

**CONSUMER PERCEPTIONS AND DEMAND FOR BIOFORTIFIED SWEET
POTATO-BASED BISCUIT: THE CASE OF AKARABO GOLDEN POWER
BISCUIT IN RWANDA**

Okello JJ^{1*}, Sindi K² and J Low²



Julius J. Okello

* Corresponding Author's email: j.okello@cgiar.org

¹International Potato Center, P.O. Box 22274, Kampala, Uganda

²International Potato Center, P.O. Box 25271, Nairobi, Kenya

ABSTRACT

Certain varieties of sweet potato, especially orange-fleshed, are being promoted as part of the strategy to combat vitamin A deficiency in children and pregnant mothers. However, the consumption of sweet potato is more widespread in rural households where it is mainly boiled or eaten raw. The lack of value addition excludes majority of urban and higher income consumers who consider sweet potato an inferior product. At the same time low income urban households that would be interested in consuming sweet potatoes are not able to receive regular supplies from the rural producing areas due to perishability and bulkiness of the produce. This study examines consumer perceptions and demand for value-added biofortified biscuit derived from the vitamin A-rich orange fleshed sweet potato in Rwanda. Specifically, it assesses consumer perceptions and preference for biofortified biscuit, consumer willingness to pay for biofortified biscuit and consumers' rating of the biofortified biscuit. It uses data from 1085 consumers stratified by income levels drawn from consumers in several urban markets of Rwanda. The study finds very favorable rating of the taste, color, packaging, looks, and sweetness for the biofortified biscuit. It also finds higher willingness to pay (WTP) for the biofortified biscuit among consumers from low and low/middle income groups. However, the study finds mixed results of WTP for the biofortified sweet potato among consumers in the high income neighborhoods. Also, contrary to expectations, the study finds no evidence that knowledge of vitamin A increases consumer rating for the biofortified biscuit, suggesting that the promotion campaigns did not change the way consumers perceive the biofortified sweet potato, perhaps due to the way the campaign was designed. The study concludes that the biofortified biscuit is currently more acceptable among the low and low/middle end income categories probably because of greater promotion at these levels. However, it has a high potential for the high and medium income groups as evident from the high rating it received among these groups. The paper discusses the implications of these findings and suggests a need for more detailed studies and indepth quantitative analysis of consumer perceptions and WTP for orange-fleshed sweet potato.

Key words: Consumers, demand, biofortified biscuits, Rwanda

INTRODUCTION

Traditional foods have recently gained prominence in many African countries and have continued to attract research and development attention [1, 2]. A number of factors have contributed to the surge in interest in these foods. First, preliminary research indicates that the majority of traditional foods have beneficial nutritional value [3, 4]. Second, increases in income among the middle class consumers have increased health awareness and hence demand for foods that deliver nutritional benefits [5]. Third, as demand for these foods has increased, a number of farmers are shifting into producing them for commercial purposes, and are growing these crops for income generation [6]. Fourth, the richness of some of the traditional foods in micronutrients has been promoted for lowering disease risks [3]. At the macro-level, traditional foods have gained importance because they are mostly grown by small farm households, with women as the majority [3,7]. Thus, the development of traditional foods can significantly contribute to household food security and poverty reduction initiatives. It can, especially, be used to tackle the problem of “hidden hunger”, defined as the lack of appropriate balance of macronutrients (calories) and micronutrients (vitamins and minerals such as vitamin A, iron, calcium, magnesium, zinc and iodine) in a consumer’s diet. Hidden hunger is therefore a form of food insecurity that can be addressed by the promotion of the consumption of many traditional foods [8,9]. At the same time, tolerance of most traditional foods to a wide spectrum of both abiotic and biotic stresses makes them more appropriate for improving household food security than their exotic counterparts that rely on pesticides and fertilizers and a good supply of water to perform well [10].

One traditional food crop that has drawn considerable attention of development agencies and nutritionists is the sweet potato, specifically the orange flesh sweet potato (OFSP). A recent study by Chowdhury *et al.* [11], for example, found that OFSP can supply the nutrients required to avert symptoms of vitamin A deficiency in children and pregnant mothers. However, most households still consume regular sweet potato in mostly raw and boiled forms. The International Potato Center (CIP) has in the last 10 years been experimenting with value added products made from beta-carotene rich sweet potato. In 2012, joint efforts between CIP and SINA Enterprises, Ltd, a private bakery and confectionary company in Rwanda, resulted in the launch of a biscuit known as as Akarabo Golden Power (Akarabo GP) in early 2012. The purpose of promoting value was to penetrate the urban households where sweet potato tends to be treated as an inferior good. This study examines the consumers’ perceptions for and willingness to pay for the Akarabo GP biscuit among the Rwanda urban consumers. It specifically:

1. Assesses consumer perceptions and preferences for various attributes of biscuits
2. Examines the willingness of consumers to pay for the Akarabo GP biscuit
3. Analyzes the effect of information about vitamin A on consumers’ willingness to pay.

