

## Consumer Perception of Sorghum Variety Attributes in the Lake Zone Tanzania

Mafuru J.M.<sup>1</sup>, Norman D.W.,<sup>2</sup> and Fox J.S.<sup>2</sup>

<sup>1</sup>ARI- Ukiriguru, P.O.Box, 133 Mwanza, Tanzania

<sup>2</sup> 311 Waters Hall, Kansas State University, Manhattan, KS 66506-4011, USA

### Abstract

Many sorghum varieties have been developed by research institutes in an effort to address food security problems in the semi-arid areas of Tanzania. Although sorghum is better adapted to drier areas than maize, farmer adoption rates for sorghum varieties are always lower than that of maize. In addition, maize based food is more acceptable to urban consumers than sorghum based food. In this study consumer evaluated quality attributes of sorghum *ugali* based on different varieties in order to determine marketing potential relating to the different improved sorghum varieties. A total of 231 consumers, randomly selected from urban and rural areas participated in a food panel to evaluate *ugali* prepared from five sorghum varieties (three improved, two local). Conjoint analysis was used to determine consumer perceptions of the variety attributes, while a logistic model was applied to determine preference ranking of different varieties. The results indicated that the color and taste of sorghum *ugali* were the most important criteria used by consumers to evaluate the quality *ugali*. The study results indicated that sorghum *ugali* with white/khaki color and the majority of panel participants preferred neutral or slightly sweet taste. Consumers from rural and urban areas accepted two improved varieties; only consumers from rural areas accepted the remaining variety.

Keywords: Adoption, consumer perception, conjoint analysis, sorghum varieties, Tanzania

### Introduction

Sorghum is a major cereal crop in hot-semi-arid tropical environments with 400-800 mm of rainfall that are too dry for maize (Warburton et al., 1995; ICRISAT, 1999). However, virtually all production is undertaken for subsistence purposes, with less than 2 percent of each season's harvest entering formal market (Rohrbach and Kiriwagulu, 2001). The amount of sorghum marketed is small because larger portions of sorghum produced are consumed in rural areas; urban consumers generally have less preference to sorghum food. In recent years the department of research and development in collaboration with national and international research organizations (i.e., International Crops Research Institute for Semi-Arid Tropics ICRISAT) have developed several high yielding sorghum varieties, which are also tolerant to other field problems such as pests, diseases and striga (*witch weed*). Despite research efforts, adoption of the new sorghum varieties by farmers and spread of improved sorghum production and storage practices (i.e., fertilizers and insecticides for storage) have been low, thus local varieties are still widely grown. The problem of past research was inadequate attention to the quality of the varieties as perceived by consumers of sorghum products. Several products can be obtained

from sorghum, which may have different quality requirements (Tiisekwa and Laswai, 1993). Therefore, omitting quality variables in the research process may lead to varieties with limited market demand. This study evaluated the acceptability of improved (Macia, Tegemeo, Pato) and local (Weigita and Gudungu) sorghum varieties based on variety attributes preferred by consumers of sorghum-based food (*ugali*).

### Materials and Methods

Food panel experiments were implemented in rural and urban areas which each consumer tasted six samples of sorghum *ugali* and their reactions were recorded. Five samples were prepared from non-composite undehulled sorghum (coarse) flour while the sixth sample was prepared from composite flour of a local sorghum variety and cassava at a ratio of one to two respectively. A questionnaire was developed to obtain information from consumers of sorghum *ugali* (a common food product prepared from sorghum flour) in the study area. The first step involved a focus group interview to identify quality attributes consumers consider important in their decision-making. A total of 70 people from rural and urban areas participated in the focus group discussions. 231 consumers randomly selected from rural and urban consumers participated

in the evaluation of *ugali*, which was obtained from the five sorghum varieties. Conjoint analysis and logistical preference analysis were applied in this study to determine consumers' perceptions of variety performance, and level acceptance. These methods were used in order to check the consistency of consumer's preferences with respect to their utility functions, determine the effect of sorghum variety characteristics on respondents' preferences as well as identify varieties that are accepted and / or rejected by consumers'.

