



ASSESSMENT OF PREFERENCE AND DEMAND FOR SWEETPOTATO VALUE- ADDED PRODUCTS AMONG CONSUMERS IN RWANDA

Report Version #1

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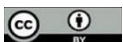
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Introduction

Rwanda's is one of the major producers of sweetpotato. It is the leading crop in terms of metric tons produced, a major staple and income earner. It is estimated that the per capita consumption of sweetpotato in Rwanda stands at 130 kg/year, making it a major food security crop (Ingabire and Vasanthakalam, 2011). Hence considerable effort has been directed at breeding for and producing improved nutritious varieties of sweetpotato in Rwanda. Indeed, Rwanda is a very active member of the East Africa sweetpotato breeding platform. The platform was set up in early 2010s with the main aim of breeding for adapted varieties, specifically focusing on resistance to sweetpotato virus diseases (SPVD), Alternaria blight, sweetpotato weevil. Parallel to the breeding effort, the Sweetpotato for Profit and Health Initiative, a multi-partner initiative, also spearheaded the introduction (through testing and release) of nutritionally enhanced varieties since 2010. Consequently, a number of high yielding improved varieties, including nutrient-rich orange-fleshed sweetpotato (OFSP) varieties have now been released in Rwanda to boost production specifically through collaborative effort between International Potato Center (CIP) and the Rwanda Agriculture and Animal Resources Development Board (RAB). The OFSP varieties are aimed at addressing Vitamin A deficiency problem, a major public health problem especially among pregnant and breastfeeding women and children under the age of 5 years.

One of the key bottlenecks to accelerating the uptake of improved varieties of clonally propagated crops such as sweetpotato is the weak seed system. For these crops, most farmers rely on own-recycled planting material or those from neighbors within the same community. The planting material therefore tend to be heavily infected with pests and diseases. To address this bottleneck, CIP and RAB have over the years established a country-wide network of more than seventy trained decentralized vine multipliers (DVM) focusing primarily on OFSP varieties. The multipliers are trained, monitored, inspected and certified to ensure that they produce quality planting material.

Despite the above interventions, the consumption of OFSP products has remained quite low in Rwanda. Consequently, OFSP producers struggle to find a reliable market for their produce. Yet, studies in Rwanda and elsewhere show that consumption of OFSP can indeed contribute to the fight against vitamin A deficiency. One of the reasons advanced for the low consumption of OFSP and poor access to market by producers is the misalignment between OFSP variety traits and consumers' preferences. Is the low consumption of OFSP produced driven by the lack of awareness?

Processing OFSP into puree, a versatile product that can be used as an ingredient in many processed products, has the potential to significantly lower the cost of baked products. The Rwanda Super Food project, for instance, established up to 45% of wheat flour can be substituted by OFSP puree resulting in cost-savings of up to 15%, 14%, and 7% in the production of doughnuts (mandazi), biscuits, and bread, respectively (Ndirigwe et al., 2015). Low and van Jaarsveld (2008) argue that up to 38% of the wheat flour can be replaced by OFSP puree in the production of buns. Diversifying the use of OFSP into fast moving consumer products such as bakery and other value-added product has the advantage of creating demand for raw roots. In addition it saves the scarce foreign exchange, especially given the high cost of wheat in the global market currently driven by the war in Ukraine. Substitution of sweetpotato for wheat is therefore seen as one strategy of easing the pressure on demand for wheat and hence the cost of its products.

In this study, we assess the consumer evaluation and preference for processed/value-added OFSP-based bakery products focusing on the attributes of these products. We then examine consumers' demand/willingness to pay for these products. The study targeted consumers in urban and peri-urban areas of Kigali city. It focused on two fast-

moving consumer products namely bread and mandazi. The former is commonly consumed by households as a breakfast meal while the latter is also widely eaten as a snack.

Study background

Majority of farmers in Rwanda grow non-orange-fleshed varieties of sweetpotato. However, these varieties have low nutritional value. The OFSP is rich in beta-carotene, a precursor of vitamin A, hence a proven food-based approach for contributing to the fight against Vitamin A deficiency. However, consumption of OFSP in the urban and peri-urban non-farming households is low. Some of the factors contributing to this include the perception of sweetpotato by some urban consumers as an inferior food, bulkiness and perishability of the roots, seasonality of root production, and the inconvenience associated to the time taken to peel and prepare the roots (Moyo et al., 2022). Processing OFSP into value-added products can resolve some of these constraints, notably those relating to bulkiness, perishability and convenience.

One of the success stories of sweetpotato commercialization in Africa has been the processing of OFSP into a thick mash known as puree. OFSP puree technology was introduced as a strategy to improve the storability of OFSP products and enhance vitamin A intake among rural and urban consumers. To make the puree easy to preserve, more efficient to handle, hence widely utilizable in a variety of food processing applications, research and development has developed shelf stable OFSP puree type, which has higher storage period under normal (non-refrigerated) conditions.

Several countries in Africa use OFSP puree in bakery applications. Current puree utilization falls into three categories, namely: fried products such as crisps, chips, chapatis, and doughnuts; baked products including breads and biscuits; and juices. Studies indicate that the fried products need OFSP varieties with high dry matter, as compared to the baked products or juices. Crisps and chips can be prepared directly from the raw roots, whereas bread, doughnuts (mandazi), biscuits, chapatis are produced from mixing OFSP puree and wheat with 20 – 50% OFSP puree (Moyo et al., 2022; Magnaghi et al., 2015). The viability of the OFSP puree-based products has been studied in several countries and on diverse products. In Kenya, Rwanda and Malawi OFSP puree has been used to make bread, biscuits, doughnuts and juice.

The literature also indicates that OFSP bread is more cohesive; crumbles less; and has a relatively longer shelf life, thus more shelf stable compared to 100% wheat bread. However, OFSP-based bread tends to have lower volume-for-weight, hence of relatively smaller size than their wheat-based counterparts. Further, because OFSP puree has no gluten, and displaces the proportion of gluten during the wheat-OFSP-puree substitution, the resulting composite bread is often relatively denser (Wanjuu et al., 2018). Indeed, the lack of gluten in OFSP makes 100% replacement of wheat flour with OFSP in bread making not feasible (Magnaghi et al., 2015).

The wheat-OFSP composite bread and other products can supply significant amounts of dietary vitamin A requirements of under-6-year-old children, pregnant women and lactating mothers (Kidane et al., 2013; Awuni et al., 2017; Malavi et al., 2022). Malavi et al. (2022) show that the proportion of OFSP puree in an OFSP-wheat composite bread is positively related not only to the beta-carotene content but also fibre content, yellow colour, and the microbial keeping quality of the bread. Amagloh (2019) find that the bread from the OFSP-wheat composite dough can meet up to 21% of Recommended Dietary Allowance (RDA) of vitamin A (1300 µg RAE/day) for lactating mothers. These studies further show greater preference among consumers for the OFSP-wheat composite bread than for 100% wheat bread.

