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Research Article

# Household Hedonic Price Model for Rice and its Attributes in Southwest Nigeria

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## Abstract

This study assessed the impact of attributes of rice grains on the price paid by households for rice grains which consequently affects its demand. Hence, this study elicited empirical data on the attributes of rice grains that need to be put in place in the locally processed rice grains. A multi-stage sampling technique was used to select 384 households across Southwest, Nigeria. Cross-sectional data were collected on household heads' socio-economic characteristics and rice grain attributes (size, colour, shape, level of cleanliness, level of broken grains, stickiness, taste, aroma and ease of cooking) using well-structured questionnaires.. The hedonic price model was used to assess the effects of various attributes of rice grains on the price paid by households. The average household size was 5 and the mean age of households' head was 45. Hedonic price model results show that coefficient for polished white rice grains colour, cleanliness (absence of stones and chaffs) of the rice grains and taste of rice were positive and significance at 10%. Robust shape of rice grains and pleasant aroma were positive and significant at 1%. This implies that households are willing to purchase rice grains at any price as long as they are white coloured, robust shape, clean, tasty and have a pleasant aroma. Therefore, this study recommends that the above mentioned attributes of rice grains be incorporated into the local variety.

**Keywords**: *Attributes, Hedonic price model, Households and Rice*



## Introduction

Over 50% of people worldwide eat rice as a staple diet, and it accounts for over 19% of all human energy consumption worldwide. Around 78% of rice produced globally is consumed by humans (KPMG Research, 2019). In Nigeria, rice is a basic food that is eaten by people from various socioeconomic backgrounds and geopolitical zones (Nwobodo *et al*., 2023). Rice is grown in almost all of Nigeria's agro-ecological zones and has taken on a vital role in the food baskets of rural and urban households (Ezedinma, 2005; Fadairo *et al.*, 2022). It has been observed that out of the 6.7 million metric tonnes of rice consumed in Nigeria each year, only roughly 57% are produced locally (KPMG Research, 2019). Nigerians are eating more rice because of changing consumer tastes, increasing population growth, growing income levels, and as well as the accelerating rate of urbanization (Kamai *et al.*, 2020). It is anticipated that as Nigeria's population grows, demand for rice will increase (KPMG Research, 2019). Therefore rice is a food crop that is of

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immense economic importance in Nigeria, achieving self-reliance in local rice production and reducing rice importation is imperative to the attainment of sustained economic growth of the country (FAO, 2022).

Food attribute is one of the main factors in consumers' decision-making at the point of purchase. This is evident in the report of some researchers who observed that Philippines rice consumers want sticky, flavorful, aromatic, and plain white rice because these attributes positively influenced consumers' purchasing decisions. (Agbas and Ceballos 2019). In the same vein, Lioe *et al*., 2019 reported that the taste and texture of cooked rice impacted consumers' demand at the point of purchase in South Sulawesi and West Java (Republic of Indonesia). It was also found that Kenyan consumers discount high amylose concentration and contaminants, whereas Ugandan consumers are ready to pay a premium for rice that contains a comparatively high proportion of unbroken grains (Twine *et al*., 2023). In Ghana, the rice-related attributes that showed marked influence on consumers' preference demand for rice were packaging quality, swelling capacity, stickiness of grains after cooking, percentage of broken grains, market availability, price, and degree of whiteness (Piao *et al*., 2020). In Lagos, Nigeria consumers identified taste and absence of stones as attributes of rice that positively influenced consumers' purchasing decisions (Oladejo, 2022). Similarly Onu, 2018, reported attributes of rice that positively and significantly influenced household demand at the point of purchase were ease of preparation, cleanliness and taste.

Previous studies in Nigeria on effect of attributes of rice on consumers' purchasing decisions for rice grain have employed econometric and statistical tools such as conjoint analysis, ordinary least square regression and ANOVA but this study assumes its importance by using hedonic price model. A hedonic price model depends on the idea that consumers value the attributes of the food they are buying, rather than the food itself (Ashiko *et al*., 2018). This means that the food prices reflect the prices of the food attributes and for rice grains some of the attributes includes the size, colour, shape, level of cleanliness, level of broken grains, stickiness, taste, aroma and ease of cooking e.t.c. When a regression model is applied, the value of each attributes can be determined. This study therefore examines household hedonic price model for rice and its attributes in the Southwest of Nigeria.

