CONSUMER PREFERENCE FOR RICE CONSUMPTION IN NIGERIA

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ABSTRACT

Rice consumption is of interest to the Nigerian economy because of the huge amount of foreign exchange being spent on its importation and the consequent depletion of scarce resources on which the level of economic activities and productivity are based. This study was aimed at identifying the quality of rice preferred by Nigerians for rice food recipes and consequently efforts made to improve the quality of locally produced rice to the taste of Nigerians. A total of 23 rice varieties were acquired from experimental fields of National Cereal Research Institute (NCRI), International Institute of Tropical Agriculture (IITA) in Ibadan and Badegi Rice Breeding Centre in Bida. Consumer preference survey of boiled rice and '*Tuwo*' foods were carried out in 6 major commercial and traditional cities of Nigeria to determine the quality of rice preferred for boiled rice and '*Tuwo*' rice foods. The survey was in questionnaire format and was carried out in Bida (Niger State), Zaria (Kaduna State), Maiduguri (Borno State), Benin (Edo State), Port-Harcourt (Rivers state) and Ibadan (Oyo State). Consumers preferred parboiled over unparboiled rice and moderate to flaky rice quality over to soft and sticky rice foods. The rating by taste panelists in Bida, Zaria and Maiduguri metropolis indicated IRAT 112, FARO 15, ITA 117 and ITA 123 were most preferred for '*Tuwo*' foods, while the least-preferred varieties were ITA 132 and TOX 1768. Consumers also preferred high amylose rice for '*Tuwo*' to low amylose, sticky rice quality. Also the rating of 6 rice varieties with respect to boiled rice indicated that ITA 117, IART 112 and FARO 15 were most preferred for boiled rice, while TOX 1768 and ITA 132 were the least-preferred in Rivers, Edo, and Oyo States perhaps as a result of people's preference for flaky rice quality for most of their rice recipes. The results indicated that most Nigerians prefer rice with moderate to high flaky rice quality suggesting that in any rice improvement programme in Nigeria these characteristics should be given a premium.

KEY WORDS: Parboiled rice, '*Tuwo*', boiled rice, imported rice, flaky and soft rice foods.

INTRODUCTION

Rice belongs to the grass family *Oryzeae*, characterized by one flowered spiklets with short glumes. Rice (*Oryza Sativa*) is a cereal that is consumed as shelled milled grain (Luh, 1980). It is the principal food crop of about one half of the population of the world (Ramaih, 1953). It contributes 40 to 80 percent of the Asian diet (IRRI, 1980) and most staple food in Liberia, Sierra Leone, Guinea, Gambia and Senegal, where rice food is eaten everyday and sometimes twice a day (Komolafe, 1974). Originally rice is not a staple diet of Nigeria, it has recently gained

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tremendous popularity (in Nigeria) as a fast-to-cook food (Okwuraiwe, 1974). In the past rice was a meal only for the rich (Eka, 1982). It was often eaten only during special occasions (Okwuraiwe, 1974). Rice meals are now very popular in Nigeria. Rice foods are cherished and widely consumed in the form of traditional recipes in Nigeria. The most popular traditional rice foods are widely consumed because of their nutritive values when cooked with other condiments and for their convenience.

Rice can be boiled and eaten with various types of soups such as vegetable soup or stew. The traditional methods of preparing rice meal by Hausa population are of interest because according to Simons (1971), rice and soup are usually prepared separately and then eaten together. The rice is boiled till it is soft, pounded or crushed into semi fufu (*Tuwo*) form and then served with soup. Nigerians preferred imported rice to locally-produced rice because of good processing and consequently improvement in cooking qualities of the imported rice (Umore, 1985). To improve the quality of locally-produced rice to the taste of Nigerians work needs to be done to determine the choice of rice quality that will match their taste. There are increasing literature on consumption pattern of local food in urban areas of Nigeria (Adeyemi, 1985; Adeyemo, l982; Ayotade, 1981; Ezuma 1986; Komolafe, 1974; Okonkwo, 1987 and Pillaiyers l981) however, there is none on boiled and '*Tuwo'* rice food covering the whole of Nigeria.

MATERIALS AND METHODS

Eight paddy rice samples from National Cereal Research Institute (NCRI) and eleven paddy rice varieties from International Institute of Tropical Agriculture (IITA) plus four additional paddy rice samples from Badegi Rice Breeding Centre were utilized for the study.