THEORY AND DATA

Theoretical framework

This study is based on Lancaster's theory of consumer choice. The theory posits that commodities can be described on the basis of their underlying attributes and characteristics, and that consumers derive satisfaction from these attributes rather than from the physical commodity [12]. Following Lancaster [12], other studies have examined the role of attributes on the demand commodities [11,13,14,15,16,17]. These studies define willingness-to-pay (WTP) as the resources individuals are willing and able to give for a product with desirable attributes, which in the context of this study entails biofortification. It encompasses availability of food of desired quality (that supplies the needed nutrients for a functional life) at desired time and amounts. Value addition through biofortification is, therefore, a process that makes food of desirable quality available at the desired time, quality and quantity, hence contributes to household food security.

Consumer theory posits that consumers will balance the marginal utility of value addition and marginal cost of one unit of value-added food. The marginal utility of value addition via biofortification is likely to be driven by consumer's socioeconomic characteristics, learning ability and exposure levels to food-borne hazards [19,20]. Hence WTP is interpreted as an indicator of demand for the biofortified products.

The literature defines two broad categories of willingness to pay, namely stated and revealed. The latter deals with actual experiments (such as auctions or direct observations) that allow the consumer to specify his/her valuation of commodities. The latter, however, entails the use of mechanisms that allow the consumer to reveal his/her valuation of the commodities through the choices they make. This study used the stated WTP, which defines (P_i) for value-added biofortified biscuits for each consumer i specifically as the additional money that consumer i is willing to pay for the biscuits. It is assumed that estimates of implicit values of characteristics can be used to reflect the price of an unobserved product by valuing embodied characteristics, namely value addition in this case.

Data

The study used data collected from a total of 1,085 consumers in November 2012. The consumers were selected randomly in different major agricultural commodity markets of Rwanda. The markets were selected to represent the various income groups: i) Low-end markets (namely, Musanze, Muhanga, Kimironko/Kigali); ii) Low to middle-end markets (namely, SINA Nyirangarama, SINA Nyabugogo (Kigali), SINA Kigali town, SINA Musanze, SINA Muhanga); iii) Middle to high-end markets (represented by Ndoli Supermarket in Kigali); and iv) High-end markets (represented by Union Trade Centre market in Kigali). Each sampled consumer was explained the purpose of the study and then asked whether he/she was willing to voluntarily participate in the study. Consumers who responded in the affirmative were then interviewed.

In each of the markets/locations, data were collected through personal interviews by trained enumerators using pre-designed and pretested questionnaires. Data collected included personal characteristics such as age, quantity of biscuits purchased, attribute perceptions, and WTP. In order to compare consumer perceptions about the various attributes of the biofortified biscuit and the ordinary ones, the consumers were further stratified into two categories, namely blind and open. In the blind category, consumers were asked to taste, feel and observe the unlabelled samples of Akarabo GP and the ordinary (but most popular) biscuits and state their perception about specific attributes including taste, color, hardness, sweetness (sugar content), and packaging. The experiment was then repeated for consumers using labelled samples of the Akarabo GP and the ordinary biscuit. Both categories of consumers were asked to state how much they would be willing to pay for Akarabo and ordinary biscuits. In order to maintain anonymity, the collected data were analyzed together for all the respondents and are reported in this paper in aggregate form.

RESULTS

Consumption of biscuits among study consumers

The mean age of the male and female respondents in this study were 27 and 29 years, respectively, with overall mean age of 28 years. Overall, the youngest respondent was 6 years old while the oldest was 80 years. More than 40 branded biscuits were sold in the study areas at the time of the survey. Among these, the most popular, in terms of purchase were Riham (48%), Nice (12%), Glucose (9%), and the 100% wheat flour Akarabo (henceforth referred to as Akarabo Wheat) biscuits (7%) (Table 1). The remaining 20 biscuit brands mentioned by the respondents in this study accounted for less than one percent of the purchases and are lumped together under “Other” in Table 1. The biofortified OFSP-based biscuit, Akarabo Golden Power (Akarabo GP), fell in this category.