Several past studies have assessed consumer acceptance of OFSP-based products. In South Africa, Laurie and Van Heerden (2012) examine consumer acceptance for four OFSP products namely, chips, doughnuts, juice, and cooked sweet potato leaves. They find that, on average, 92% of the consumers liked the color of the products. They also report that 87% of the respondents were ready to buy the products in the future while 88% would make them at home. Amagloh (2019), on the other hand, found that at least 77% of the consumers in their study in Ghana liked the appearance, aroma and sweetness of OFSP-based products. Other studies have also documented the drivers of demand for OFSP-based products. Chowdhury et al. (2011) for instance found that taste plays an important role in consumers' willingness to pay for OFSP products. In a study done in the same environment as ours (i.e., in Kigali), Bocher et al. (2019) found that taste, aroma and sweetness were major drivers of acceptance of OFSP juice. Okello et al. (2021) in a study of bread consumers in Nairobi find that sensory characteristics played a major role in the acceptance of OFSP-based bread. At household level, Adekambi et al. (2020) examined the joint effect of root sweetness, taste and drymatter content on demand for planting material. They found that these attributes had a joint significant effect. However, sweetness alone did not affect demand for roots and planting material.

Methods

Area and Sampling

This study was conducted in Kigali City Province of Rwanda. The province has a population of about 1.3 million people (Jaganyi et al., 2018) and hosts more than 75% of the urban population in Rwanda. It is divided into 3 districts namely, Gasabo, Kicukiro and Nyarugenge. The three districts are comprised of 15, 10 and 10 administrative sectors, respectively. About 21% of children under five years old in the city of Kigali are stunted (NISR, 2021).

The study used a multi-stage sampling technique to select study locations and participants. In the first stage, all the eight shops which sold the OFSP-based mandazi in Kigali were considered. The stores were then stratified by location (used as proxy of income level) into low and middle to high income residential areas. One of the stores, which was in a low-income area, was dropped due to congestion and difficulty of creating a conducive interview space. This resulted in the selection of 7 mandazi retail stores. Two of these stores were in or next to low-income residential neighbourhoods while five were in or around middle to high income residential neighbourhoods. All the stores were owned by the Ese Urwibutso Enterprise Ltd (also known as Sina Gerard Ltd), a multi-investment company which focuses on agro-processing with both downstream and upstream linkages by producing, retailing and marketing its own products. The stores sold both OFSP and non-OFSP mandazi. They were drawn from a total of seven administrative sectors.

For the case of bread, we worked with the private sector producer, CARL Group Ltd, to map all the stores it supplies taking into consideration income level of the people living in or around the store neighbourhood; store space to ensure that enumerators have room/space inside the store to conduct interviews/experiment; and the traffic flow of shoppers in the store. The latter was to make sure that enumerators would have enough bread buyers to interview per day and attain their pre-determined daily quotas. Using these criteria, we selected eight out of the total of 26 stores that retailed the OFSP-based (Vita) bread in Kigali were selected to participate in the study. One store was in the low-income residential neighborhood while seven were in the middle to high income residential neighborhoods. The stores drawn from eight administrative sectors. Figure 1 shows a map of the location of the mandazi and bread retail stores selected for the study. Appendix 1 presents random pictures OFSP mandazi and VITA bread in the respective stores where the interviews were conducted.

In the second stage of sampling, we used systematic random sampling technique to select the study respondents from both the mandazi and bread buyers. The sampling procedure was as follows: An enumerator, stationed in the mandazi/bread section of the store, approached and recruited every 2nd buyer who purchased the non-OFSP mandazi/bread. Next, the enumerator explained the objective of the study, then sought informed consent from the recruited mandazi/bread purchaser to participate in the study. If the response was affirmative, the enumerator proceeded with the interview, otherwise the interview was terminated. This process was repeated until a set number of interviews are completed in each selected store. For both products, the quota was set at four interviews per enumerator per day.

Interviews were conducted by trained enumerators using predesigned and pre-tested interview protocols in Kinyarwanda. They were conducted in Kinyarwanda or English, the two major languages in Rwanda. The language used depended on the respondent's preference. Interviews were conducted from 7:00am to 8:00pm from Monday to Saturday to capture different shopping patterns. Sunday was excluded because most city stores don't

receive significant number of shoppers as most people stay home/go to church. Figure 2 and 3 show enumerators conducting interviews with the mandazi and bread buyers, respectively.

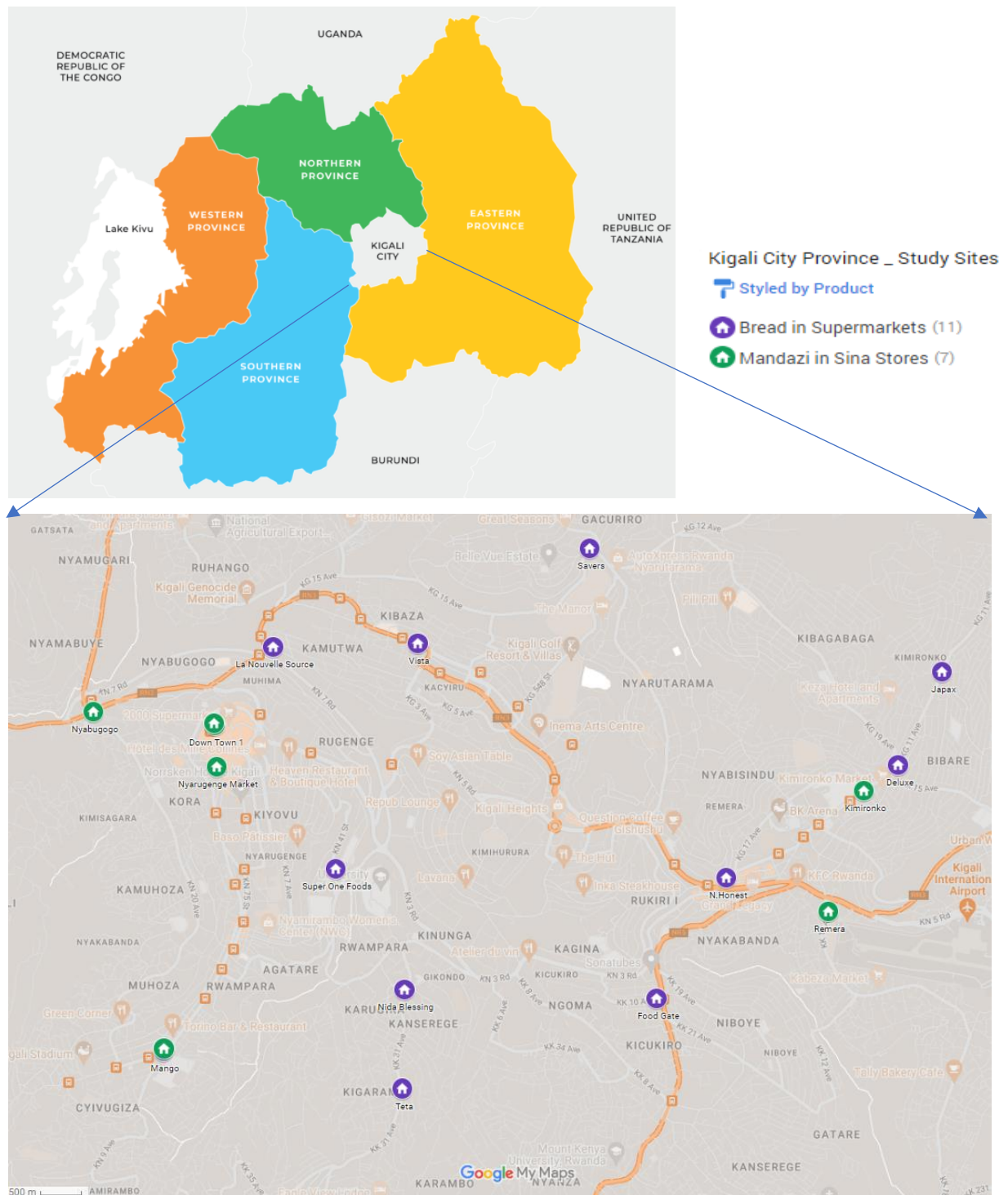


Figure 1: Study locations for the mandazi stores (green) and the bread supermarkets/sores (pink)