A total of 3 kg of each sample was processed by using modified parboiling method. Cleaned paddy rice sample of about 1500 g was steeped in 2L of distilled water at 80ºC for 6hr in water bath equipped with calibrated thermometer. The steeped paddy was then immersed and steamed for 18min in 2.5L of boiling distilled water using a laboratory electric steamer. The steamed paddy rice was then oven dried at 130ºC to about 16% moisture content and slowly dried to 11-13% moisture content in the shade drying (tempering) at room temperature to avoid grain kernel stress. Data were collected on physical, chemical and cooking properties of rice.

Triplicate of 200g of each rice sample of parboiled and unparboiled paddy was hulled in a laboratory Satake Husker (model: THU) operating on two rubber roller system set at 0.8mm to determine the amount of hull to the brown rice. Also the triplicate of brown rice collected for unparboiled and parboiled rice sample was further milled to determine the amount of bran to that of polished rice.

The Grainman Milling Machine (model 60-220T) a frictional type of milling machine with prescribed additional weight on the pressure cover, milled the brown rice for 2minutes each in one pass. The difference in the weight of brown rice to that of polished rice was used to calculate the percentage of brown and polished rice. A laboratory grader or disc separator (model TGR) was used to determine the percentage of whole rain (head rice) to that of the brown rice. Most of the broken rice was discarded. One third of whole polished rice (parboiled and unparboiled) rice collected was grounded into

flour in UDY cyclone (model: 33G) mill using a 60 mesh size screen.

Alkali digestibility an index of gelatinization temperature (gel. T) was carried out on the milled rice of unparboiled and parboiled samples following the procedure of Little *et. al.* (1958). Six kernels of whole milled rice were arranged in triplicate so that the kernels did not touch each other, they were then introduced into plastic boxes (4.6 x 4.6 x 1) cm^3 containing 10ml of 1.7% KOH. The boxes were covered and incubated for 23hr at 30ºC. Evaluations were done visually to determine the extent of disintegration of the endosperm. Rice with low gelatinization temperature (gel. T) disintegrated completely, while rice with intermediate gel.T showed partial disintegration and rice with high gel.T remained unaffected in the alkali. Percentage amylose content in rice flour was evaluated using Technico Auto-analyzer (model: TNII). The accuracy of this method was verified using the 300-N Micro-sample spectrophotometer determining in triplicates the percentage amylose content of rice flour following the methods of William et. al.(1958). The percentage starch content of rice flour for unparboiled and parboiled sample was determined using the phenol-sulphuric acid methods of Duboise *et. al.* (1956).

Rice Consumer Preference Survey

A total of six screened milled rice varieties differing in amylose contents were selected for the sensory evaluation of '*Tuwo*' and boiled rice recipes. These rice varieties included: ITA 123 (28.52 amylose), FARO 15 (28.0 amylose), ITA 117 (22.21 amylose), IRAT 112 (22.0 amylose), ITA 132 (11.72 amylose) and TOX 1768 (11.0 amylose) contents. Two kilograms of each varieties of unparboiled and parboiled rice were milled and used for boiled rice sensory evaluation. Also, one kilogram of unparboiled and parboiled rice were milled and used in preparation of '*Tuwo*'. The sensory evaluation of '*Tuwo*' was carried out in Bida (Niger State), Zaria (Kaduna State) and Maiduguri (Borno State), where it forms a staple food of the Hausas, while sensory evaluation of boiled rice was conducted in Portharcourt (Rivers State), Benin City (Bendel State) and Ibadan (Oyo State). The score card sheets for performance and acceptability rating were provided to participants for assessment.

Cooking Methods

About three grams of each sample of milled rice was cooked in a 6 automatic electric cookers (Toshiba type). Before cooking, each sample was thoroughly washed in about 360ml of tap clean water. The wash water was decanted and replaced with 400ml of water into the pot containing washed rice sample. The electric cooker was switched on from the main and left for 15minutes when the audible switch-off sound was hard. The rice was tested by pressing a grain of cooked rice between fingers and further cooked to doneness. '*Tuwo*' was made by crushing cooked rice with a wooden pestle into semi-*fufu* form. The cooked boiled rice and '*Tuwo*' were served warm in serving plates to each participant at the evaluation room. A cup of water was provided to each participant to rinse the mouth after each sample was evaluated following the procedure of Lamond (1982).