Analysis of purchases by neighborhood shows that low income neighborhood consumers are the dominant purchasers of Riham, accounting for 57% as shown in Figure 1. The Figure shows that the majority of Nice consumers belonged to the high income neighborhood. Most of the respondents in high income neighborhoods consume “Other” brands of biscuits; with Digestive as the most purchased brand of biscuit in that group of biscuits. Less than 1% of the respondents (i.e., 0.07 %) in this category of consumers purchased Akarabo GP.

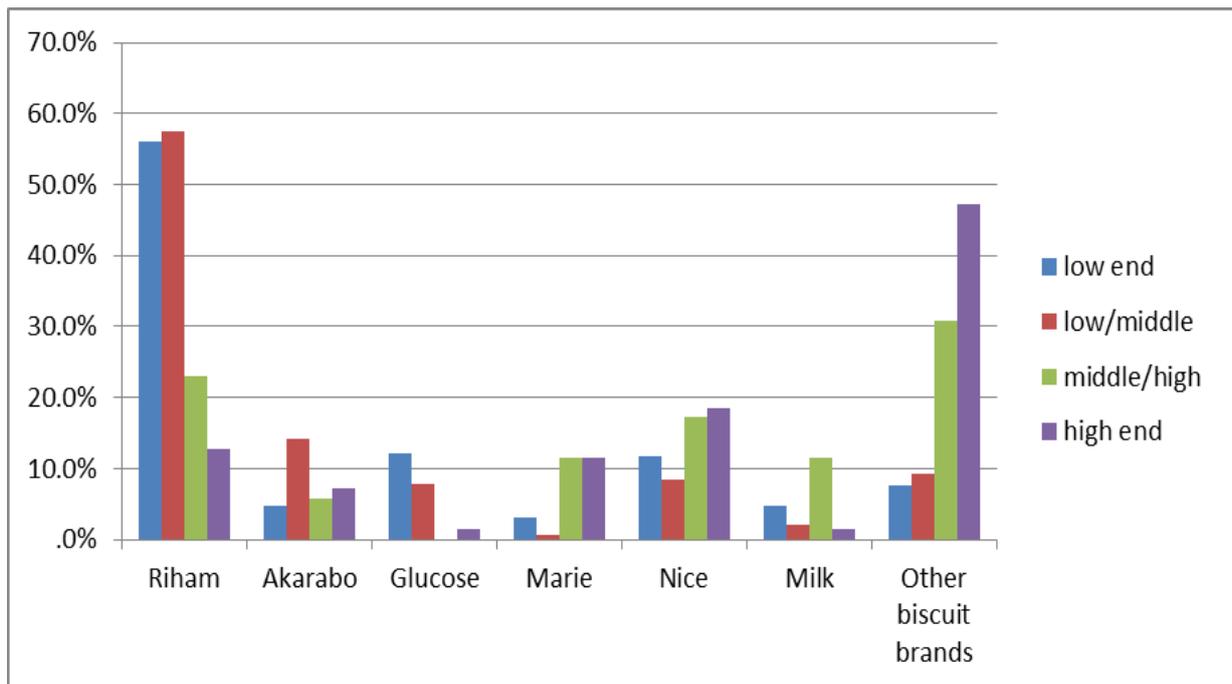


Figure 1: Comparison of purchases of different brands of biscuit in Rwanda consumers, by neighborhood

Demand for attributes

This study examined the various attributes likely to influence demand patterns. Indeed, past and recent studies indicate that consumers usually demand the attributes that are embodied in the product, rather than the product *per se* [12,13,16,17,18]. These past studies posit that consumers derive satisfaction from the attributes of the product. This study, therefore, examined the consumers' perceptions of the size, shape, color, hardness/crunchiness of the Akarabo GP biscuit against those of the most popular biscuit. The information was collected through both open and blind testing. The results of this analysis, based on open testing, are presented in Figure 2.

Several observations emerge from the graph. First, more consumers rated Akarabo GP more favorably in most of the non-price attributes when compared to the other dominant biscuits in the market. Second, more male consumers, in absolute terms, indicated that Akarabo GP had better appearance, color, taste, hardness, and packaging than the dominant competing brand. At the same time, more male than female consumers reported that Akarabo GP was sweeter (more sugary) than the dominant competing brand. Third, one striking difference was that the competing brand was harder than Akarabo GP.