## Materials and Methods

The study was carried out in Southwest region of Nigeria. A random selection of three States were made from the seven States that make up South-western Nigeria The States selected are Ogun, Osun, and Ondo. A multi-stage sampling technique was used to select 384 household rice consumers in the selected States. The formula by Krejcie and Morgan, (1970) was used to obtain the sample size for this study.

$S = X^2 NP (1-P) / d^2 (N-1) + (X^2 P (1-P)$ - - - - - - - - - - - - - - - - - - - - (8)

Where,

S= Sample size chosen for the study

$X^2$= Table value of chi-square for 1 degree of freedom at the desired confidence level of 3.841

N=Population size (for the three states namely: Ogun (3,751,140), Osun (3,416,959) and Ondo (3,441,024) which was equal to 10,609,123 (NPC, 2006).

P=Population proportion which was assumed to be 50 percent of the population size; that is, 0.50 since this would give the maximum sample size

d=Degree of accuracy desired which was expressed as a proportion (0.05)

Therefore, the sample size that is representative of the population was estimated as:

$S = 3.841 (10,609,123 X 0.5) (1-0.5) / (0.05^2) (10,609,123-1) + (3.841 X 0.5) (1- 0.5)$

$S = 10,187,410.3607 / 26,523.76525$

$S = 384.086$

Approximately, the representative sample size, (S) chosen for this study was 384.

Also, the sample size chosen for each state ($S_t$) was derived as follows:

$S_t$ = [Population of a state / total population of the three states] x representative sample size for the study (i.e.384).

Furthermore, the sample sizes for the local government areas that were randomly selected in each state were obtained as follows:

$S_L$ = [Population of a local government area / total population of all the local government areas sampled within each state] x $S_t$ (representative

sample size for the state).
Six LGAS were randomly selected in each state drawn from the Southwest, Nigeria.
Primary data were collected using well-structured questionnaire. Descriptive statistics and econometric tool (hedonic price model) were used to analyze the data collected for this study. Following Benjamin *et al*. (2011), Danso-Abbeam *et al*. (2014) and Bunyasiri *et al*. (2018), the hedonic price model is specified as follows:

$P_{0} = \beta_0 + \sum \beta_i Z_i + \mu_i$ _____ (1)

Where,
$P_{0} =$ Price of rice grains (₦/kg)
$\beta_{0} =$ Intercept term
$\mu_{i} =$ Error term
$\beta_{i} =$ Coefficient for attributes of rice grains
$Z_i$ = various attributes of rice grains, (i= 1, 2, 3, …, 9)
$Z_1$ = Size of rice (short = 0; and long = 1)
$Z_2$ = Colour (unpolished = 0; and polished = 1)
$Z_3$ = Shape of rice (slender = 0 and; robust = 1)
$Z_4$ = Level of Cleanliness (ranked using likert scale 1 to 3)
$Z_5$ = Level of broken grains (ranked using likert scale 1 to 3)
$Z_6$ = Rice grains stickiness (ranked using likert scale 1 to 3)
$Z_7$ = Taste (ranked using likert scale 1 to 3)
$Z_8$ = Aroma (ranked using likert scale 1 to 3)
$Z_9$ = Ease of cooking (ranked using likert scale 1 to 3)

## Results and Discussion

Table 1 show that majority (67.40) of household heads in the Southwest were about 31 and 50 years old, with a mean age of 45. This suggests that the household heads are in their active years and are more likely to consume larger amounts of rice grains (i.e. calorie or energy foods) to satisfy their daily dietary needs, which may have a positive impact on the demand for rice. Most (88.8 per cent) of the sampled households in the Southwest are headed by male. A larger percentage of Southwest Nigerian households (49.4 per cent) consist of between 4-6 people, with 5 being the average household size. This report agrees with the findings of Ogunleke (2020) who observed that above 50 per cent of households are headed by male and 54.8 per cent of households have less than five people.

Result of the hedonic price model for the impact of attributes of rice grains on the price paid by households is presented in Table 2. The included independent variables, which are the attributes of rice grains selected by the sampled households, explained 51 per cent of the variation in the price that households paid for rice grains ( i.e the estimated coefficient of multiple determination; $R^2 = 0.51$).