Statistical Analysis

Analysis of variance was used to test the data and the difference among the means was compared using Duncan Multiple Range test (Duncan, 1955).

RESULTS AND DISCUSSION

Rice qualities preference by Nigerian consumers is presented in Table 1. Under processing, parboiled rice is most preferred, followed by white polished rice, while fresh from farm gate is the least preferred rice with means of: (71.5, 24.0 and 4.0) respectively. Under shape of rice, long and slender rice is most preferred with a mean of (47.3), followed by medium size and short and fat rice with means of: (3.0 and 20.0) respectively. However, some Nigerians consumers who do not care about shape of rice are in the minority with a mean of (2.30). For forms of rice, whole grain rice with a mean of (78.5) is most preferred to ground rice with a mean of (21.5). For colour preference, white rice colour is most preferred with a mean of (60.8), followed by cream white rice colour with a mean of (23.8), while slightly brownish rice colour with a mean of (15.3) is the least preferred. Under origin of rice, imported rice with a mean of (57.5) is the most preferred over the local rice varieties with a mean of (42.8). Under preference between imported rice brands, Uncle Ben's is the most preferred with a mean of (50.5), followed by followed by consumers who cannot distinguish among the imported rice brands with a mean of (3.0), while Carolina and Thailand rice brands with means of (11.4 and 8.2) respectively are the least preferred brands. Finally, the most important quality looked for in rice, stone free is the most preferred with a mean of (52.8), followed by taste/aroma with a mean of (24.8), while less broken rice and uniform in shape with means of: (12.3 and 7.3) respectively are the least preferred.

Parboiled rice is known to offer some advantages that may attract consumer's attention especially when such rice is properly parboiled. For instance, parboiling salvages the damaged grains and eliminates cracks, it increases head yield and is known to prevent loss of nutrients. Parboiling process inactivates and denatures the enzymes responsible for browning and deterioration of rice kernel. It is also known to improve storage property of processed rice so as to extend its shelf life. Parboiling also produces extremely hard grains that offer resistance to insect and mold attacks. The milling yield is higher and quality improved because the cracks in the rice kernels have been anneald (Ali and Ojha, 1976). The processes of steeping and hot steam treatment activate the starch granules to gelatinized and expand filling up the surrounding air spaces by removing chalkiness and imparting an amber colour characteristics to rice kernel. During parboiling, water soluble vitamins and mineral salts are spread round the grain. This resulted in the riboflavin and thiamine content being four times higher in the parboiled than the unparboild rice varieties (Kennedy *et. al.,* 1975). Majority of the people preferred long and slender rice to other forms followed by the medium size rice perhaps as a result of the quality of rice Nigerians are accustomed to see in most imported rice varieties. Varieties of rice with long and slender grains usually had uniform parboiling quality when compared to rice with medium to short sizes. The processes of steeping and heating are quicker and easier for long slender grains as water and heat uniformly penetrate and rapidly reach the middle of the endosperm (Luh, 1980), as compared to fat and short rice varieties with uneven cooking quality. There is a higher economic value attached to quality rice because most commercial rice produced and marketed are usually long and slender rice grains. The unequal size and shape rice kernel associated with fat and short medium size usually results in poor quality with unsatisfactory milling product. Over 70% of

Table 1: Rice quality preference by Nigeria consumers

Characteristics	Rice Qualities	X	LSD (0.05)
	Parboiled Rice	71.5a	5.07
Processings	White Polished Rice	24.0b	
	Fresh from farm	4.0c	
	Short and Fat Rice	20.0c	7.63
Shapes	Medium Size Rice	30.3b	
	Long and Slender Rice	47.3a	
	Does not matter	2.3a	
	Ground Rice	21.5b	7.78
Forms of Rice	Whole grain Rice	78.5a	
Colour Preference of	White colour	60.8a	9.06
cooked Rice	Creamy White	23.8b	
	Slightly Brownish	15.3b	
Preference	Imported Rice (Totality)	57.2a	0.84
	Slightly (Totality)	42.8b	
Preference between im-	Uncle Ben's	50,5c	18.30
ported rice…	Caroline	11.4c	
	Thailand	8.2c	
	No Preference	30.0b	
Most important qualities	Stone free	52.8a	6.25
looked for in rice	Less broken rice	12.3c	
	Taste/aroma	24.8b	
	Uniform in shape	7.3c	

rice consumers in Nigeria preferred white, whole grain rice to ground rice.