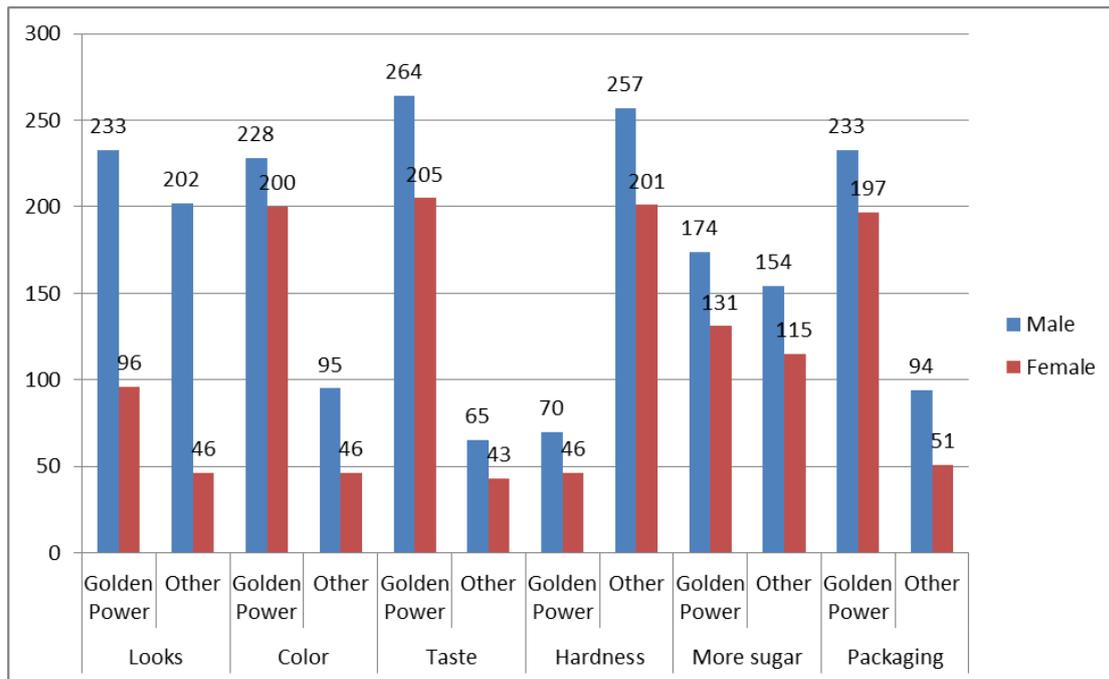


Figure 2: Consumer preference for non-price attributes of OFSP-based biscuit in Rwanda, by gender (N= 542): Results of open testing

Indepth analysis of the gender aspects revealed some additional insights. In particular, computing the percentage within each category of gender (male and female) shows that a higher proportion of women found the packaging, color and appearance of Akarabo GP more attractive than those of the dominant competing brand. Specifically, 80% (vs 72%), 81% (vs 71%), and 82% (vs 71%) male (vs female) consumers found packing, color, and appearance, respectively, of Akarabo GP better. Tests of differences in means yielded p-values of 0.001 in all the three cases.

The results of the blind test are presented in Figure 3. The Figure shows no major differences in the way that male and female consumers perceive the attributes of Akarabo GP biscuits from the perceptions of the open-tested respondents reported above. More male and female respondents found other brands of biscuits harder than Akarabo GP.