*Conjoint Analysis (CA)*

Conjoint analysis is based on the premise that consumers evaluate the value (i.e., utility) of a product by combining the separate amounts of value produced by each attribute of a product (Louviere, 1991). In this study conjoint analysis was used to determine consumer preference of sorghum *ugali* in which marginal utility (part –worth) for each attribute level were generated. Also, the method was used to establish relative importance of sorghum, *ugali* attributes, to determine profile of *ugali* using total utility approach. The additive effect model of the composition rule was applied to explain how respondents combine part-worth values to form total utility (Hildreth *et al.*, 1998; Harrison *et al.*, 1997; Louviere, 1991; Green and Srinivasan, 1978; Green and Rao, 1971; Dawes and Corrigan 1974). In the additive rule each respondent's total utility is the sum of the part worth of each attribute. Therefore, the attribute's impact on utility is independent of levels of other attributes. The main effect model was specified as:

$$U_j = a + \sum_{i=1}^3 b_{il}r_{il} + \varepsilon_i \quad i=1 \dots N(1)$$

Where  $U_j$  is the overall utility measure of the  $j^{th}$  variety;  $a$  is an additive constant,  $r_i$  is the perception (i.e., defined in terms of 3 levels  $l$ ) of the variety attribute  $i$  and the  $b_{il}$  's are the part-worth utilities for the 3 levels ( $l$ 's) of each of different attributes ( $i$ 's) of the  $j^{th}$  variety,  $\varepsilon_i$  is a normally distributed error term. We consumer that each consumer adds the individual part-worth utilities to evaluate the overall utility of each sorghum *ugali*. In practice  $U_j$  is unobservable, we only observe respondent's evaluation through rating (ranking), and thus the empirical model is:

$$R_j = a_0 + \sum_{i=1}^3 b_{il}r_{il} + \varepsilon_i \quad (2)$$

Where:  $R_j$  is the ranking evaluation of the farmer for a sorghum variety  $j$  with production/consumption

characteristics (attributes)  $i$ ; other parameters are as previously defined. This evaluation suggests that respondent's ratings are an additive function of the "true" but unknown part-worth utilities. The model uses the Ordinary Least Squares (OLS) regression to solve for utilities using rating scales as independent variables. Each independent variable indicates the rating of a particular attribute level by the respondent while the dependent variable is the respondent's overall ranking of *ugali* variety described by the independent variables. In addition, profile utilities for each sorghum *ugali* were constructed using the frequencies of each attribute levels. The attribute level with the highest frequency was selected to describe the dominant level of that attribute in the profile for that particular *ugali*. Then total utility values of each profile of *ugali* were computed by adding together the intercept (from Equation 2) and part-worth (i.e., marginal utility or estimated coefficients) of the selected attribute levels in the profile. *Ugali* with the highest total utility value was considered to be the most preferred, and vice versa.

*Logistical Preference Analysis*

The logistical preference ranking analysis technique (Equation 3) was used to determine the probability of acceptance/rejection of the sorghum *ugali* by the respondents (CIMMYT, 1993):

$$P_R = \left[ \frac{K}{1 + e^{-a+bR}} \right] \quad (3)$$

Where,  $P_R$  is the cumulative probability of acceptance;  $R$  is the overall ranking of the *ugali* by consumers (i.e., rank from one to six, where one means the best); and  $K$  is the maximum probability of acceptance,  $b$  is a constant related to probability of acceptance and,  $a$  is a constant related to ranking. Equation 3 was estimated using Ordinary Least Square (OLS) method to obtain an idea of the acceptability of individual sorghum varieties in the study area (Griliches, 1957).