The general appearance of rice grain is an index of its acceptance and its purchasing value. The whole grain rice of virtuous and translucent kernels is increasingly in demand in rice industry because they offer excellent uniform processing well as good storage properties. Grains with chalky appearances are usually weak and break up more easily during milling operations because starch granules in the chalky area of the kernels are less densely packed than in virtuous translucent grain rice. Most people preferred imported rice to local rice and this may be related to their preferences for long and slender rice grains. The mean population of those who consume local rice was not different from the mean population of those who consumed imported rice. Per-

haps this may be due to some local varieties having acceptable eating quality as those of the imported brands. There is also the possibility that long and slender rice grains are being grown locally thereby replacing the imported brand. Among the brands of imported rice, Uncle Ben's rice was the most preferred over Carolina and Thailand brands. This may partly be due to the popularity coupled with longer period of existence of Uncle Ben's rice in the Nigerian markets than other brands.

Parameters of preference between *Tuwo* and boiled rice recipes are presented in Table 2. Under eating qualities for boiled rice food, in-between soft/hard rice is most preferred with a mean of (61.3), followed by soft and tender quality with mean of (33.7), while hard rice with a mean of (4.8) is the least-preferred. Fluffy rice quality with a mean of

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(71.7) is the most-preferred over sticky rice with a mean of (28.3). Boiled rice food with salt and water medium is most- preferred with a mean of (51.8) followed by *Tuwo* form of whole grain rice food with a mean of (32.3) while boiled rice, drained and steamed rice with a mean of (16.3) is the least preferred. Under the eating quality of *Tuwo* rice food, in-between soft/hard rice is most preferred with a mean of (25.5), followed by soft *Tuwo* food with a mean of (21.0), while a hard *Tuwo* rice food with a mean of (2.0) is the least preferred. Warm *Tuwo* rice food with a mean of (38.8) is the most preferred over a hot *Tuwo* and cold *Tuwo* rice foods with the means of (7.3 and 2.2), respectively.

Generally, consumers vary greatly in their preference for cooked rice. While some prefer cooked rice to be fluffy, dry and moderately hard, others desire moist and sticky rice. The cooking and eating quality of milled rice are influenced by the ratio of amylose and amylopectin fractions of starch content (Sanjiva, *et. al.,* 1952). A non-waxy/ non-glutinous rice variety usually has high amylose content. Such rice shows high volume expansion with high degree of flakiness when cooked. They also cook dry, hard and separate upon cooling. On the contrary, a waxy (glutinous) rice variety has more of amylopectin starch fraction. Such rice do not expand appreciatively in volume and when cooked it is glossy and sticky. Over 60% of rice consumers preferred in-between soft and hard quality rice suggesting that Nigerian populace prefer quality of rice with intermediate amylose rice starch content that cooks moist, tender and does not become too hard upon cooling. This choice of rice shows moderate volume expansion with intermediate degree of flakiness without clumping of rice grains. Preference for in-between soft and hard rice may be related to the mode of cooking and eating patter of consumers of rice foods. Less than 5% of the consumers like very hard flaky rice. Most consumers preferred moderately flaky rice than sticky rice quality, while boiled rice with salt and water was preferred to drain and steam rice. Also, *Tuwo* with intermediate texture between soft and hard rice is most-preferred while hard *Tuwo* is least preferred.

Table 2:   Parameters of performance between Tuwo and Boiled rice recipes

Boiled Food	Eating Qualities	X	LSD (0.05)
Boiled Rice	Hard rice	4.8b	38.20
	Soft and Tender	33.7ab	
	In-between Soft/Hard	61.3a	
	Sticky rice	28.3b	2.75
	Fluffy rice	71.7a	
	Boiled, drain, stem	16.3b	27.58
	Tuwo form (from whole grain rice)		
	Boiled with salt and water	32.3ab	
		51.8a	
Tuwo Rice	Hard Tuwo	2.0b	10.00
	Soft Tuwo	21.0a	
	In-between soft/Hard	25.5a	
	Hot Tuwo Food	7.3b	10.00
	Warm Tuwo Food	38.8a	
	Cold Tuwo Food	2.2b	

