



RESEARCH ARTICLE

FACTORS AFFECTING LOCAL TOMATO VARIETY PREFERENCES AND PRICE ACCEPTANCE IN BENIN REPUBLIC

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ABSTRACT

Background: Tomato is the most consumed vegetable in Africa as in most of the world. It is consumed by millions of people across the continent's diverse religious, ethnic and social groups. However, for proper producer and market supporting system development with district orientation, it is essential to focus research on consumer choices with respect to local tomato preferences. **Aim:** Within many local varieties of tomato grown in Benin Republic, the most preferred variety, consumers' willingness to pay for it and its characteristics were searched in details within this study respecting the factors that influence consumers' willingness to pay. **Material and Methodology:** Based on Hedonic-pricing model, primary data was collected from 223 consumers in Cotonou district of Benin Republic to identify the key factors that are most likely to affect consumers' accepted premium price for the most preferred tomato variety. **Results:** 51% of consumers preferred mostly 'Akikon' (*L.esculentum var. Pyriforme*). The average accepted premium was \$0.28 and the price rises to \$0.64 with addition of 200 FCFA (\$0.36), the standard market price of 400 grams of conventional tomato. Shape, colour, freshness, size, variety preference and income appeared as the factors affecting Akikon choice. **Conclusion:** Both producers and marketers should pay attention on the desired product characteristics. Supply chain should be shortened for increasing fresh supplies.

INTRODUCTION

Vegetables are important components of daily diet in Africa and important sources of income especially in urban and peri-urban areas. Vegetable supplies significant reduction of rural poverty, increasing rural employment and economic development in Benin Republic. For example, 15 % of agricultural GDP in Benin constituted only four types of vegetables, namely tomato, capsicum, onion and okra with 80 million Dollars in 2007 due to the data retrieved from National Institute (Anonymous, 2008). As many as twenty different types of indigenous and exotic vegetables are grown at major vegetable production sites around the western Africa. Tomato is one of the most popular and widely grown vegetable in sub-Saharan Africa. In addition, tomato ranks the first among vegetable crops produced in Benin Republic (Colin and Heyd, 1991). According to FAO statistics, 335.412 tonnes of tomato was produced in Benin on 40.177 hectares in 2016. Tomato increases the benefit of gardeners and producers, offers employment to thousands of people without jobs and contributes significantly to poverty reduction in Benin (Ezin *et al.*, 2012). Therefore, tomato production and marketing plays a vital role in social and economic status and nutritional scheme in Benin. Fresh and processed tomato consumption has been increasing in the world.

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Tomato is the most consumed vegetable in Africa as in most of the world. It is consumed by millions of people across the continent's diverse religious, ethnic and social groups (Iwuoha, 2016). Both in its raw and processed forms, tomato is central to most African diets and remains a regular ingredient in preparation of many dishes across the continent. The average growth rate of Benin's vegetable consumption between 1991 and 2007 was 22.94% (Depetris *et al.*, 2012). More than 20,000 varieties are produced in the world and fifteen indigenous tomato varieties are produced locally in Benin. Each variety has its own diverse desired characteristics, which can be derived from consumers' willingness to pay for it. Many research have been conducted on households' willingness to pay (Xu *et al.*, 2015; Grebitus *et al.*, 2013; Anonymous, 2011; Carpio *et al.*, 2009; Darby *et al.*, 2006; Giraud *et al.*, 2015; Brown, 2003) for consumption goods and crops. However, little is known on the local variety of tomato that Benin consumers prefer more, the premium price level that can be accepted for different characteristics of this crop and factors that affect premium price acceptance. The main objective of this study is to analyse factors affecting market price including the accepted premium price of Akikon (*L.esculentum var. Pyriforme*) variety grown in Benin.

MATERIALS AND METHODS

Materials: Primary data was collected from Cotonou province of Littoral region in 2017 through a field survey. Cotonou was

selected as it is the economic and commercial capital of Benin Republic. Also, being a cosmopolitan city, Cotonou hosts various consumption attitudes. Heckman's random sample selection criteria was applied (Heckman, 1979) with reference to 95 % confidence interval (Collins, 1986) in determining the overall sample. Data for this study was retrieved from 223 consumers in Cotonou via simple random sampling with 95 % confidence interval (1). The sample was distributed to the 13 districts of Cotonou on a ratio basis respecting their population.

$$n = \frac{t^2}{E^2} P * Q \quad (1)$$

This article is focused on six popular local tomato varieties were selected among fifteen such as Tounvi (*L. esculentum var. cerasiforme*), Akikon (*L. esculentum var. pyriforme*), Sonafel, Ouaga (*L. esculentum var. grandifolium*) Mongal and Petromèche depending on consumer preferences. A standard market price of 200 FCFA (\$0.36)¹ for 400 grams of conventional tomato was chosen as a reference. Then, consumers were asked how much they were willing to pay more than a standard market price of 200FCFA (\$0.36) in order to consume regularly their most preferred local tomato variety. Accordingly, Akikon (*L. esculentum var. pyriforme*) was the most selected variety of consumers due to its various characteristics. The households' accepted price premiums for local Akikon variety were asked for the analysis. In order to estimate impacts of Akikon variety, tomato characteristics and consumer demographics on the accepted premium, a hedonic pricing model was next applied to the data retrieved.