The coefficient for white rice grains colour was positive and significance at 10%. It indicates that households are willing to purchase rice grains at any given price as long as the grains are white coloured. The coefficient for robust shape of rice grains was positive and significant at 1%. The results show that robust shape of rice grains has a positive and significant impact on the price households will to pay for rice grains. The coefficient for cleanliness (absence of stones and chaffs) of rice grains was positive and significant at 10% and this agrees with a priori expectations. It implies that households are willing to purchase rice grains at any given price if it is clean. The results of the above findings agrees with that of previous researchers who reported that people are willing to pay a premium for white and very clean rice grains (Ogundele 2014 ; Agbas and Ceballos 2019; Piao *et al*., 2020 and Oladejo, 2022). The coefficient for taste of rice was positive and significant at 10%. This indicates that households are willing to purchase rice grains at any given price if it is very tasty. Earlier researchers reported that the taste of rice greatly influenced rice consumers' choice at the point of purchase (Lioe *et al*., 2019 and Oladejo, 2022). Pleasant aroma was also positive and statistically significant at 1%. The indication is that pleasant aroma has a positive and significant impact on the price households are willing to pay for rice grains. The results above are in line with the report of Bunyasiri *et al*., 2018 they observed that some of the significant attributes influencing price are colour, taste and pleasant aroma.

## Conclusion

The study revealed that the mean age of household heads was 45 and average household

size was 5 in Southwest. Base on the hedonic price model, the result indicates that rice grains colour for polished white rice, the cleanliness (absence of stones and chaffs) of the rice grains and taste of rice were statistically significant at 10% and positive. Also, robust shape of rice grains and pleasant aroma were statistically significant at 1% and positive. This implies that households are ready to purchase rice grains at any given price as long as the grains are white, clean, very tasty, robust in shape and with pleasant. Therefore, this study recommends that the above mentioned attributes of rice grains be incorporated into the local variety.

**Declaration of Competing Interest**

The authors have no relevant financial or non-financial interest to disclose.

**Authors' Contributions**

All authors participated in the research and article preparation as follows:
Adewale G. A.: PhD. Student
Olubanjo O. O.: Main Supervisor
Idowu A. O.: Co-Supervisor
Otunaya A. O.: Co-Supervisor
All authors have approved the final article**.**

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**Table 1: Socio-economic characteristics of the households**

| Characteristics | Southwest |
|---|---|
| Age of households' head in years | Freq.(Percent) |
| Below 30 | 13 (3.60) |
| 31-50 | 240 (67.40) |
| Above 50 | 103(29.00) |
| Total | 356 (100.00) |
| Mean age | 45 |
| Educational status of households' head | |
| No formal education | 34 (9. 60) |
| Primary education | 30 (8.40) |
| Secondary education | 43 (12.10) |
| Tertiary education | 249 (69.90) |
| Total | 356 (100.00) |
| Gender of households' head | |
| Male | 316 (88. 76) |
| Female | 40 (11.24) |
| Total | 356 (100.00) |
| Household size | |
| 1-3 | 98 (27.5) |
| 4-6 | 176 (49.40) |
| 7-12 | 81 (22.80) |
| Above 12 | 1 (0.30) |
| Total | 356 (100.00) |
| Mean | 5 |

**Table 2: Results of the hedonic price analysis of the effects of rice grains attributes for the Southwest**

| Ln Price | Coefficients | t-statistics |
|---|---|---|
| Size of rice | 0 .0163672 | 0.81 |
| Colour | 0.018548* | 1.87 |
| Shape of rice | 0 .1275973*** | 5.88 |
| Level of Cleanliness | 0 .1982144* | 1.91 |
| Level of broken grains | -0.0465875 | -0.52 |
| Rice grains stickiness | 0.0105522 | 0.90 |
| Taste | 0.1871984* | 1.91 |
| Aroma | 0.0502994*** | 3.01 |
| Ease of cooking | 0.0047937 | 0.29 |
| Constant | 5.961122*** | 111.15 |
| R-squared | 0.5101 | |
| Adjusted R-squared | 0.4974 | |
| Root MSE | 0.08792 | |
| F-statistics | 40.4*** | |

Note: * significant at 10percent; ** significant at 5percent; *** significant at 1percent