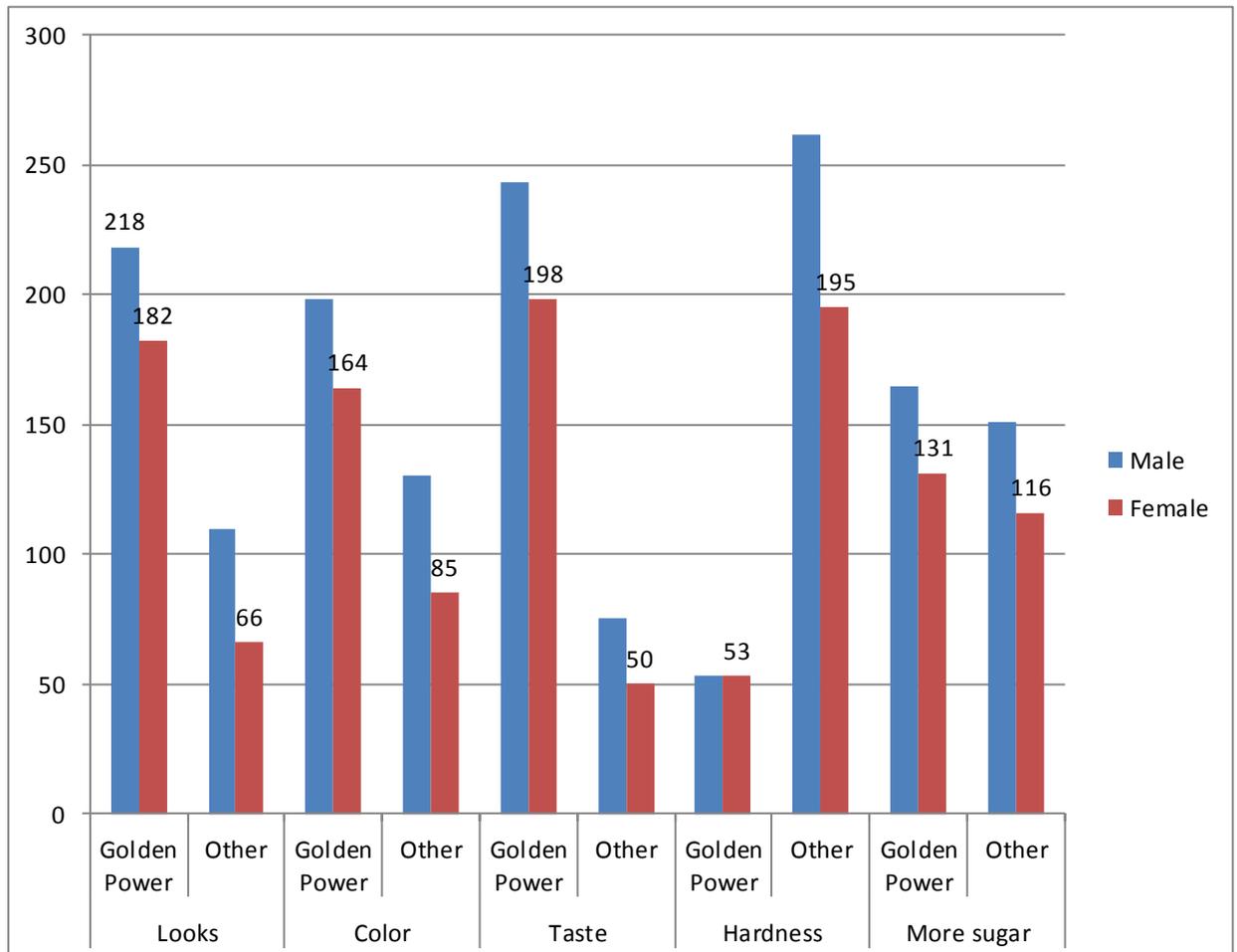


Figure 3: Consumer preference for non-price attributes of OFSP-based biscuit in Rwanda, by gender (N = Various): Results of blind testing

However, analysis of preference for the non-price attributes by neighborhood categories show striking differences from the above. In all the considered attributes, other than hardness, female consumers in lower end neighborhoods/income category reported that Akarabo GP was better than the other brands. They also reported that Akarabo GP was more sugary (hence sweeter) than the dominant competing brand.

There was no statistical difference in the number of respondents that rated the Akarabo GP biscuits as being better between those with and without information about vitamin A content of the OFSP-based biscuit. Just as in the earlier case of the analysis of preferences by gender, results in Figure 4 indicate that more consumers (both with and without vitamin A information) found the dominant competing biscuit brand harder than the Akarabo GP biscuit.