**Results**

Results of consumer preference analysis for the three models (i.e., all consumers, urban consumers and rural consumers) are presented in Table. In all the models the F-statistics were statistically at the 1 percent level implying that the attributes jointly affect preference ranking of consumers in the Lake Zone. Tables 2 and 3 show total utilities for sorghum *ugali* as perceived by urban and rural consumers. Profiles for sorghum *ugali* were based on consumers' perceptions. Results from

**Table 1.** Part-worth analyses and relative importance of quality attributes for sorghum *Ugali* in the Lake Zone Tanzania

Variable	All Consumers (N=231)		Urban Consumers (n=119)		Rural Consumers(n=112)	
	Utility	Relative Importance (%)	Utility	Relative Importance (%)	Utility	Relative Importance (%)
Intercept	3.5225***		3.4811***		3.5576***	
Color						
White/khaki	0.6794***	24.75	0.5450***	19.80	0.7970***	28.37
Reddish/Brownish	-0.386		-0.0252		-0.0658	
Red/Brown	-0.6408***		-0.5198***		-0.7312***	
Taste						
Neutral	0.4757***	18.50	0.4653***	17.66	0.5476***	20.99
Sweet	0.0357		0.0192		0.0358	
Bitter	-0.5113***		-0.4845***		-0.5829***	
Soft on hand						
Less soft	0.0711	6.52	0.1173*	7.69	0.0743	6.22
Soft	0.1384***		0.1482***		0.1304**	
Too soft	-0.2096***		-0.2655***		-0.2047***	
Soft in mouth						
Less soft	0.1246**	4.20	0.0759	2.21	0.1533***	5.19
Soft	-0.0996		-0.0431		-0.1265**	
Too soft	-0.0249		-0.0328		-0.0268	
Sticky on hand						
Less sticky	0.3023***	10.04	0.4333***	15.26	0.1086	3.74
Not sticky	0.0687		0.0456		-0.0729	
Sticky	-0.2335***		-0.3877***		-0.0160	
Sticky in mouth						
Less sticky	0.1351***	8.41	0.1735***	9.10	0.1056	8.76
Not sticky	0.1568***		0.1424***		0.1831***	
Sticky	-0.2919***		-0.3158***		-0.2887***	
Aroma						
Aromatic	0.0300	2.82	0.0331	1.91	0.0343	3.61
Neutral	0.0601		-0.0348		0.0802	
Bad smell	-0.0902		-0.0679		-0.1145*	
Price Tsh170						
Low	0.1716***	10.91	0.1822***	9.94	0.1390**	12.52
Average	0.2051***		0.1707***		0.2676***	
High	-0.3767***		-0.3529***		-0.4066***	
Price Tsh 250						
Low	0.1644***	13.86	0.1938*	16.43	0.1964**	10.61
Average	0.2874***		0.3449***		0.1786**	
High	-0.4158***		-0.5387***		-0.3750***	
F-value	171.94***		92.57***		86.72***	
R-Squared	69.4		70.6		70.5	

Note: \* Statistically significant at 10% level; \*\* Statistically significant at 5% level;  
 \*\*\* Statistically significant at 1% level

Source: Survey, 2004

the logistic preference analysis are summarized in Table 4. In urban areas only Macia and Tegemeo had statistically significant positive intercepts, while Pato and Local/cassava had negative intercepts that were

not statistically significant. Weigita and Gundungu had negative intercepts that were statistically significant.

### Discussions

Consumer preference analysis revealed that color was the most important criteria for acceptability of sorghum *ugali* by both rural and urban consumers. Most respondents indicated that they would prefer a white and or khaki color, while red and/or brown

colors were the least preferred *ugali*. Therefore, sorghum varieties, which produce white or khaki flour, have a higher probability of being accepted to sorghum consumers in the Lake Zone. Other important quality attributes are taste, soft in the mouth, sticky in the hand and prices. Consumers would prefer *ugali* with a good taste. Softness in the mouth was a reflection of the fineness of flour; coarse flour produces stiff *ugali*, which is less acceptable to consumers. Preference for less soft *ugali* justifies the importance of improved dehulling techniques, which were currently not available in the Lake Zone. A non-sticky *ugali* in the hand was mostly preferred by urban consumers, but for rural consumers the attribute was not important, except in terms of how it felt in the mouth. This attribute can either be influenced by chemical characteristics of the variety and /or cooking quality. Price influenced preferences of *ugali* consumers. It was observed that price per plate of sorghum *ugali* was relatively more important to rural consumers than urban consumers. The differences of consumer reactions to price levels between rural rural and urban were due to their socio-economic environments. Unlike urban consumers in rural areas prices of sorghum *ugali* in restaurants are generally low; therefore, rural consumers are sensitive to high prices. Urban and rural consumers ranked Macia and Tegemeo as their first and second choices respectively. Pato was ranked third by urban consumers but ranked fourth by rural consumers. All consumers were indifferent to composite *ugali*, but they rejected *ugali* prepared from local sorghum varieties, while rural consumers rejected *ugali* prepared from Pato.

