the same husk colour but *Oje-igbale* has red coloured bran instead of white like the *Adede-agidi* and other common rice grains cultivated in other parts of Nigeria.

Uses and different processing applications of rice include boiled whole grain rice, breakfast cereals, brewers rice, canned rice, baby foods, quick-cooking, convenience and speciality food products, rice flour as a thickener and rice starch, for industrial and other processes[3]. Rice end-use depend on the inherent characteristics of the rice grain which include amylose content, gel consistency, gelatinization temperature and physical dimensions. There is a need to know other end-use qualities of *Oje-igbale* and *Adede-agidi* through characterization for value addition thereby contributing to food security. It is recognized that indigenous foods and dietary diversity among indigenous foods within an ecosystem can be powerful sources of nutrients and thus mediums for better health and food security[4]. The objective of this study was to characterize and determine other end-use qualities of *Oje-igbale* and *Adede-agidi* for value addition thereby contributing to food security

MATERIALS AND METHODS

Study area: The study area where samples were collected was from farmers in Ibaji LGA of Kogi State. All the analyses were performed in the Food Processing and Chemistry Laboratory of the Department of Food Science and Technology, University of Nigeria, Nsukka from May to August, 2019.

Materials: Three samples each of *Oje-igbale* and *Adede-agidi* rice varieties paddy were purchased from different farmers in different locations in Ibaji LGA of Kogi State and coded, OJ_1, OJ_2 and OJ_3 and AA_1, AA_2 and AA_3, respectively.

Methods: The samples were taken to the Food Processing Laboratory of Food Science and Technology, of the University of Nigeria, Nsukka for parboiling and milling with Engelberg Huller. A portion of the paddy of the two different rice varieties was not parboiled but dehulled and milled to flour for determining functional properties.

Determination of functional properties

Gel Consistency (GC) determination: Gel Consistency (GC) of rice samples was determined according to the method of Bhat and Riar[5] as reported by Kaur *et al.*[6]. After sample preparation and analysis, the tubes containing the analyte were laid horizontally over a ruled paper graduated in millimetres and the length of the gel from the bottom of the test tube was measured after 45 min. The sample is categorized according to the standard as shown in the footnote of Table 1.

Amylose content determination: Amylose Content (AC) was determined according to the method described by Villota *et al.*[7]. The analyte was shaken and allowed to stand for 20 min and the per cent Transmittance was determined at 620 nm using a colorimeter. The amylose content of the samples was determined by a standard curve (graph) and expressed on a percentage basis as shown in Eq. 1:

$$\text{Amylose}\ (\%) = \frac{\text{Amylose content of standard} \times \text{Absorbance of rice sample}}{\text{Absorbance of standard sample}} \quad (1)$$

$$\text{Amylopectin}\ (\%) = 100 - \%\ \text{Amylose}$$

Physical properties of the rice varieties

Determinations of grain dimensions: Rice grain dimensions-grain length and width were determined using a digital vernier calliper (0.1-100 mm A&D Company, Limited) according to the method by Odenigbo *et al.*[8].

Table 1: Physicochemical properties of *Adede-agidi* and *Oje-igbale* rice varieties

Rice samples	Gel consistency (mm)	Gel consistency behaviour	Amylose (%)	Amylopectin (%)	Classification based on amylose content
AA_1	66.43±0.04^d	Soft	19.47±0.02^b	80.47±0.02^d	Low
AA_2	68.60±0.01^e	Soft	20.23±0.04^c	79.22±0.02^c	Intermediate
AA_3	72.52±0.02^f	Soft	18.47±0.01^a	81.54±0.02^e	Low
OJ_1	29.23±0.04^a	Hard	20.78±0.00^d	79.25±0.04^c	Intermediate
OJ_2	38.11±0.01^c	Hard	24.68±0.02^e	78.34±0.01^c	Intermediate
OJ_3	32.67±0.00^b	Hard	24.20±0.05^e	75.83±0.04^b	Intermediate