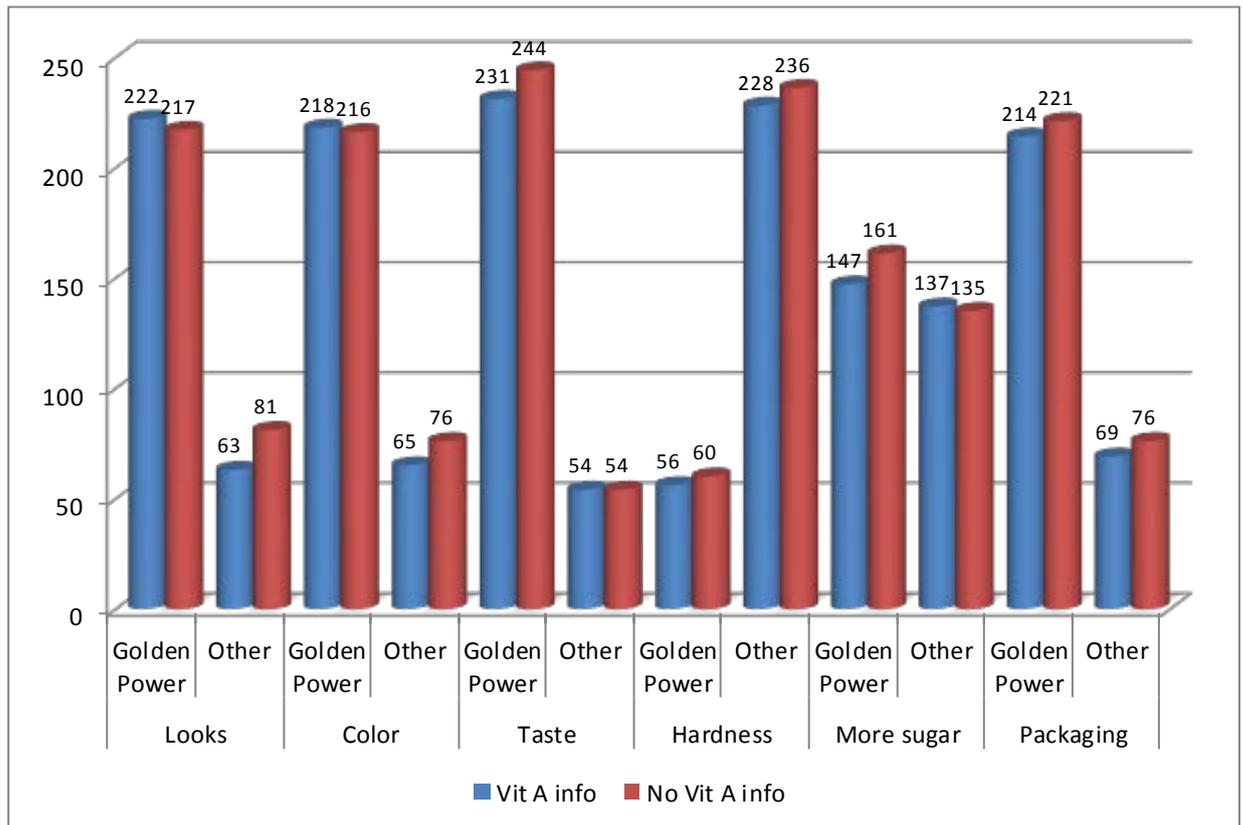


Figure 4: Preference for non-price attributes of OFSP-based biscuit in Rwanda, by vitamin A information (N is shown on bars)

Willingness to pay for Akarabo GP biscuit

The results of the analysis of consumers WTP for OFSP sweet potato-based biofortified biscuit are presented in Table 2 along with WTP for the dominant competing brand. Several observations emerge from these results. First, in general, consumers from middle and high income neighborhoods had a higher willing-to-pay for the Akarabo GP biscuits than those from low end neighborhoods. This finding is in line with *a priori* expectations. It is expected that consumers from more affluent neighborhoods will pay more for healthier biscuits because they have higher disposable income than their counterparts. Second, female consumers in the low, low/middle and high income neighborhoods are willing to pay more for Akarabo GP biscuits than their male counterparts. This gender difference was, however, not found among consumers in the middle/high income neighborhoods.

Third, the majority of the consumers, especially those in the low and low/middle income neighborhoods, are willing to pay more for Akarabo GP biscuits than the the competing brands. However, the picture is rather mixed among middle/high and high-end consumers. Among this group, the data show higher willingness to pay for the competing brand of biscuits. The only exception is the male consumers in the middle/high neighborhood who are willing to pay a marginally higher amount for the

OFSP-based biscuits. This finding is contrary to expectations. It was expected that consumers in lower to higher income neighborhood would be willing to pay more for Akarabo GP due to improvements in its nutritional value. This finding could be due to the fact that under the blind testing, consumers were not adequately informed that the Akarabo GP is biofortified with vitamin A. Therefore, WTP responses obtained from the respondents could be based on other factors.

The last two columns of Table 2 specifically seek to examine if the WTP for Akarabo GP would be higher for middle/high neighborhoods than those from low end among those aware of the enhanced nutritional content of the OFSP-sweet potato-based biscuit. As shown in these columns, male and female consumers in the middle/high neighborhoods are willing to pay RWF 298 and RWF 195, respectively, for the competing brand of biscuit compared to RWF 261 and RWF 161, respectively, for Akarabo GP. The same trend is observed for both male and female consumers in high-end neighborhoods. Notably though, the share of respondents in these two neighborhood categories to the total survey respondents is quite small.