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**Table 2.** Sorghum ugali profiles based on consumer preferences in the urban areas of Lake Zone , Tanzania

	Color	Taste	Soft in hand	Soft in mouth	Sticky in hand	Sticky in mouth	Aroma	P170	P250	Profile Utility
Macia	White/ khaki	Sweet	Soft	Less soft/soft	Not sticky	Less/ sticky	Aroma tic	Low	Ave/ high	4.5474
Tege- meo	White/ khaki	Sweet	Soft	Soft	Not sticky	Less/not sticky	Neutral	Low	High	3.9782
Pato	Reddish/ Brownish	Sweet	Less soft/soft	Less Soft/soft	Not sticky	Not sticky	Neutral	Ave	High	3.4250
Gud- ungu	Reddish/ Brownish	Bitter	Soft	soft	Not sticky	Not sticky	Neutral	High	High	2.3692
Weigita	Red	Bitter	Soft	Soft	Not sticky	Not sticky	Neutral	High	High	1.8746
Casava/ Local	Reddish/ Brownish	Neutral	Too soft	Less Soft/soft	Sticky	Sticky	Neutral	Ave/ high	High	2.3040

Dodoma region, Tanzania. “ Natural Resource  
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**Table 3.** Sorghum ugali profiles based on consumer preferences in the rural areas of Lake Zone , Tanzania

	Color	Taste	Soft in hand	Soft in mouth	Sticky in hand	Sticky in mouth	Aroma	P170	P250	Profile Utility
Macia	White/ khaki	Sweet	Less Soft	Less soft	Less sticky	Less sticky	Aromatic	Low	High	5.1423
Tege-meo	White/ khaki	Sweet	Less Soft	Soft	Not sticky	Not sticky	Neutral	Low	High	4.2728
Pato	Reddish/ Brownish	Sweet	Soft	Less soft/soft	Not sticky	Not sticky	Neutral	High	High	3.0604
Gudungu	Reddish/ Brownish	Bitter	Soft	Less Soft/soft	Not sticky	Not sticky	Neutral	High	High	2.4417
Weigita	Red	Bitter	Soft	soft	Not sticky	Not sticky	Neutral	High	High	1.6364
Cassava/L ocal	Reddish/ Brownish	Sweet	Less Soft	Less soft	Sticky	Sticky	Neutral	Ave/ High	High	3.0862

Source: Survey 2004

**Table 4.** Comparative analysis of consumer ranking for sorghum *ugali* in the Lake Zone, Tanzania

	Urban Consumers (n=119)			Rural Consumers (n=112)		
	Intercept (a)	Slope (b)	Decision	Intercept (a)	Slope (b)	Decision
Macia	0.354* (0.096)	0.123** (0.025)	Accepted by consumers	0.452** (0.098)	0.106** (0.025)	Accepted by consumers
Pato	-0.091 (0.063)	0.193*** (0.016)	Indifferent	-0.123** (0.026)	0.187*** (0.007)	Rejected by consumers
Tegemeo	0.231* (0.057)	0.135*** (0.015)	Accepted by consumers	0.145 (0.074)	0.154*** (0.019)	Indifferent
Local/ cassava	-0.061 (0.066)	0.161*** (0.017)	Indifferent	-0.032 (0.035)	0.165*** (0.009)	Indifferent
Gudungu	-0.216* (0.070)	0.195*** (0.018)	Rejected by consumers	-0.283* (0.085)	0.198*** (0.022)	Rejected by consumers
Weigita	-0.258* (0.100)	0.191*** (0.026)	Rejected by consumers	-0.222* (0.082)	0.187*** (0.021)	Rejected by consumers

Note: Numbers in brackets are standard errors \* Statistically significant at 10% level\*\* Statistically significant at 5% level  
 \*\*\* Statistically significant at 1% level

Source: Survey. 2004