Methods: Hedonic pricing was first implemented in agriculture by Waugh (Waugh, 1929), who analysed the effects of product characteristics (colour, size, variety) on vegetable preferences. In his study, it was found that the accepted price changes due to quality features of vegetables. Different applications of hedonic pricing can be noted as the price analysis of wheat (Espinosa and Goodwin, 1991), apple (Tronstad *et al.*, 1992), cottonseed (Misra and Bondurant, 2000) and tomato (Xu *et al.*, 2015; Huang and Lin, 2007). Although product characteristics are neither produced nor consumed in isolation, hedonic pricing model assumes that the price of a product reflects embodied characteristics valued by some implicit or shadow prices. Under the hedonic hypothesis, individual products themselves do not provide a consumer utility but instead are seen as bundles of individually valued attributes, and the value of a product is based on the utility delivered by these attributes. The hedonic pricing analysis offers a method to estimate the impact of individual attributes on retail prices. Early adopters such as Becker, Lancaster and Muth (Becker, 1966; Lancaster, 1966; Muth, 1966), attributed these values strictly as consumers' value of these attributes. Rosen extended this into a more widely accepted view demonstrating the hedonic pricing function as a reduced form equation, which reflects mechanisms of both supply and demand (Rosen, 1974). A further important task researchers faced has been is how to functionalise the relationships between dependent variable and the explanatory variables naturally. This has been important as an incorrect functional form of regression equation most probably leads to misspecification bias and the researcher fails to interpret the effects properly. The analytical framework of this article is based on Rosen's hedonic price theory (Rosen, 1974). Products in the market are

described by n objectively measured characteristics and, therefore, can be fully represented by the vector $z = (z_1, \dots, z_n)$, where z_j describes the j^{th} attribute of the product. Prices for products are then interpreted as function of the bundled characteristics; in particular, the price p_i of product i is $p_i(z_1, \dots, z_n)$. Perfect competition is assumed where producers and consumers are price takers with perfect information of the market. Therefore, prices are revealed in the market through the usual mechanisms of individual consumers' utility maximization, producers' profit maximization, and market clearing conditions. In this framework, estimated hedonic price effects are not interpreted as identifying the structure of consumer preferences or producer technologies but instead are generated through a joint-envelope function of supply and demand. The recent hedonic pricing methodology incorporates linear and log-linear models that enable valid interpretation of parameter estimates. Accordingly, double log-linear estimation was used in this study to estimate Akikon tomato price premium for Benin following Diewert (2003).

$$\ln(PA_i) = a + b \times \text{Akikon var.}_i + \sum_k \beta_k \times MF_{ki} + \sum_n \gamma_n \times QF_{ni} + \sum_r \theta_r \times S_{ri} + \sum_s \delta_s \times SD_{si} + e_i \quad (2)$$

In the equation above (2), the dependent variable is a varying willingness to pay for Akikontomato variety. Yet, the price was calculated with addition of a premium to the standard market price of \$ 0.36 (200 FCFA) of 400 grams packaged of any other tomato variety except Akikon variety. This reference price was attributed to conventional tomato, either imported or produced locally, after the pre-market analysis. Therefore, the price referred to the consumer's accepted price for Akikon tomato in exchange to this conventional tomato. The explanatory variables are categorised due to average responses retrieved from survey participants. Table 1 presents names and description of variables.

RESULTS

Socio-Demographic Outlay and Consumption Preferences:

Considering surveyed 223 attendants, major socio demographic findings need to be interpreted. Most of the households surveyed were female with 81 %. The mean age of the sample was 44, while 60 % ranged between 25 and 45. While 17 % of the participants were unemployed, income generating activity of 37 % was small-scale sales business as street vending. 25 % of participants were working with payroll in public or private sectors. 51 % of the respondents had secondary or above degree, with 17 % (37 participants) holding university degrees. When the income distribution is considered, 210 participants indicated that they have personal income with an average of \$ 152.39 (84471.43 FCFA XOF) per month. The average household income was \$ 275.55 (152741.94 FCFA XOF) and 46 % of consumers declared that they have monthly family income below \$ 180.4 (100000 FCFA XOF). The results show that 72% of the interviewed consumers care about tomato variety in their routine purchases. Figure 1 depicts information on consumer's most preferred local varieties of tomato and it was understood that 51 % of consumers had chosen Akikon (*L. esculentum var. pyriforme*) as the most preferred local variety within the pre-selected varieties above.