Figure 2: Enumerator (right) interviewing a mandazi buyer at the Sina Gerard shop in Nyabugogo, Nyarugenge district



Figure 3: Enumerator (right) interviewing a bread buyer in La Nouvelle Source supermarket, Kinamba, Gasabo district, Kigali

The interview and auction experiment

The interview proceeded as follows. After the administration of the consent statement, the respondent was asked to discuss briefly why s/she had opted for the brief (i.e., storytelling). Specifically, the enumerator opened this session by saying:

“I noticed that you selected product called [name]. Could you please describe the product (bread/mandazi) you have just selected and share about your awareness of, and preferences for, products (bread/mandazi) within this category”.

This conversation was intended as a warm-up hence information was not recorded. The storytelling ended with a question on the consumption (brand, weight, number purchased, and frequency of consumption). Data on the consumption was collected.

Next, the enumerator described the OFSP product using the narrative presented in Appendix 1. The description focused on the use of OFSP to make the bread, nutritional advantages of OFSP as relates to vitamin A enhancement, why vitamin A is important in preventing health problems associated with its deficiency and the processing of the OFSP-based products.

Data on anthropomorphism, i.e., the personification of product was then collected. This part of the interview sought to understand the personal characteristics that the respondents associated the OFSP bread with. That is the attribution of human behavior, emotions, or intentions to the OFSP-based products. Specifically, anthropomorphizing a brand usually affects the relationship a consumer has with the brand/product. In marketing, anthropomorphism is used to make a product endearing and desirable to consumers by imbuing human characteristics. The ultimate aim is to entice a consumer to form a variety of different relationships with a product –relationships such as casual acquaintances, close friendships, committed partnerships, flings, ... In this study, the respondents were asked to choose from a list of 100, no more than 10 most distinguishing human characteristics the respondent can attribute to the OFSP mandazi and bread. The respondent and the enumerator first went through the full list of 100 human characteristics (see Appendix 2) as the respondent selected those that they can attribute to the respective OFSP product. Thereafter, the respondent was asked to prioritize ten human characteristics out of the shortlist they made.

Following the anthropomorphism, the product conceptualization was administered. This followed a Trinity Matrix approach adapted from previous studies (Thomson 2010; Lagerkvist et al. 2015; Okello et al., 2021). The Trinity Matrix of product conceptualization focuses on three features of a product (i.e., bread/mandazi) namely, the label, the package and product. It assesses these product design features in terms of functional, emotional and hedonic/abstract attributes. Functional characteristics relate to what the product can do for you, emotional to the feelings that a product evokes, and hedonic to what is it that you as a consumer likes about the product. The trinity matrix administered in this study is presented in Appendix 3. It contained 83 items that pretested in two focus group discussions (FGDs) one with mandazi and another with bread consumers. A check-all-that-apply (CATA) approach was used in characterizing the OFSP bread/mandazi. The respondent was specifically asked to select the characteristics that, in his/her opinion, best described the OFSP-based product with regard to the label, packaging and the OFSP-based product (i.e., bread/mandazi) itself.

The respondents were also asked to taste and evaluate the sensory attributes of the products using the just-about-right (JAR) scale. This scale has been used extensively in assessing the products characteristics and is very useful to customizing a product to the market needs either prior to new launch or in recalibrating/refining the product to meet the needs of market. The scale consists of 5 items number in ascending order as -2 (much too little – MTL), -1 (too little – TL), 0 (just about right – JAR), 1 (too much – TM) and 2 (much too much – MTM). The scale was used to conduct sensory evaluation of the of OFSP-based products against 17 product features ranging from compactness to size. The features were evaluated through taste, touch and sight. Prior to tasting, the respondents asked to rinse their mouths thoroughly with clean still water.

In addition to assessing the sensory profile of the respondents using the three techniques above (i.e., anthropomorphism, CATA and JAR), we examined the “hurdles” consumers face in buying the OFSP products. In particular, we administered a Rasch scale module that collected data on intentions to buy OFSP product. We also assessed OFSP related aspects that act as barrier to purchase and consumption of OFSP products.

We assessed the respondents' willingness-to-pay a premium (and willingness-to-accept compensation) for OFSP-based products (and be compensated for replacing non-OFSP with the OFSP product) in this study using the Becker-Diamond and Meshack (BDM) auction approach to examine (Meshack et al., 1964). The auction proceeded as follows. First, the respondents were asked to recall the tasting of the bread. They were then given an endowment of 2000 RWF (for bread) and 500 RWF (for mandazi), disguised as a token of appreciation for participating in the study. Next, using the auction script in Appendix 4, the auction process was explained and demonstrated with an illustration. Once the respondent understood the process and how to bid, they were asked whether they would be willing to trade the non-OFSP product they had selected for the OFSP-based product. If the response was affirmative, the respondent was then asked to state the premium s/he would be willing to pay for the exchange of non-OFSP product with the OFSP product. On the other hand, if the respondent did not wish to trade the non-OFSP product for the OFSP product, they were asked to state the reasons for the decision and how much premium they would want as a compensation to do the exchange.

The sizes of OFSP bread and OFSP mandazi were different from those retailing in Kigali. The OFSP and non-OFSP breads both weighed 400g, but the non-OFSP bread was bigger in size/form. The difference in sizes was attributed to the fact that OFSP bread is much denser than 100% wheat bread. The OFSP mandazi sold by SINA Gerrard stores were also bigger in size than non-OFSP mandazi sold in the same stores. We therefore standardized the product sizes in order to make it easy for the respondents to state the premium bids for the two OFSP products. We did this by asking the respondents to consider/imagine a situation where the two products were of identical size and weight.

Data and analysis

The data was collected using ODK and transferred into Excel and Stata for analysis. The results presented were analysed using descriptive statistics in both Excel and State. Statistical tests of differences in means and frequencies were conducted using.

Results

Socio-demographic characteristics

Table 1 presents the socio-demographic characteristics of the study respondents by product and gender. Starting with the overall sample, results show that the respondents were, on average, middle-aged (31 years) and had 12 years of education. Majority (58%) had no salaried employment. The first three compares the characteristics of male and female respondents for the whole sample. More than one-half (54%) of the study participants were male buyers of bread and mandazi. The two groups of respondents differ in terms of employment, income level, count of children under 6-months and 5-years of age. They also differ in terms of the presence of pregnant and breastfeeding mothers in the respondent's household. Further, more male respondents (46.5%) had salaried employment compared to their female counterparts (38%). However, fewer male respondents (23%) fell under the low- income category compared to female (43%). More female respondents also reported that that their households had a child under five years, pregnant woman and a breastfeeding woman compared to male counterparts. Interestingly, the share of male respondents reporting that their households had a child under 6 months of age was higher (37%) than for female respondents (23%).