SUMMARY AND CONCLUSIONS

This study sought to assess the demand for a newly released OFSP-based biscuit, namely the Akarabo GP biscuit. It used both blind and open testing to gather information on the consumption of biscuits, the perception about various attributes, the knowledge of vitamin A and WTP for vitamin A-rich Akarabo GP and a competing brand. The results show that Riham is the most widely consumed biscuit. The consumption of Akarabo GP is, however, quite low. The results also indicate that the majority of consumers rated Akarabo GP very favorably in terms of color, packaging and appearance and also sugar content. However, compared to other brands, Akarabo GP is less hard, which is a reflection of the fact that it is a cookie and not a hard biscuit. Overall, more male consumers rated the Akarabo GP more highly than their female counterparts. Results also indicate that both male and female consumers in low neighborhoods found the color and other non-price attributes of Akarabo GP more attractive.

Male and female consumers in the low and low/middle end neighborhoods had higher willingness to pay for Akarabo GP than the dominant competing brand. However, contrary to our expectations, consumers in affluent (middle/high and high) neighborhoods have higher willingness to pay for the competing brand than Akarabo GP.

Two conclusions arise from the findings of this study. First, the positive attributes (color, appearance, and packaging) make Akarabo GP biscuit attractive among the current consumers, especially those in low and low/middle income neighborhoods. Second, there is evidence that consumers, especially those in the low and low/middle neighborhoods, are willing to pay for the biofortified biscuit. However, high end consumers have higher WTP for the competing brands. It is likely that this inconsistency is due to data or design of the study. This contradiction calls for a more

carefully designed follow-up study to assess the WTP for the biofortified biscuit. Such study should also examine the factors that condition WTP using more rigorous quantitative analysis which the data could not support. Such analysis calls for collecting more detailed information on socio-economic characteristics of the respondents.

Though more rigorous analysis is needed to validate the findings of this study, the finding that consumers in the low end and low/middle end neighborhoods have higher demand for Akarabo GP implies that targeting these consumer groups can help alleviate vitamin A deficiency that is more prevalent in such class of neighborhoods. The findings also imply that targeting consumers with OFSP sweet potato-based products can greatly benefit from knowledge and information about vitamin A. The implication of this last finding is that health and public health departments need to focus more attention in informing the public about the dangers of hidden hunger and in promoting inexpensive means of overcoming the problem such through consumption of biofortified sweet potato and/or its value-added products.

Table 1: Preference for biscuit brands¹ in terms of frequency of purchase

Biscuit brands	Frequency	Valid Percent	Cumulative Percent
Riham	280	48.0	48.0
Akarabo Wheat (100% wheat)	42	7.2	55.2
Glucose	50	8.6	63.8
Marie	25	4.3	68.1
Nice	71	12.2	80.3
Milk	26	4.5	84.7
Other biscuit brands	93	15.2	100.0
Total	583	100.0	

¹ Akarabo Golden is included under the “Other biscuit brands” because of its relative unimportance in terms of frequency of purchases

Table 2: Mean willingness to pay (RWF) for different brands of biscuit, by gender and neighborhood category

Market class	Gender		Blind testing		Open testing	
			WTP for		WTP for	
			Akarabo GP	Other	Akarabo GP	Other
Low- end	Male	Mean	145.7	95.5	159.3	186.1
		N	144	144	138	138
		Std. Dev.	99.9	77.4	117.5	10601
	Female	Mean	146.4	84.0	183.54	191.7
		N	125	124	158	158
		Std. Dev.	92.0	64.2	129.9	149.1
Low-middle	Male	Mean	157.0	106.9	166.2	202.7
		N	73	72	96	96
		Std. Dev.	95.2	88.8	101.09	154.2
	Female	Mean	171.4	96.8	158.5	187.8
		N	59	59	41	41
		Std. Dev.	97.8	85.8	100.6	134.5
Middle -high end	Male	Mean	259.1	255.2	261.9	297.6
		N	55	54	42	42
		Std. Dev.	166.1	252.0	160.7	195.1
	Female	Mean	175.0	185.4	250.1	295.2
		N	24	24	10	10
		Std. Dev.	94.4	149.3	164.8	156.7
High end	Male	Mean	266.4	370.5	247.5	341.0
		N	37	37	39	38
		Std. Dev.	210.1	327.8	204.4	275.8
	Female	Mean	308.1	348.4	434.5	484.5
		N	31	31	29	29
		Std. Dev.	251.0	236.10	447.0	412.1