¹24.11.2017: \$1 = 554.31 FCFA XOF

Table 1. Name and description of variables

Variables	Descriptions	
Dependent :	Accepted market price for Akikon tomato variety by the i^{th} consumer, including price premium to standard price of conventional tomato – (400 grams) (Dollar - \$)	
PA_i		
Independent Variables	Modality	
Akikon Preference (AP);	Akikon tomato variety choice of i^{th} consumer (1-Akikon, 0- another variety)	
S_{ri}	Dummy variable indicating seasonal fluctuations (1 - more consumption in local supply season, 0 - more consumption in other seasons)	
MF_{ki}	Market related factors with four sub-factors.	
a. Purchasing Places	1 - bazaar & district bazaar	0 - supermarket & peddler
b. Preferred package	1 - basket	0 - plastic bag & cardboard
c. Preferred size	1 - medium	0 - small & big
d. Purchasing frequency	1 - more than once per week	0 - once or less than once per week
QF_{ni}	Product quality related factors with four sub-factors	
a. Hardness	1 - most preferred quality feature is hardness	0 - not
b. Shape	1 - most preferred quality feature is shape	0 - not
c. Colour	1 - most preferred quality feature is colour	0 - not
d. freshness	1 - most preferred quality feature is freshness	0 - not
SD_{si}	Socio-demographic features of the household with five sub-factors	
a. Employment status	0- employed	0 - unemployed
b. Age	1-if between 18 and 45	0 - other
c. Gender	1- female	0 - male
d. Education	1- if between 18 and 45	0 - other
e. Income	Household income in Dollars-\$)	

64 % of consumers explained that Akikon variety has been more expensive than others. Tounvi (*L. esculentum var. cerasiforme*) and Sonafel (*L. esculentum var. grandifolium*) were respectively the second and the third most preferred varieties. Consumers mentioned that Akikon is the most preferred variety due to its attributes. Firstly this variety has a good taste (31%) and nutritious (30%). Other reasons of its preference are the shelf life of Akikon tomato fruit (17 %), its freshness (10%), its availability (8 %) and its price (4 %). Due to these various attributes of Akikon, consumers were asked if they were willing to pay more for this variety in order to consume it regularly. 60 % of consumers had willingness to pay more for Akikon due to its attributes. The average gross premium price was \$0.28 (153.85 FCFA XOF). Figure 2 depicts consumer’s willingness to pay a premium for Akikon variety. Consumers were asked the potential premium that they were able to afford in addition to the price of standard packed 400 grams of conventional variety fixed at 200 FCFA (\$0.36). Adding the gross average premium price retrieved (\$0.28) to the fixed standard market price 0, the final average accepted premium price was \$0.64 (354.76 FCFA).

Hedonic Pricing Analysis: Prior to proceeding in the analysis, it was essential to verify the estimation format by checking data characteristics. Normally test results for Akikon price (PA) were presented in Table 2 under the assumption of normal distribution. According to the p-values found (both for Kolmogorov-Smirnov and Shapiro-Wilk), local Akikon price seemed not to have a normal distribution. Accordingly it appeared as a necessity to continue the analysis with the logarithmic transformation of continuous variables. In this study natural logarithmic transformation was applied to continuous variables. Therefore, Akikon price including the accepted premium price and the standard market price for 400 grams of tomato was estimated and the results were demonstrated in Table 3. First the variation explained by the dependent variables was found out as 24%. Yet, single significance and inference quality of the parameters need to be emphasized as well. Income, Akikon preference, size, quality_colour and quality_freshness were found as statistically significant factors with 95 %. Even if the joint significance was high due to F-test with 4,395 (0.00*), there were non-interpretable factor estimates and a possible

problem of overestimation. Accordingly, it was considered as essential to check the linear relationship between Akikon price and independent variables. As most of the variables were dummy variables representing categories attached, it was essential to check the correlation between variables to infer on linear relationship (Gujarati, 2003). Positive correlation had appeared for income, Akikon preference, purchasing place, freshness preference and employment status with dependent variable ‘Akikon Price’, while the relationship was opposite for colour preference and respondents ages. These correlations were statistically significant within 95 % confidence interval. Therefore, the possible overestimation problem was overcome with reduction of inefficient parameters and Akikon price was re-estimated with correlated and economically interpretable variables (Gujarati, 2003). The findings were shown in Table 4. The variation in Akikon tomato price explained by the independent variables was 24 % for the selected indicators. Yet, the correlated variables indicated above seemed to have statistical significance by 99 %, leaving freshness preference aside with a significance of 90 %. However, the high joint significance with F-statistics of 7.334 (0.00*) enabled us to interpret the insignificant seasonal effect, age and employment variables.