Columns 4 and 5 presents the differences in sociodemographic characteristics by gender for the mandazi buyers. The male and female buyers differ with respect to income level, household size, number of pregnant women and children under 5 years of age. As before, fewer male respondents (26%) fell in the low-income category compared to females (46%). For instance, the average size of household of male mandazi buyers was smaller, averaging 4 members, than that of females with an average of 5 members. However, female buyers reported a large share (11%) of pregnant members than male counterparts (5%).

The last two columns of Table 1 present differences in sociodemographic characteristics for male and female bread buyers. Unlike the case of mandazi, male and female buyers differed with respect to employment status. About 57% of male bread buyers had salaried employment compared to 43% for female buyers. In addition, and as seen earlier, fewer male buyers (17%) fell in the low- income category compared to female (39%).

Table 2 presents the socio-demographic characteristics by income category. Among the mandazi purchasers, we find significant differences between low and middle-high income groups with respect to age, education, gender and marital status. Majority of the mandazi purchasers in the middle-high income group were older, had higher education and were married compared to their counterparts in the low-income group. We find a similar trend for the bread purchasers. In addition, however, majority of the middle-high income group tended to be in salaried employment.

The socio-demographic characteristics of study respondents by location of store are presented in Table 3. A large proportion (86%) of the overall sample was interviewed in the stores located in the urban setting. A few differences in the characteristics of the sample based on the location of the store (i.e., urban, or peri-urban) are notable, especially in terms of the composition of the respondents' households. Mandazi buyers in the pre-urban settings had relatively more buyers that were married, pregnant mothers, children under 6 months old, and children between 2 to 5 years old compared to their counterparts in the urban settings. In the case of bread, buyers in the peri-urban settings had relatively more years of education. A higher proportion of them (37%) also had in their household members who are breastfeeding than their urban counterparts (17%).

Table 1: Demographic characteristics of the study respondents, by product and gender

Demographics by gender	Total (Mandazi +bread)			Mandazi			Bread		
	Female (n=179; 45.7%)	Male (n=213; 54.3%)	P-value	Female (n=97; 43.3%)	Male (n=127; 56.7%)	P-value	Female (n=82; 48.8%)	Male (n=86; 51.2%)	P-value
Age (Years)	30.13 (10.18)	30.99 (9.03)	0.37	30.18 (9.74)	30.21 (8.58)	0.98	30.07 (10.74)	32.14 (9.59)	0.19
Education (Years)	11.32 (3.84)	11.89 (12.11)	0.54	10.72 (3.62)	11.34 (12.08)	0.63	12.02 (3.99)	12.71 (12.17)	0.63
Salaried employment (1=Yes)	68 (38.0)	99 (46.5)	0.09	33 (34.0)	50 (39.4)	0.41	35 (42.7)	49 (57.0)	0.06
Store location (1=Urban; 0=Peri-urban)	157 (87.7)	180 (84.5)	0.36	83 (85.6)	105 (82.7)	0.56	74 (90.2)	75 (87.2)	0.53
Income level (1=Low; 0=Middle-High)	77 (43.0)	48 (22.5)	0.00	45 (46.4)	33 (26.0)	0.00	32 (39.0)	15 (17.4)	0.00
Married (1=Yes)	79 (44.1)	102 (47.9)	0.46	49 (50.5)	57 (44.9)	0.40	30 (36.6)	45 (52.3)	0.04
Marital Status:									
Single (1=Yes)	90 (50.3)	110 (51.6)		44 (45.4)	69 (54.3)		46 (56.1)	41 (47.7)	
Married & live with the spouse (1=Yes)	72 (40.2)	94 (44.1)		46 (47.4)	54 (42.5)		26 (31.7)	40 (46.5)	
Married but live far from spouse (1=Yes)	7 (3.9)	8 (3.8)		3 (3.1)	3 (2.4)		4 (4.9)	5 (5.8)	
Divorced/Separated/widowed (1=Yes)	10 (5.6)	1 (0.5)	0.02	4 (4.1)	1 (0.8)	0.26	6 (7.3)	0 (0.0)	0.03
Household size (count)	5.46 (9.92)	4.41 (2.19)	0.14	4.85 (1.78)	4.22 (1.97)	0.01	6.18 (14.54)	4.70 (2.47)	0.35
Household composition:									
<6 months old (count)	0.06 (0.23)	0.11 (0.37)	0.08	0.07 (0.26)	0.12 (0.37)	0.30	0.04 (0.19)	0.10 (0.38)	0.14
6-24 months old (count)	0.94 (9.28)	0.23 (0.49)	0.27	0.24 (0.47)	0.21 (0.45)	0.69	1.78 (13.70)	0.27 (0.54)	0.31
24 months to 5-year-olds (count)	0.33 (0.57)	0.33 (0.62)	0.99	0.39 (0.62)	0.39 (0.71)	0.98	0.26 (0.49)	0.23 (0.42)	0.74
> 5 years old (count)	4.13 (1.87)	3.74 (1.94)	0.04	4.15 (1.77)	3.50 (1.66)	0.00	4.11 (2.00)	4.10 (2.25)	0.99
Breastfeeding (count)	0.21 (0.41)	0.23 (0.44)	0.68	0.25 (0.43)	0.23 (0.44)	0.75	0.17 (0.38)	0.23 (0.45)	0.34
Pregnant (count)	0.09 (0.29)	0.05 (0.22)	0.10	0.11 (0.32)	0.05 (0.21)	0.06	0.07 (0.26)	0.06 (0.24)	0.70
HH has breastfeeding (1=Yes)	38 (21.2)	47 (22.1)	0.84	24 (24.7)	28 (22.0)	0.64	14 (17.1)	19 (22.1)	0.41
HH has pregnant (1=Yes)	17 (9.5)	11 (5.2)	0.10	11 (11.3)	6 (4.7)	0.06	6 (7.3)	5 (5.8)	0.69
HH has under-6-y/o (1=Yes)	10 (5.6)	20 (9.4)	0.16	7 (7.2)	13 (10.2)	0.43	3 (3.7)	7 (8.1)	0.22
HH has 6- 24-m/o (1=Yes)	35 (19.6)	45 (21.1)	0.70	21 (21.6)	25 (19.7)	0.72	14 (17.1)	20 (23.3)	0.32
HH has over 2 y/o to 5 y/o (1=Yes)	51 (28.5)	59 (27.7)	0.86	32 (33.0)	39 (30.7)	0.72	19 (23.2)	20 (23.3)	0.99

Note: Values are mean and standard deviation in parentheses, or frequency and percentages in parentheses for continuous and categorical variables, respectively. * p-values from Student's t-tests and Chi-square tests for the continuous and categorical variables, respectively.