REFERENCES

1. **Onyango MOA** Market survey on African indigenous vegetables in western Kenya. In: *Proceedings of the 2nd JKUAT/DAAD workshop on sustainable Horticultural production in the Tropics* 6th-9th August 2002. pp 39-46.
2. **Onyango MOA** Unexploited potential of Indigenous African Vegetables in Western Kenya, *Maseno. Journal of Education Arts and Science*, 2003; **4(1)**: 103-122.
3. **Irungu C, Mburu J and P Maundu** Analysis of markets for African leafy vegetables within Nairobi and its environs and implications for on-farm biodiversity conservation. Global Facilitation Unit for Underutilized Species, Rome, Italy. 2007.
4. **Matenge STP, van der Merwe D, de Beer D, Bosman MJC and A Kruger** Consumers' beliefs on indigenous and traditional foods and acceptance of products made with cow pea leaves. *African Journal of Agricultural Research*, 2012; **7(14)**: 2243-2254.
5. **Weinberger K and TA Lumpkin** Diversification into horticulture and poverty reduction: A research agenda. *World Development*, 2007; **35**:1464–1480.
6. **Muhanji G, Roothaert RL, Webo C and S Mwangi** African indigenous vegetable enterprises and market access for small-scale farmers in East Africa. *International Journal of Agricultural Sustainability*, 2011; **9(1)**:194-202.
7. **Burchi F, Fanso J and E Frison** The role of food and nutrition system approaches in fighting hidden hunger. *International Journal of Environmental Research and Public Health*, 2011; **(2)**: 358-373.
8. **Abukutsa-Onyango M** The diversity of cultivated African leafy vegetables in three communities in western Kenya. *African Journal of Food Agriculture Nutrition and Development*, 2007, **7 (3)**: 1-15.
9. **Hutchinson MJ, Kipkosgei L and LS Akundabweni** The effect of farm yard manure and CAN fertilizers on micronutrient density and seed yield of *Solanum villosum* and *Cleome gynandra* on Eutric Nitisol. *Journal of Agriculture Science and Technology*, 2010; **13**: 35-52.
10. **Opiyo AM** Effect of nitrogen application on leaf yield and nutritive quality of black nighshade *Solanum nigrum* L. *Outlook on agriculture*, 2004; **33(3)**:209-214.
11. **Chowdhury S, Meenakshi JV, Tomlins KI and C Owori** Are consumers in developing countries willing to pay more for micronuntriient dense biofortified foods? Evidence from from a field experiment in Uganda. *American Journal of Agricultural Economics*, 2013; **93(1)**:83-97.

12. **Lancaster KA** New approach to consumer theory. *Journal of Political Economy*. 1966; **74**: 134 – 157.
13. **Lusk JL and D Hudson** Willingness-to-Pay estimates and their relevance to agribusiness decision making. *Review of Agricultural Economics*, 2004; **26** (2):152-169.
14. **Akgüngör S, Miran B and C Abay** Consumer willingness to pay for food safety labels in Urban Turkey: A case study of pesticide residues in tomatoes. *Journal of International Food and Agribusiness Marketing*, 2007; **12**(1): 91-107.
15. **Lacaze V, Rodriguez E and B Lupin** Risk perceptions and willingness to pay for organic fish chicken in Argentina. *Contributed paper prepared for presentation at international Association of agricultural economic conference, Beijing, China, August 16-22, 2009*.
16. **Takatsuka Y, Cullen R, Wilson M and S Wratten** Using stated preference techniques to value four key ecosystem services on New Zealand arable land. *International Journal of Agricultural Sustainability*, 2009; **7**(4):279-291.
17. **Lippe RS, Mergenthaler M and S Isvilanonda** Consumer willingness to pay for pesticide safe produce: the case of cabbage and yellow mango in Thailand. Available at www.globalresearch.com/main/.../PAPER_238_ConsumerWillingness.pdf 2010
18. **Lusk JL and B Briggeman** Food Values. *American Journal of Agricultural Economics*, 2009; **91**(1): 184-196.
19. **Blend J and E Van Ravensway** Consumer demand for eco-labeled apples: survey methods and descriptive results. *Staff paper 98-20*. Michigan University University, East Lansing, Michigan, USA. 1998.
20. **Gao Z and C Ted** Effects of label information on consumer willingness to pay for food attribute. *American Journal for Agricultural Economics*, 2009; **91**: 795-806.