Values are means±standard deviation of duplicate determination, means in the same column carrying similar superscripts are not significantly ($p<0.05$) different, Gel consistency: Soft gel consistency = 61-100 mm, medium = 41-60 mm, hard = 26-40 mm, Amylose content: Waxy (1-2% amylose), very low amylose content (2-9% amylose), low amylose content (10-20% amylose), intermediate amylose content (20-25% amylose), high amylose content (25-33% amylose), AA_1-AA_3 (*Adede-agidi* rice variety from three different farmers) and OJ_1-OJ_3 (*Oje-igbale* rice variety from three different farmers)

Determination of grain length: Ten milled whole rice grain samples of each variety were randomly selected and the length of the grains was measured using a digital calliper (0.1-100 mm A&D Company, Limited). The mean value of each variable was determined and noted. The value obtained was recorded as each sample's grain length.

Determination of grain shape: Ten milled whole rice grain samples of each variety were randomly selected and the width of the grains was determined with a digital calliper (0.1-100 mm A&D Company, Limited). The mean value of each variable was obtained and the length/width ratio of the samples was calculated as shown in Eq. 2:

$$\frac{L}{W}\text{ratio} = \frac{\text{Average length of rice } L_l \text{ (mm)}}{\text{Average width of rice } Wd_l \text{ (mm)}} \tag{2}$$

The value obtained was recorded as grain shape for each sample.

One thousand grain weight (W_1): One hundred milled kernel representative samples (triplicates) for each variety were randomly selected. The weight of each sample was determined using a 500 g capacity weighing scale (Electronic Pocket Scale Model EHA251). The value obtained was multiplied by 10 and the mean weight of the samples obtained was noted as W_1.

Determination of the volume of raw rice grains: The volume of raw rice grain was determined by the displacement method as described by Kaur *et al.*[6]. One hundred raw rice grains were placed in a measuring cylinder containing 20 mL of water (V_1). The new volume of water after the raw rice grains was added to the measuring cylinder was noted as (V_2). The volume of raw grains (V_3) was obtained by subtracting the volume of water containing raw rice grains from the initial volume of water contained in the measuring cylinder (Eq. 3):

$$V_3 \text{ (mL)} = V_2 - V_1 \tag{3}$$

Where:

V_3 = Volume of raw grain
V_2 = Volume of water after the raw rice grains were added to the measuring cylinder
V_1 = The 20 mL of water which was an initial volume of water in the measuring cylinder before grains were added to the measuring cylinder

Density of raw rice grain: The density of the rice grain samples was obtained by dividing the weight of raw rice grain by its volume (Eq. 4):

$$\text{Density (g mL}^{-1}) = \frac{\text{Weight of raw rice grain } W_l \text{ (g)}}{\text{Volume of raw rice grain } V_3 \text{ (mL)}} \tag{4}$$

Cooking analysis

Minimum and optimum cooking time: The minimum and optimum cooking time were determined according to the method by Odenigbo *et al.*[8].

Quantity of water absorbed: The quantity of water absorbed by rice samples was determined as described by Azuka *et al.*[9].

$$\text{Quantity of water absorbed } V_6 \text{ (mL)} = 60\text{-}V_5 \quad (5)$$

Volume expansion ratio: The volume expansion ratio was determined according to the method as described by Chukwuemeka *et al.*[10]. The volume expansion ratio is calculated as follows Eq. 6:

$$\text{Volume expansion ratio} = \frac{V_8}{V_3} \quad (6)$$

Where:

V_8 = Volume of cooked rice

V_3 = Volume of raw rice

Weight increase: The increase in weight of rice samples was obtained as described by Azuka *et al.*[9]. The increase in weight was obtained by subtracting the weight of cooked rice grains from the uncooked rice grains as shown in Eq. 7:

$$\text{Weight increase (g)} = W_2\text{-}W_1 \quad (7)$$

Where:

W_2 = Weigt of cooked rice grain

W_1 = Weight of raw rice

Elongation ratio: The elongation ratio of rice grain samples was determined according to the method of Odenigbo *et al.*[8] using ten cooked samples of each variable and ten uncooked rice grains. Their Elongation ratio was obtained as shown in Eq. 8:

$$\text{Elongation ratio} = \frac{\text{Average length of cooked grains}}{\text{Average length of uncooked grains } (L_1)} \quad (8)$$

Water Uptake Ratio (WUR): The water uptake ratio was determined according to the method described by Pokhrel *et al.*[11]. Four grams of whole milled kernel rice sample was measured in triplicates and cooked in 60 mL of water for 20 min. The sample was removed from heat and the cooked grains were strained and placed on a filter paper to remove excess water and weighed and calculated as shown in Eq. 9:

$$\text{Water uptake ratio} = \frac{\text{Weight of cooked rice sample}}{\text{Weight of raw milled rice sample}} \quad (9)$$

Statistical analysis: A Completely Randomised Design (CRD) was used for this study. The data generated from all analyses and sensory evaluations were subjected to statistical Analysis of Variance (ANOVA) using SPSS (version 20). Means were separated using Duncan's Multiple Range Test[12].

RESULTS AND DISCUSSION

Functional properties of rice varieties: Table 1 shows the functional properties of *Adede-agidi* and *Oje-igbale* rice varieties.

The gel consistency value of the *Oje-igbale* rice varieties ranged from 29.23-38.11 mm while that of *Adede-agidi* ranged from 66.43-72.52 mm. Significant ($p<0.05$) differences exist between the gel consistency of the two rice varieties. Gel consistency measures the tendency of the starch content of the cooked rice to harden after cooling, the values of *Oje-igbale* (29.23-38.11 mm) showed its rice starch to be of hard gel-consistency while the values of *Adede-agidi* (66.43-72.52 mm) denotes its rice starch to be of soft gel-consistency. Rice varieties of that of hard gel consistency harden when cooked and cooled and are not preferred for consumption as whole grains but find use in canned rice products, prepared convenience products, rice noodle manufacture, dumpling and any other high-temperature treatment processes due to their resistance to splitting into cooking water during boiling rice of soft gel consistency is tender when cooked, hardened slightly when cooled and preferred for consumption which *Adede-agidi* possess. The hard gel consistency of *Oje-igbale,* explains why it is not cooked as a whole grain for consumption but used in making dumplings, while the tenderness of *Adede-agidi* explains why it is preferred for consumption as cooked whole grains. *Adede-agidi* rice varieties with soft gel consistency can also find application in making baby foods. Results from Oko *et al.*[13] showed the gel consistency of the samples to range between 43.00-54.00 mm and were described as rice of medium gel consistency. Different categories of gel consistency are shown in the footnote of Table 1.

The AA_1 and AA_3 had amylose content of 19.47 and 18.47, respectively which makes them low-amylose rice grains while AA_2 had an amylose content of 20.23% which makes it intermediate amylose rice grain. Low-amylose rice grains are desirable in making breakfast cereals, baby foods and risottos while intermediate amylose rice grains can be used in making fermented rice cakes. Amylose content of the *Oje-igbale* variety ranged from 20.78-24.68% and makes them intermediate-amylose rice grains. Differences between amylose content of the same varieties could be a result of ecology where the grains were planted since the grains were procured from different farmers at different locations. The amylose content in rice is considered the single most important characteristic used in describing and predicting rice cooking and processing qualities[14]. High amylose grains cook dry, are less tender and become hard upon cooling while low amylose grains cook moist and sticky and find use in baby cereals and risottos. Intermediate amylose rice is preferred in most rice-growing areas of the world for consumption because it is tender and non-sticky. Rice of the same amylose content is usually differentiated from themselves with their degree of a gel consistency.