Therefore, the final estimation of Akikon tomato price equation can be summarized as follows (3):

$$\ln(\widehat{PA}_i) = 2,972 + 0.192 * AP_i - 0.91 * Size + 0.046 * SE - 0.108 * QH - 0.215 * QC + 0.125 * QF + 0.083 * \ln(Income) - 0.068 * age + 0.086 * ES(3)$$

It’s important to emphasize some important details in parameter estimation stage. In order to reach sound interpretations, the dependent and explanatory variables, especially the continuous variables, were multiplied by 100 before inserting them into the analysis due to their considerably initial low values. The continuous variables as ‘Akikon Price’ and ‘income’ were used in Dollars after their natural logarithmic transformation. Accordingly, the proportional change obtained by the logarithmic transformation in the explanatory variables is considered to estimate numerically the dependent variable ‘Akikon Price’ rate (Gujarati, 2003).

Table 2. Normality Test for Local Variety ‘Akikon’ Price

Kolmogorov-Smirnov		Shapiro-Wilk	
Statistics	p-value	Statistics	p-value
.231	.000*	.751	.000*

Table 3. Estimation Output for Selected Local Variety (Akikon) Price

Independent Variables	β	t	p-value
Constant	2.966	9.776	.000*
Ln(Income)	.081	2.722	.007*
Akikon Preference	.195	4.448	.000*
Purchasing Place	.043	.546	.586
Packaging	-.022	-.485	.629
Size	-.096	-2.002	.047*
Frequency	-.004	-.082	.935
Seasonal effect	.050	.936	.350
Quality _hardness	-.091	-1.647	.101
Quality _shape	.071	.955	.341
Quality _colour	-.195	-2.117	.035*
Quality _freshness	.137	1.952	.052*
Age	-.066	-1.337	.183
Employment Status	.082	1.431	.154
Gender	-.012	-.167	.867
Education	.016	.336	.737

Table 4. Estimation Output for Akikon Tomato Variety Price with Selected Variables

Independent Variables	β	t	p-value
Constant	2.972	1.0.415	.000*
ln Income	.083	3.013	.003*
Employment Status (ES)	.086	1.592	.113
Akikon Preference (AP)	.192	4.531	.000*
Seasonal Effect (SE)	.046	.881	.379
Quality _freshness (QF)	.125	1.846	.066*
Size	-.091	-2.085	.038*
Quality _hardness (QH)	-.108	-2.039	.043*
Quality _colour (QC)	-.215	-2.444	.015*
Age	-.068	-1.469	.143

While the Ordinary Least Squares (OLS) estimation on the level is used to estimate the expected arithmetic mean, the OLS estimation of the log transformed outcome provides the expected geometric mean of the original variable. Therefore, the value of estimated constant of 2.972 (Table 4) represents the unconditional expected mean. So the geometric mean is the exponential value (anti-logarithm) of the constant that gives $\exp^2(2.972)$: 15.530. As the level variables were multiplied by 100, the average mean value for ‘Akikon Price’ was \$0.15 when all the variables were kept constants. In Benin Republic’s local currency, consumers accepted to pay 83 FCFA XOF for Akikon variety holding others variables constants. When it comes to interpretation of categorical variables’ estimates, as they haven’t been transformed such Akikon preference (AP), its exponential coefficient is the ratio of the geometric mean for Akikon choice to the geometric mean for conventional tomato choice³. Accordingly, consumers were willing to pay 21 % more to Akikon if they prefer Akikon consumption as $\exp(0.192)$: 1.211. This meant that consumers accepted to pay \$0.03 or 17 FCFA more than the average. Size, age and tomato quality attributes such as hardness and colour affected the Akikon price inversely. If consumers used to prefer medium size tomato they accepted to pay 9 % less than average price ($\exp(-0.091)$: 0.91). The consumers who perceived hardness (QH) and colour (QC) as the most important quality characteristic, they were willing to pay 10% (0.01\$ or 8 FCFA) and 19% (0.03\$ or 16 FCFA) less than the average respectively. Yet, for freshness preference, the accepted price for Akikon rose by 13% (\$0.02 or 11 FCFA). The most significant interpretation occurs with the parameter of logged income. Without any requirement of anti-log transformation, a 100 % rise in consumer’s average family income used to lead 8 % more payment willingness for Akikon tomato variety. Accordingly, when consumer’s family income rises by 100%, they accepted to pay \$0.16 (76 FCFA) more than the average price. Although, age, employment status and seasonal consumption preference were not statistically significant factors affecting the willingness to pay, their effects on Akikon price were interpreted as well. Hence, the consumers whose age range between 18 to 45 years were willing to pay 7% or 0.01\$ (6 FCFA) less than the average as $\exp(-0.068)$: 0.93. The transformation of employment status and seasonal consumption preference factors appeared as $\exp(0.086)$:1.09 and $\exp(0.046)$: 1.047 respectively. Accordingly, employed consumers that were holding jobs and those who prefer buying Akikon tomato variety mostly in intense tomato supply period were willing to pay 9 % (\$ 0.01 or 4 FCFA) and 5% (\$ 0.008 or 4 FCFA) more than the average price respectively.