Table 2: Demographic characteristics of the study respondents by income category

Demographics by income level	TOTAL (mandazi +bread)			Mandazi			Bread		
	Low income (n=125; 31.9%)	Middle-High (n=267; 68.1%)	P-value	Low income (n=78; 34.8%)	Middle-High (n=146; 65.2%)	P-value	Low income (n=47; 28%)	Middle-High (n=121; 72%)	P-value
Age (Years)	27.66 (9.80)	31.97 (9.16)	0.00	28.06 (9.18)	31.34 (8.85)	0.01	27.00 (10.83)	32.74 (9.50)	0.00
Education (Years)	9.81 (3.60)	12.48 (10.89)	0.01	9.54 (3.55)	11.89 (11.27)	0.07	10.26 (3.68)	13.20 (10.40)	0.06
Gender(1=Female)	77 (61.6)	102 (38.2)	0.00	45 (57.7)	52 (35.6)	0.00	32 (68.1)	50 (41.3)	0.00
Salaried employment (1=Yes)	44 (35.2)	123 (46.1)	0.04	30 (38.5)	53 (36.3)	0.75	14 (29.8)	70 (57.9)	0.00
Store location (1=Urban; 0=Peri-urban)	106 (84.8)	231 (86.5)	0.65	64 (82.1)	124 (84.9)	0.58	42 (89.4)	107 (88.4)	0.86
Married (1=Yes)	42 (33.6)	139 (52.1)	0.00	31 (39.7)	75 (51.4)	0.10	11 (23.4)	64 (52.9)	0.00
Marital Status:									
Single (never married) (1=Yes)	79 (63.2)	121 (45.3)		46 (59.0)	67 (45.9)		33 (70.2)	54 (44.6)	
Married & live with spouse (1=Yes)	40 (32.0)	126 (47.2)		29 (37.2)	71 (48.6)		11 (23.4)	55 (45.5)	
Married but live far from spouse (1=Yes)	2 (1.6)	13 (4.9)		2 (2.6)	4 (2.7)		0 (0.0)	9 (7.4)	
Divorced/Separated/widowed (1=Yes)	4 (3.2)	7 (2.6)	0.01	1 (1.3)	4 (2.7)	0.29	3 (6.4)	3 (2.5)	0.00
Household size (count)	4.38 (1.90)	5.13 (8.26)	0.31	4.38 (1.88)	4.55 (1.93)	0.54	4.36 (1.95)	5.83 (12.07)	0.41
Household composition (count):									
<6 months old (count)	0.06 (0.23)	0.10 (0.35)	0.19	0.06 (0.25)	0.12 (0.36)	0.25	0.04 (0.20)	0.08 (0.33)	0.44
6-24 months old (count)	0.30 (0.90)	0.68 (7.59)	0.58	0.27 (0.47)	0.20 (0.45)	0.27	0.36 (1.34)	1.26 (11.26)	0.59
24 months to 5 year olds (count)	0.26 (0.48)	0.36 (0.64)	0.14	0.32 (0.52)	0.43 (0.74)	0.24	0.17 (0.38)	0.27 (0.48)	0.19
> 5 years old (count)	3.76 (1.68)	4.00 (2.01)	0.26	3.74 (1.75)	3.80 (1.73)	0.81	3.79 (1.57)	4.23 (2.30)	0.22
Breastfeeding (count)	0.22 (0.41)	0.22 (0.44)	0.85	0.24 (0.43)	0.23 (0.44)	0.86	0.17 (0.38)	0.21 (0.43)	0.54
Pregnant (count)	0.06 (0.25)	0.07 (0.26)	0.70	0.05 (0.22)	0.09 (0.29)	0.31	0.09 (0.28)	0.06 (0.23)	0.52
HH has breastfeeding (1=Yes)	27 (21.6)	58 (21.7)	0.98	19 (24.4)	33 (22.6)	0.77	8 (17.0)	25 (20.7)	0.59
HH has pregnant (1=Yes)	8 (6.4)	20 (7.5)	0.70	4 (5.1)	13 (8.9)	0.31	4 (8.5)	7 (5.8)	0.52
HH has under-6-y/o (1=Yes)	7 (5.6)	23 (8.6)	0.30	5 (6.4)	15 (10.3)	0.33	2 (4.3)	8 (6.6)	0.56
HH has 6- 24-m/o (1=Yes)	29 (23.2)	51 (19.1)	0.35	20 (25.6)	26 (17.8)	0.17	9 (19.1)	25 (20.7)	0.83
HH has over 2 y/o to 5 y/o (1=Yes)	31 (24.8)	79 (29.6)	0.33	23 (29.5)	48 (32.9)	0.60	8 (17.0)	31 (25.6)	0.24

Note: Values are mean and standard deviation in parentheses, or frequency and percentages in parentheses for continuous and categorical variables, respectively. * p-values from Student's t-tests and Chi-square tests for the continuous and categorical variables, respectively.

Table 3: Demographic characteristics of the study respondents by store location

Demographics by Store location	Total			Mandazi			Bread		
	Urban (n=337; 86%)	Peri-urban (n=55; 14%)	P-value	Urban (n=188; 83.9%)	Peri-urban (n=36; 16.1%)	P-value	Urban (n=149; 88.7%)	Peri-urban (n=19; 11.3%)	P-value
Age (Years)	30.36 (9.77)	32.05 (8.18)	0.22	29.82 (9.07)	32.17 (9.01)	0.16	31.04 (10.58)	31.84 (6.54)	0.75
Education (Years)	11.52 (7.99)	12.31 (15.07)	0.56	11.28 (10.07)	9.97 (4.36)	0.44	11.82 (4.07)	16.74 (24.76)	0.03
Gender (1=Female)	157 (46.6)	22 (40.0)	0.36	83 (44.1)	14 (38.9)	0.56	74 (49.7)	8 (42.1)	0.53
Salaried employment (1=Yes)	144 (42.7)	23 (41.8)	0.90	71 (37.8)	12 (33.3)	0.61	73 (49.0)	11 (57.9)	0.46
Income level (1=Low; 0=Middle-High)	106 (31.5)	19 (34.5)	0.65	64 (34.0)	14 (38.9)	0.58	42 (28.2)	5 (26.3)	0.86
Married (1=Yes)	145 (43.0)	36 (65.5)	0.00	81 (43.1)	25 (69.4)	0.00	64 (43.0)	11 (57.9)	0.22
Marital Status:									
Single (never married) (1=Yes)	183 (54.3)	17 (30.9)		103 (54.8)	10 (27.8)		80 (53.7)	7 (36.8)	
Married & live with the spouse (1=Yes)	136 (40.4)	30 (54.5)		78 (41.5)	22 (61.1)		58 (38.9)	8 (42.1)	
Married but live far from spouse (1=Yes)	9 (2.7)	6 (10.9)		3 (1.6)	3 (8.3)		6 (4.0)	3 (15.8)	
Divorced/Separated/widowed (1=Yes)	9 (2.7)	2 (3.6)	0.00	4 (2.1)	1 (2.8)	0.01	5 (3.4)	1 (5.3)	0.14
Household size (count)	4.87 (7.41)	5.00 (1.89)	0.90	4.40 (1.95)	4.97 (1.63)	0.10	5.47 (10.91)	5.05 (2.34)	0.87
Household composition (count):									
<6 months old (count)	0.08 (0.31)	0.15 (0.36)	0.14	0.09 (0.32)	0.17 (0.38)	0.17	0.07 (0.30)	0.11 (0.32)	0.60
6-24 months old (count)	0.58 (6.76)	0.44 (1.29)	0.88	0.22 (0.45)	0.25 (0.50)	0.70	1.03 (10.15)	0.79 (2.07)	0.92
24 months to 5-year-olds (count)	0.30 (0.55)	0.49 (0.81)	0.03	0.36 (0.61)	0.58 (0.94)	0.06	0.23 (0.46)	0.32 (0.48)	0.47
> 5 years old (count)	3.92 (1.96)	3.93 (1.62)	0.98	3.74 (1.75)	3.97 (1.68)	0.47	4.14 (2.19)	3.84 (1.54)	0.57
Breastfeeding (count)	0.20 (0.41)	0.35 (0.52)	0.02	0.22 (0.43)	0.31 (0.47)	0.30	0.17 (0.38)	0.42 (0.61)	0.01
Pregnant (count)	0.07 (0.25)	0.11 (0.31)	0.24	0.06 (0.24)	0.17 (0.38)	0.02	0.07 (0.26)	0.00 (0.00)	0.22
HH has breastfeeding (1=Yes)	67 (19.9)	18 (32.7)	0.03	41 (21.8)	11 (30.6)	0.25	26 (17.4)	7 (36.8)	0.05
HH has pregnant (1=Yes)	22 (6.5)	6 (10.9)	0.24	11 (5.9)	6 (16.7)	0.02	11 (7.4)	0 (0.0)	0.22
HH has under-6-m/o (1=Yes)	22 (6.5)	8 (14.5)	0.04	14 (7.4)	6 (16.7)	0.08	8 (5.4)	2 (10.5)	0.37
HH has 6-24-m/o (1=Yes)	66 (19.6)	14 (25.5)	0.32	38 (20.2)	8 (22.2)	0.78	28 (18.8)	6 (31.6)	0.19
HH has over 2 y/o to 5 y/o (1=Yes)	88 (26.1)	22 (40.0)	0.03	55 (29.3)	16 (44.4)	0.07	33 (22.1)	6 (31.6)	0.36