Rice varieties of intermediate amylose-hard gel consistency are less tender compared to that of an intermediate amylose-soft gel consistency. Low amylose- soft gel consistency rice varieties (AA_1 and AA_3) are most tender and suitable for use in baby foods, cooked whole grains and breakfast cereals because of their ability to produce a relatively stable gel during storage. They can also be used as popped and puffed rice as a result of expansion in volume[6,15]. Varieties with intermediate amylose-soft gel consistency (AA_2) are used in making fermented rice cakes, because of their optimum volume expansion on steaming and their soft texture while intermediate amylose hard-gel consistency grains (*Oje-igbales*) will find application in canned rice products, rice noodle manufacture, dumpling and any other high-temperature-long time treatment processes.

Physical dimensions: Table 2 shows the dimensions of the uncooked rice grains. The length of *Adede-agidi* samples ranged from 5.42-5.92 mm, making it a bowl of medium-grain rice. The length of the *Oje-igbale* variety ranged from 6.48-6.69 mm which makes it long-grain rice. Significant ($p<0.05$)

Table 2: Dimensions and classification of *Adede-agidi* and *Oje-igbale* rice varieties

Rice samples	Length (mm)	Classification	Width (mm)	Length: width ratio	Classification	Weight (g)	Classification	Volume (mL)	Density (g mL^{-1})
AA_1	5.70±0.12^b	Medium	2.25±0.01^c	2.51±0.01^b	Bold	19.02±0.00^a	Moderately heavy	11.62±0.02^b	1.73±0.00^b
AA_2	5.42±0.02^a	Medium	2.23±0.02^c	2.44±0.01^a	Bold	20.67±0.02^d	Heavy	11.63±0.01^b	1.74±0.03^b
AA_3	5.92±0.02^c	Medium	2.27±0.02^c	2.62±0.01^c	Bold	19.83±0.01^b	Moderately heavy	10.49±0.01^a	1.83±0.02^c
OJ_1	6.65±0.02^e	Long	2.12±0.02^b	3.17±0.02^e	Slender	21.72±0.06^e	Heavy	13.20±0.02^d	1.86±0.00^c
OJ_2	6.48±0.08^d	Long	2.14±0.01^b	3.01±0.02^d	Slender	20.34±0.02^c	Heavy	12.68±0.01^c	1.62±0.02^a
OJ_3	6.69±0.02^e	Long	2.01±0.01^a	3.35±0.03^f	Slender	22.01±0.01^f	Heavy	12.64±0.01^c	1.73±0.01^b

Values are means±of duplicate determination standard deviation, means with different superscript within the same column differ significantly ($p<0.05$), Length = Extra-long-≥7.0, long-6.00-6.99, medium-5.0-5.99, short <5.0, Shape = Slender->3.0, bold-2.0-3.0, round-<2.0. Weight = Extra-heavy->25 g, heavy-20-25 g, moderately heavy <20 g, AA_1-AA_3 (*Adede-agidi* rice variety from three different farmers) and OJ_1-OJ_3 (*Oje-igbale* rice variety from three different farmers)

differences exist in all the dimensions of the raw rice grain varieties. Cooked grains of medium-grain rice varieties are moist and tender and have a greater tendency to cling together than long grain rice and are desirable in making baby foods, whole cooked grains, breakfast cereals and risottos[16,17].

Medium grain rice varieties have low to intermediate amylose content which describes the *Adede-agidi* varieties. Milled rice of typical long-grain varieties usually cooks dry and fluffy when boiled or steamed[3,15,16]. The cooked grains lie separate and are generally preferred for use in prepared products such as canned rice, canned soups, dry soup mixes, frozen dishes and other convenience-type rice-containing foods[3]. Long-grain and extra-long-grain rice have intermediate to high amylose content which describes the *Oje-igbale* varieties. Results from Danbaba *et al.*[16] showed the samples studied to be 6.69-5.44 mm, indicating long-grain to medium grain rice and were within the reported range.