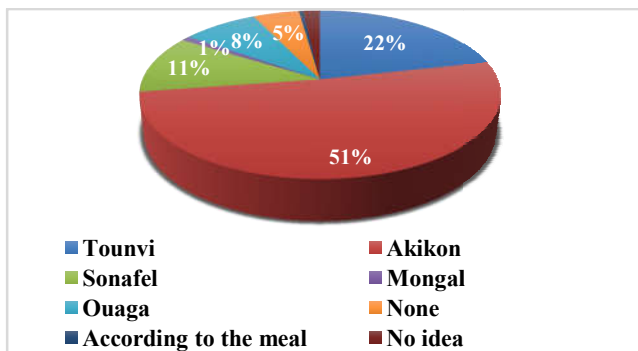


Figure 1. The distribution of the most preferred local tomato varieties



Figure 2. Distribution of consumers' willingness to pay a premium for Akikon tomato variety

DISCUSSION AND CONCLUSION

More than 15 local and improved tomato varieties are produced in Benin Republic, being a western African country. Nonetheless, within these locally grown varieties, which one is the consumer’s favourite? This study provides information about the most preferred locally grown tomato variety and examined the factors affecting consumers’ price acceptance (market price plus the accepted premium) for 400 grams of this variety by using hedonic pricing analysis. Secondly, the reasoning behind acceptance of a higher or lower price than the

²e=2.718

³Akikon preference is a categorical variable that is dichotomous (it has two categories such as “0-Akikon choice; 1- another variety) (Table 1)

conventional market price needed to be interpreted. It was found that 72 % of surveyed consumers cared about tomato variety in their purchases. Daily market and neighbourhood bazaar were the major sources of tomato supply. Within six varieties that were chosen in this study, 51 % of consumers had chosen 'pears tomato' (*L. esculentum var. pyriforme*). This variety was locally called as 'Akikon' in Benin. They specified that despite its high price, due to product characteristics as good taste, nutritional value, long shelf life, freshness, availability and price, they mostly prefer Akikon over the others varieties. Accordingly, 60 % of surveyed consumer's had a willingness to pay more for Akikon variety. When all of the variables were neglected, consumers accepted to pay \$0.15 for Akikon. Those who had a visible preference for Akikon were willing to pay 21% as a premium with reference to the average price. Akikon preference, preferred size, market factors, household income and Akikon tomato fruit quality preferences such as hardness, colour and freshness affected Akikon price premium acceptance positively. Moreover, there appeared also inverse relationships between the Akikon price and consumers who perceived tomato fruit's hardness (QH) and colour (QC) as the most important quality characteristics for Akikon tomato and also for age and size. Those consumers were willing to pay less than the average price.

In conclusion, there was a significant positive relationship between local tomato preference and Akikon variety preferences as well as local conventional tomato price and the Akikon price premium. These results showed that there was an important potential demand for Akikon tomato variety in Benin Republic. This study has provided some information regarding the development and application of marketing policies for tomato producers in Benin considering Akikon variety, and consumers expected quality attributes for this variety. So, it should be noted that other than positive influences of family income and direct variety preference, freshness and high season consumption preference of Akikon appeared as motivators for consumers. Therefore, improved production and harvest methodologies can provide benefits to other local variety producers in the high season with increasing fresh supplies. In addition, for Akikon producers, colour, hardness and size of the variety should be considered as potential improvement fields. So, rather than increasing the amount of production fields and number of producers, methodological advancement and shortening of supply chains can be considered as promising venues.

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Conflict of Interest: Authors have declared that no competing interests exist.

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