Note: Values are mean and standard deviation in parentheses, or frequency and percentages in parentheses for continuous and categorical variables, respectively. * p-values from Student's t-tests and Chi-square tests for the continuous and categorical variables, respectively.

Mandazi and bread consumption behaviours

Figure 2 shows the frequency of consumption of mandazi and bread in a typical week among respondents in Kigali. Results indicate that both mandazi and bread buyers consumed, on average, the respective products more than 4 times in week. However, consumption of bread is more regular than that of mandazi. For instance, 35% of bread buyers consume it daily while only 20% of mandazi buyers do so. Overall, the figure shows that consumption of bread and mandazi by the study respondents is fairly high.

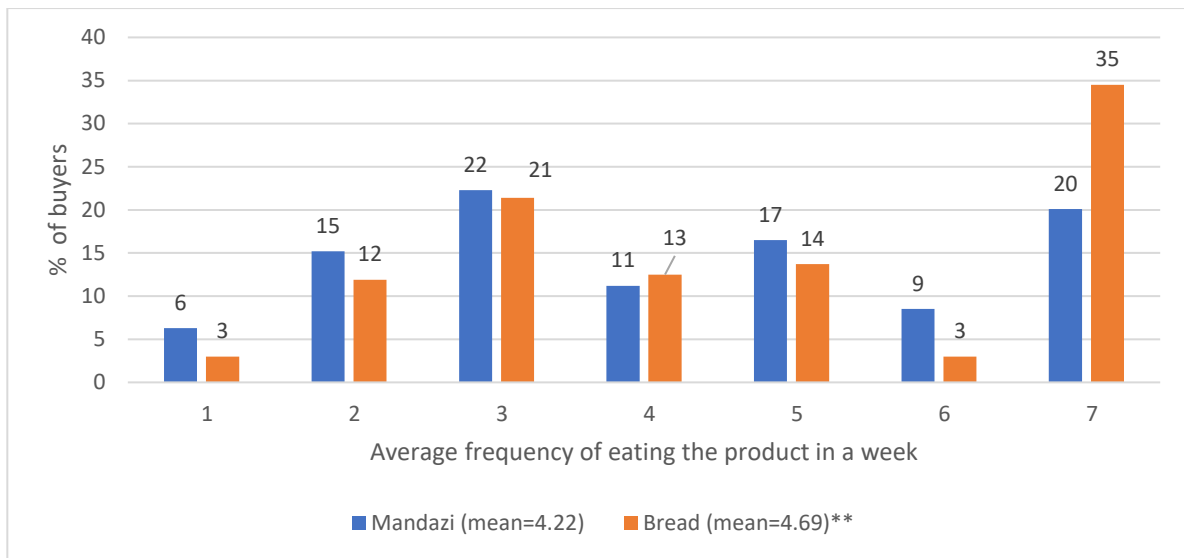


Figure 4: Average frequency of eating any brand of bread/mandazi per week

Figure 3 shows the frequency of consumption of the specific mandazi or bread that the respondents had selected prior the interview. It shows the bread consumers are quite loyal to the brand they had selected that day than the mandazi consumers. About 46% of bread buyers as compared 37% for mandazi buyers indicated that they typically consume the selected products for at least 4 days in a typical week.

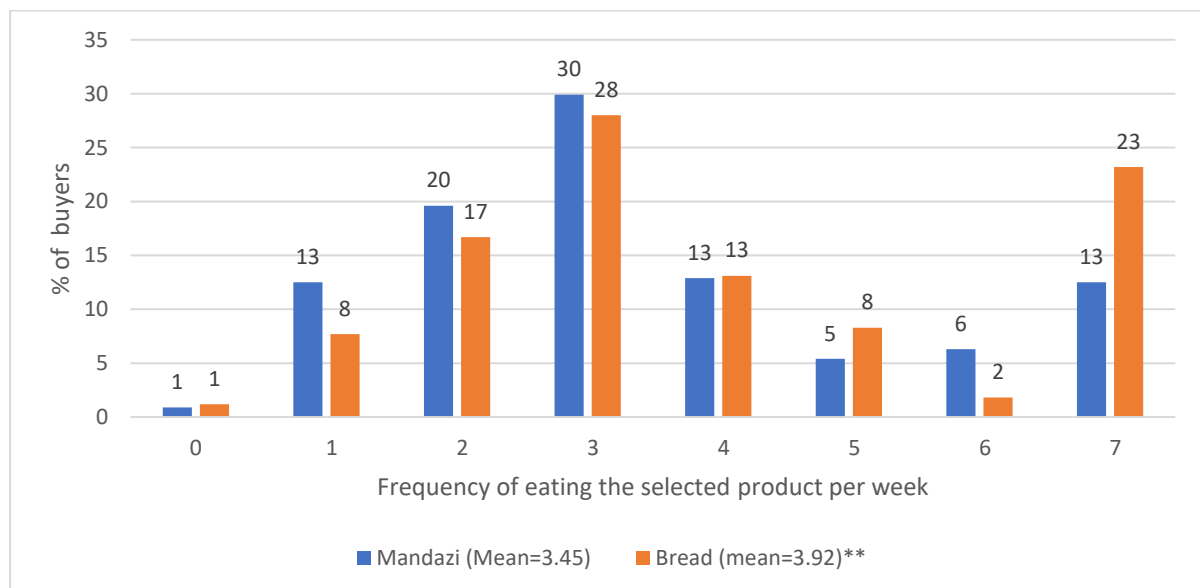


Figure 5: Frequency of consumption of the selected non-OFSP products per week

Prices of the non-OFSP and OFSP products

The price of the bread selected prior to interviews varied widely based on differences in bread size (400g to 1000g), color (white, brown or yellow), brand and form, and location. The most common bread brands encountered during the study were La Galette, Simba, Ilite, Bourbon Coffee, and Agasabo bakery. These bread types sold at different prices based also on store location and type. Supermarket stores located in middle-high income neighbourhoods sold bread at relatively higher prices with a premium of RWF 100 or RWF 200. The 600g of La Galette brown bread was sold at the highest price (RWF 2400) while the 400g of white bread from Agasabo bakery was sold at the lowest price of RWF 600. The price of the VITA bread also varied across supermarkets ranging from RWF 1000 to RWF 1200 for the one size (600g loaf) available in the market at the time of the study. The price of the mandazi, however, did not vary by store or location. Unlike bread, the mandazi was unbranded. They were produced by one firm and sold in outlets owned by the firm. The normal round-shaped wheat-based mandazi was sold at RWF 200. The OFSP-based mandazi, on the other hand, sold at a fixed price of RWF 300 in all the stores.