The correlation matrix between those who preferred *Tuwo* and boiled rice foods are presented in Table 3. WBR is positively correlated significantly with HTB, while TF and WTF are positively correlated with FBR. The fluffy boiled rice (FBR) is negatively correlated with: ST and HTB. STB is negatively correlated with TF (-0.97), BF (-0.97), IBSH (-0.97), ST (-0.98), HTF (-0.82) and WTF (-0.97). TF also shows a perfect correlation with BF, SHT, IBSH and WTF with correlation matrix of: (1.0, 1.0, 1.0 and 1.0), respectively, while TF is highly correlated with HTF showing a correlation matrix of (0.82). BF indicates a perfect negative correlation with IBSH (-1.0) and ST (-1.0) as well as showing a highly negative correlation with HTF (-0.82), whereas, it indicates a perfect correlation with WTF (1.0). IBSHT has a perfect correlation with WTF having a correlation matrix of (1.0). Finally, ST is positively correlated with HTF (0.83) and equally shows a perfect correlation with WTF having a correlation matrix of (1.0).

There was a negative correlation between those who preferred hot boiled rice (HTBR) and those who preferred warm boiled rice (WR) suggesting that those who liked warm boiled rice did not like hot rice foods. There was a positive correlation between those who like fluffy boiled rice (FBR) and those who preferred *Tuwo* food, thus suggesting that those who liked *Tuwo* food preferred the fluffy boiled rice (FBR) to soft *Tuwo* (ST) and hot *Tuwo* food (HTF) indicating that consumers generally did not like soft hot *Tuwo* food. There was a negative correlation between the sticky boiled rice (STBR) and *Tuwo* food (TF) suggesting that most consumers did not like sticky *Tuwo* food, and the negative correlation between sticky boiled rice (STBR), hot *Tuwo*

food (HTF) and warm forms. Also, the negative correlation between *Tuwo* food (TF) and boiled rice food (BR) suggested that those who liked *Tuwo* food would prefer their *Tuwo* food prepared from ground rice. The positive correlation between *Tuwo* food (TF) stiffly hard *Tuwo* (SHT) and in-between soft and hard *Tuwo* (IBSH) suggested that consumers did not like soft *Tuwo* food generally. There was a positive correlation between in-between soft and hard *Tuwo* food (IBSH) and warm *Tuwo* food (WTF) indicating that people who preferred to eat *Tuwo* of intermediate texture prefer it warmed.

The mean relative preference score for *Tuwo* rice food is presented in Table 4. IART 112, FARO 15, ITA 117, and ITA 123 rice varieties had average preference scores of: (18.5, 171, 167, and 168), while ITA 132 and TOX 1768 had preference scores of 113 and 105 respectively. The relative rating of genotype by taste panelists Bida (Niger State), Zaria (Kaduna State) and Maiduguri metropolis, (Borno State) indicated that IRAT 112, FARO 15, ITA 117 and ITA 123 were the most-preferred for *Tuwo* preparations.

This is probably due to their high amylose contents which ranged from intermediate (20 -25%) to high (26-30%) a characteristic which made them suitable for *Tuwo* preparations. The least preferred varieties: ITA 132 and TOX 1768 had amylase contents of 11.75 and 11.0 percent respectively. This suggests that amylase content of rice is a major characteristic for its suitability for Tuwo preparations. The average rating of the six rice varieties were not different in the three locations of Zaria, Bida, and Maiduguri. This suggests the universal requirement of intermediate to high amylase content of rice for *Tuwo* preparation as Bida and Maiduguri represented two widely separated *Tuwo* consum-

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ing areas in Nigeria.

The mean relative preference for boiled rice preparation is presented in Table 5. ITA 117, IRAT 112, FARO 15 and ITA 123 were the most preferred over TOX 1768 and ITA 132 for boiled rice preparations. ITA 117 with relative average score of (189) was the most preferred rice variety followed by IRAT 112, FARO 15 and ITA 123 with relative average scores of: (174, 169.3, 152.7) respectively. However, TOX 1768

and ITA 132 with relative average scores of 119.6 and 116.6 were the least preferred for boiled rice foods in Rivers, Edo, and Oyo states where boiled rice forms a stable rice diet of the populace. Again, there appeared to be a relationship between the amylose contents of 28.0 while the least preferred varieties had low amylose content of 11.6. It may be that farmers generally preferred flaky to very flaky rice for most of the food preparation.