Adede-agidi varieties are bold grains (2.44-2.62 mm) while *Oje-igbale* rice varieties are slender grains (3.01-3.35 mm). These rice varieties will make use of different post-harvest equipment due to differences in their length-width ratio to reduce the number of broken and obtain high head-rice. Length:width ratio (shape) is said to be probably the most meaningful of the determinations since it is used in sizing rice with slotted sieves or precision graders[3]. The knowledge of length-width ratio is used in sorting, grading, cleaning, milling and other post-harvest processing operations. Rice with bold grains usually has low amylose while rice with slender grains has intermediate to high amylose content. According to Danbaba *et al.*[16] ten rice varieties studied reported a range of 2.17-3.25 indicating some were bold grains in shape while others were slender in shape.

The AA_1 (19.02 g) and AA_3 (19.83 g) are moderately-heavy grains, while AA_2 (20.67 g) are heavy grains. The values of *Oje-igbales* ranged from 20.34-22.01 g making them heavy grains. Heavy grains have high amylose content and absorb more water when cooked while moderately heavy grains have low to intermediate amylose content. Grains higher in weight will sell at a higher price in international trade when rice is sold on a weight basis and will be more profitable to the seller. A range of 16.97-20.05 g was recorded for ten rice varieties studied by Danbaba *et al.*[16] showing they were moderately heavy and heavy grains.

The volume of the *Adede-agidi* variety ranged from 10.49-11.63 mL and that of *Oje-igbale* ranged from 12.64-13.20 mL, a significant ($p<0.05$) difference existed in the volume of *Oje-igbale* and *Adede-agidi*. Grains highest in volume will occupy more storage space during packaging, transportation and sales of agricultural produce. In international trade when rice is traded in volume, grains highest in volume will be beneficial to the seller because they will occupy more storage space while those of low volume will be beneficial to the buyer. In the transportation of rice grains, grains of less volume will attract fewer transportation costs than those of high volume. Results from Danbaba *et al.*[16] showed the samples were within the reported range (10.05-14.34 mm^3).

Table 3: Cooking characteristics of *Adede-agidi* and *Oje-igbale* rice varieties

Rice samples	Elongation ration	Weight increase	Volume expansion ratio	WUR	MCT (mins)	OCT (mins)	VWA (mL)
AA_1	1.33±0.01[ab]	29.35±0.04[c]	3.45±0.03[c]	2.32±0.03[b]	20.50±0.02[a]	22.49±0.02[a]	18.34±0.02[a]
AA_2	1.30±0.00[a]	28.34±0.02[b]	3.35±0.03[b]	2.27±0.02[ab]	19.34±0.02[b]	21.38±0.00[b]	22.10±0.02[b]
AA_3	1.35±0.00[bc]	28.03±0.04[a]	3.01±0.01[a]	2.22±0.03[a]	23.21±0.01[c]	24.23±0.01[c]	19.01±0.01[c]
OJ_1	1.41±0.01[de]	34.35±0.04[e]	4.35±0.03[f]	2.68±0.00[d]	27.85±0.01[d]	29.87±0.01[d]	22.94±0.02[e]
OJ_2	1.43±0.02[e]	34.13±0.04[d]	4.21±0.01[e]	2.51±0.01[c]	32.34±0.02[f]	34.34±0.01[f]	22.66±0.01[d]
OJ_3	1.37±0.01[cd]	36.04±0.05[f]	3.86±0.00[d]	2.87±0.02[e]	29.41±0.01[e]	31.34±0.01[e]	23.06±0.05[f]

Values are means±standard deviation of duplicate determination, means in the same column carrying similar superscripts are not significantly ($p<0.05$) different, AA_1-AA_3 (*Adede-agidi* rice variety from three different farmers) and OJ_1-OJ_3 (*Oje-igbale* rice variety from three different farmers)

Cooking quality: The cooking characteristics of the rice varieties include their Elongation Ratio (ER), Weight Increase (WI), Volume Expansion Ratio (VER), Water Uptake Ratio (WUR), minimum and optimum cooking time and Volume of Water Absorbed (VWA).

Cooking characteristics of *Adede-agidi* and *Oje-igbale* rice varieties: Table 3 shows the cooking characteristics of *Adede-agidi* and *Oje-igbale* rice varieties. Significant ($p<0.05$) differences existed in the VER within and between rice varieties.