Personification of OFSP products

The results of the personification of the OFSP bread and mandazi are shown in Figure 4. They suggest that both products are predominantly associated with positive human characteristics. Negative characteristics accounted for less than 1.5% of the total 3,632 responses (1.8% of 2075 responses for mandazi and 1.1% of 1,557 responses for bread). The top ten positive human characteristics associated with the OFSP-based mandazi (in order of frequency) are: active, brilliant, energetic, intelligent, creative, determined, brave, wise, confident, and loving. These were mentioned by at least 23% of the respondents and accounted for 36% of the 2,075 responses. On the other hand, in the case of VITA bread, an OFSP-based product, the most common human characteristics respondents associated it with are: active, brilliant, intelligent, loving, energetic, brave, wise, determined, confident and creative. These were selected by at least 27% of the respondents and accounted for 35.8% of the total responses in the bread survey.

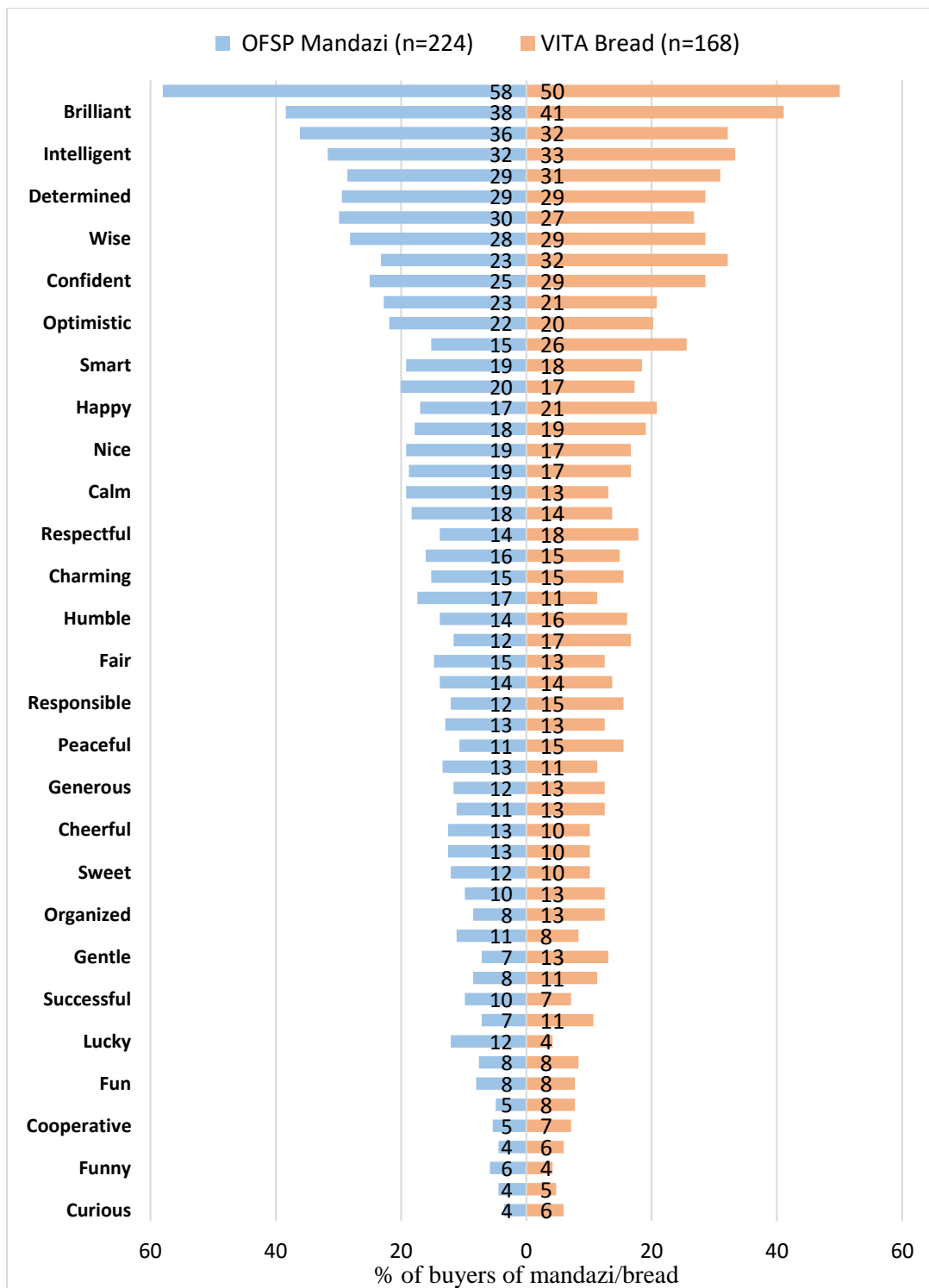


Figure 6: Major human characteristics the respondents associated with the OFSP-based products

Conceptualization of the OFSP products (Trinity matrix)

Table 4 shows the proportions of the check-all-that-apply (CATA) responses to the constructs in the Trinity Matrix for each of the OFSP products while Table 5 compares the responses by gender for the two OFSP-based products. There were no significant differences in the weight that the respondents attached to the functional, emotional, hedonic features between the OFSP mandazi and VITA bread. However, men and women conceptualized the products differently. Men gave the OFSP mandazi product higher weights than women did in all the three dimensions (functional, emotional hedonic). On the other hand, when it comes to the VITA bread, women gave higher weights than men in all the three dimensions. Women showed greater emotional attachment to the OFSP bread than men, even though the difference is not statistically significant.