Table 3: Correlation matrix of preference between boiled rice and Tuwo food

	HBR	SBR	*BBR	HTBR	WBR	CBR	FBR	STBR	TF	BF	SHT	IBSHT	ST
SBR	-.021												
IBBR	-0.01	-0.44											
HTBR	0.62	-0.15	0.26										
W BR	0.52	0.31	0.12	0.85*									
CBR	0.37	0.49	-0.44	0.47	0.23								
FBR	0.43	0.27	-0.34	-0.74	0.54	-0.21							
STBR	0.43	-0.27	0.34	0.74	-0.38	-0.24	0.42						
TF	0.42	0.80	-0.15	-0.71	0.62	-0.36	0.97**	-0.97**					
BF	0.40	-0.76	0.14	0.69	-0.75	0.38	0.40	-0.97**	1.00**				
SHT	0.57	0.33	-0.24	0.02	-0.05	-0.11	-0.38	0.38	1.00**	-0.43			
IBSH	0.50	0.22	-0.01	-0.73	0.62	-0.35	-0.26	-0.97**	1.00**	-1.00**	0.31		
ST	0.39	0.12	0.57	-0.69	0.51	-0.32	-0.98**	-0.98**	0.42	-1.00**	0.44	0.61	
HTF	0.00	0.45	-0.45	-0.54	0.47	0.28	-0.82*	-0.82*	8.82**	-0.82*	0.79	0.74	0.83*
WTF	0.43	0.04	-0.12	-0.71	0.60	-0.33	0.97**	-0.97**	1.00	1.00*	0.34	1.00**	1.00**
CTF	0.34	-0.44	0.16	-0.50	0.48	-0.33	-0.69	-0.69	0.79	-0.79	0.13	0.83	0.77

*,**, Significant at 5% and 1% levels respectively

HBR	=	Hard Boiled rice	STBR	=	Sticky Boiled Rice
SBR	=	Soft Boiled rice	TF	=	Tuwo Food
IBBR	=	In-Between Soft/Hard	BF	=	Boiled Rice Food
HTBR	=	Hot Boiled Rice	SHT	=	Stiffly Hard Tuwo
WBR	=	Warm Boiled Rice	IBSHT	=	In Between Soft/Hard Tuwo
CBR	=	Cold Boiled Rice	ST	=	Soft Tuwo Food
FBR	=	Fluffy Boiled Rice	HTF	=	Hot Tuwo Food
			WTF	=	Warm Tuwo Food
			CTF	=	Cold Tuwo Food

Table 4: The Relative Preference of Six Rice Varieties for "Tuwo" <u>Rice</u>

Variables	Relative preference as indicated by average scores
IRAT 112	185a.
FARO 15	171a.
ITA 117	167a.
ITA 123	167a
ITA 132	113b.
TOX 1768	105b

Means not followed by the same letters are significantly different from each other by Duncan's Multiple Range Test at 0.05 level of probability

Table 5: The Relative Preference of Six Rice Varieties for Boiled Rice Food

Variables	Relative preference as indicated by average scores
ITA 117	189.3a
IRAT 112	174.6ab.
FARO 15	169.3ab
ITA 123	152.7b
TOX 1768	119.6c
ITA 132	116.6c

Means not followed by the same letters are significantly different from each other by Duncan's Multiple Range Test at 0.05 level of probability

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However, the particularly high amylose rice varieties preferred most varied from location to location probably due to ease of availability. For example, in Rivers State, ITA 117 was the most preferred, while in Edo State ITA 117 and IRAT 112 were the most preferred varieties. In Oyo State, ITA 117 was also the most preferred variety as a result of people's preference for flaky rice for most of their rice recipes.

CONCLUSION

Rice preference studies indicated that most Nigerians prefer imported rice which has mainly long and slender grains because of its ease of preparing rice recipes, cleanliness and acceptable odour as opposed to some local rice varieties which contain dirt, grits and sometimes foul odour. To improve the consumer acceptance of Nigerian rice, emphasis should be placed on good processing methods. The results also concluded that most Nigerians prefer rice with moderate to high amylose rice. This suggests that in any rice improvement programme in Nigeria such characteristics should be given a priority.

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