The volume expansion ratio of the two rice varieties exceeded 300% with the *Oje-igbales* having the highest VER (3.86-4.35). The rice varieties with high VER would produce rice more in volume than those with lower VER when cooked and Food vendors prefer rice varieties with high VER to make more profit from its high expansion.

The elongation ratio (ER) of samples ranged from 1.30-1.43. The ER of rice can be influenced by both the length to width ratio and the amylose content[17,18]. The ER is desirable to consumers who love long-grain rice. The result obtained was within the range reported by Sanusi *et al.*[19], Nehemiah *et al.*[16] and Odenigbio *et al.*[8].

There was a significant ($p<0.05$) difference between the water uptake ratio of the grains. The Water Uptake ratio (WUR) of the *Adede-agidi* rice variety ranged from 2.22-2.32. The WUR of the *Oje-igbale* rice variety ranged from 2.51-2.87. Water Uptake Ratio (WUR) is a measure of the rate at which the rice grains take up water and increase in volume and weight. Grains with high WUR increased more in weight than those with low WUR. High WUR is a result of high amylose content and it is desirable in rice varieties for canning purposes. In other words, *Oje-igbale* can be a good rice variety for canned rice products. The values obtained were lower than most of the values obtained by Sanusi *et al.*[19] higher than the results reported by Nehemiah *et al.*[16] but within the range of the values reported by Odenigbo *et al.*[8].

Significant ($p<0.05$) differences existed in the minimum and optimum cooking time of *the Adede-agidi* rice variety. *Adede-agidis* had an optimum cooking time of 21.38-24.23 min while the *Oje-igbales* had an optimum cooking time of 29.87-34.34 min. The variation in cooking time between and within samples can be a result of the gelatinization temperature since the gelatinization time correlates positively with the cooking time of the rice. The rice which takes a long time to gelatinize contains higher amylose. It has been shown that the higher the gelatinization temperature, the longer it takes to cook rice[20] and the cooking time was observed to be dependent on the gelatinization temperature. The differences within samples can be a result of environmental factors where the grains were grown. The *Adede-agidis* cooked for a short period less than the *Oje-igbale* which takes a longer time. These characteristics can be attributed to the higher amylose content of *Oje-igbale*. The values obtained were higher compared to the values obtained by Singh *et al.*[17], Frei *et al.*[20] and Odenigbio *et al.*[8].

Significant ($p<0.05$) differences existed in the Volume of Water Absorbed (VWA) between and within rice samples. The *Adede-agidi* rice variety had a VWA of 18.34-22.10 mL/1000 grains. The *Oje-igbale* rice variety had a VWA of 22.60-23.06 mL. VWA is a direct measure of the amount of water required to cook the rice grains to their optimum eating quality. It was observed that the *Adede-agidi* rice varieties imbibed less water when cooked than the *Oje-igbale* variety. This may be attributed to the higher amylose content and water affinity sites of the *Oje-igbale* rice samples. Its starch content could be exploited in producing rice noodles

CONCLUSION

The *Oje-igbale* rice variety is longer, has an intermediate amylose-hard gel consistency and will be suitable in canned rice products, convenience-type rice-containing foods and rice noodle manufacture along with its use as a dumpling. The *Adede-agidis* being of low amylose-soft gel consistency rice varieties (AA_1 and AA_3) are suitable for use in baby foods, breakfast cereals popped rice and puffed rice, along with its use as cooked whole grain. In making fermented rice cakes, AA_2 with intermediate amylose-soft gel consistency can be used. *Oje-igbale* also has high OCT and VWA which is not desired in whole-grain cooking, because of more expended heat energy and water, respectively but it is desired in making dumplings to form a stiff paste.

SIGNIFICANCE STATEMENT

This study has provided knowledge on the characteristics and different obtainable end-use qualities of *Oje-igbale* and *Adede-agidi* other than their use in making dumplings and being prepared as cooked whole grain, respectively. This knowledge will help and should be used by food industries for value addition in pursuit of food security

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