Table 4: Proportions of the CATA responses per category of the trinity matrix by product

	Mandazi (n=224)			Bread (n=168)			Difference: <i>Mandazi – Bread (P-value*)</i>		
	Functional	Emotional	Hedonic	Functional	Emotional	Hedonic	Functional	Emotional	Hedonic
Label	-		-	68		42	-		-
Package	-	26	-	63	24	49	-	2(0.22)	-
Product	57		53	55		54	3(0.36)		1(0.71)

Table 5: Proportions of the CATA responses per category of the trinity matrix on the OFSP Products by gender

<i>OFSP-based mandazi by gender</i>									
	Female (n=97)			Male (n=127)			Difference: <i>Female - Male (P-value*)</i>		
	Functional	Emotional	Hedonic	Functional	Emotional	Hedonic	Functional	Emotional	Hedonic
Label	-		-	-		-	-		-
Package	-	23	-	-	28	-	-	-5(0.03)	-
Product	54		50	60		56	-6(0.05)		-7(0.03)
<i>OFSP-based bread by gender</i>									
	Female (n=82)			Male (n=86)			Difference: <i>Female -Male (P-value*)</i>		
	Functional	Emotional	Hedonic	Functional	Emotional	Hedonic	Functional	Emotional	Hedonic
Label	70		45	66		39	4(0.15)		6(0.02)
Package	67	24	51	59	26	47	8(0.01)	2(0.27)	3(0.41)
Product	58		58	51		50	7(0.06)		8(0.01)

Table 6 compares the CATA responses for each OFSP-based products by income level of the respondent. Low and high income mandazi buyers share the same weighting for the functional, emotional, hedonic attachment to the OFSP mandazi. However, there are significant differences among bread buyers of different income levels in conceptualization of the VITA bread with respect to functional, emotional, and hedonic dimensions. The differences between the low-income earners and high-income earners conceptualization with regard to hedonic features of the product were not statistically significant.

Table 6: Proportions of the CATA responses per category of the trinity matrix on the OFSP products by income level

<i>OFSP mandazi by income level</i>									
	<u>Low income (n=82)</u>			<u>High income (n=86)</u>			<u>Difference: Low – Middle to High(P-value*)</u>		
	Functional	Emotional	Hedonic	Functional	Emotional	Hedonic	Functional	Emotional	Hedonic
Label	-		-	-		-	-		-
Package	-	26	-	-	25	-	-	0.4(0.57)	-
Product	57		53	57		54	0(0.98)		1(0.74)

<i>VITA bread by income level</i>									
	<u>Low income (n=82)</u>			<u>High income (n=86)</u>			<u>Difference: Low – Middle to High (P-value*)</u>		
	Functional	Emotional	Hedonic	Functional	Emotional	Hedonic	Functional	Emotional	Hedonic
Label	74		49	65		40	8(0.01)		9(0.00)
Package	67	31	52	61	21	48	7(0.04)	10(0.00)	4(0.27)
Product	62		59	51		52	11(0.02)		7(0.05)

*In parentheses are P-values of results of Mann-Whitney U test for the hypothesis that the distributions of proportions per category is the same by category across treatments

Sensory evaluation of the OFSP products

Table 7 presents respondents' evaluation of the appropriateness of various sensory characteristics of the OFSP-based mandazi, by gender of the respondent. The last column presents the results of Mann-Whitney U test for significant differences in the sensory characteristics by gender. None of the 17 characteristics met the 70% recommended threshold of acceptability on the JAR rating scheme (Stone & Sidel, 2004). Nonetheless, eight characteristics (airy texture, yellow color, hard texture, soft texture, sweetpotato smell, sweetpotato flavor, sourness, and sweetness/sugariness) had the highest deviation from the threshold. These were scored below 50% by both male and female consumers. This indicates that these characteristics were significantly below what the consumers would have wished to have in the products. Thus, they can be prioritized in the refinement of the products to meet sensory characteristics consumers desire to have in OFSP-based mandazi.

Both male and female respondents found the compactness, shape, heaviness, golden crust, smell of mandazi, soft texture, saltiness, size/rising of the mandazi were on the higher side, i.e., 'too much'. The two categories of the respondents however evaluated airy texture, sweetpotato smell, sweetpotato flavour, wheat flavour, sourness of the dough and sweetness/sugariness of the sweetpotato mandazi to be on the lower side, namely, 'too little.' At the same time, male and female study respondents showed significant variation in their assessment of five sensory characteristics namely, airy texture, sweetpotato flavour, sourness and color. A significantly high number of female respondents compared to male assessed airy texture, sweetpotato flavour, sourness of the mandazi to be on the lower side, i.e., 'too little'. In addition, higher number of female respondents tended to differ on the intensity of the yellow colour and texture characteristics. A higher number of female respondents also found the (yellow) colour to be 'too little' (28%) as opposed too little (22%) as compared to their male counterparts who instead assessed color to be 'too much' (32%) as opposed to 'too little' (22%). In addition, while relatively more female respondents evaluated the hard texture as 'too little' (36.1%) as opposed to 'too much' (33%), male respondents found it to be 'too much' (38%) as opposed to 'too little' (22%).

Table 7: Proportion of non-OFSP mandazi buyers in different JAR score categories by sensory characteristic and gender

% JAR responses for OFSP mandazi by gender	Female (n=97; 43.3%)					Male (n=127; 56.7%)					p-value*
	MTL	TL	JAR	TM	MTM	MTL	TL	JAR	TM	MTM	
1. Compactness	0	3.1	63.9	24.7	8.2	0	5.5	63.8	21.3	9.4	0.62
2. Shape	0	5.2	61.9	19.6	13.4	0	8.7	59.8	21.3	10.2	0.50
3. Mandazi heaviness	0	4.1	56.7	32.0	7.2	0	7.1	44.9	37.0	11.0	0.29
4. Airy texture	20.6	30.9	38.1	5.2	5.2	17.3	23.6	39.4	13.4	6.3	0.08
5. Golden crust	1.0	5.2	61.9	26.8	5.2	0.0	11.0	55.1	22.0	11.8	0.93
6. Yellow color	4.1	23.7	49.5	12.4	10.3	2.4	19.7	41.7	18.1	18.1	0.04
7. Smell of bread/mandazi	3.1	14.4	54.6	12.4	15.5	1.6	9.4	54.3	16.5	18.1	0.16
8. Hard texture	4.1	32.0	30.9	21.6	11.3	0.0	22.0	40.2	23.6	14.2	0.07
9. Soft texture	2.1	24.7	43.3	16.5	13.4	3.1	21.3	48.0	16.5	11.0	0.92
10. Sweetpotato smell	29.9	30.9	27.8	9.3	2.1	22.0	36.2	20.5	14.2	7.1	0.16
11. Sweetpotato flavor	25.8	36.1	26.8	6.2	5.2	15.0	36.2	26.8	14.2	7.9	0.02
12. Wheat flavor	8.2	13.4	63.9	11.3	3.1	5.5	26.0	42.5	18.1	7.9	0.74
13. Sourness/sourdough	6.2	35.1	43.3	8.2	7.2	7.9	20.5	49.6	11.8	10.2	0.07
14. Saltiness	2.1	12.4	62.9	12.4	10.3	2.4	13.4	61.4	14.2	8.7	0.85
15. Sweetness/sugary	10.3	26.8	42.3	9.3	11.3	7.9	18.9	50.4	10.2	12.6	0.20
16. Mouthfeel	0	21.6	55.7	9.3	13.4	0.8	15.7	53.5	15.0	15.0	0.21
17. Size (rising)	0	7.2	52.6	23.7	16.5	0	15.7	49.6	16.5	18.1	0.23

* Mann-Whitney U test (Female vs Male). MTL=Much Too Little; TL=Too Little; JAR=Just About Right; TM=Too Much; MTM=Much Too Much

The results of assessment of OFSP-based bread using the JAR scale are presented in Table 8. Contrary to OFSP-mandazi case, some of the characteristics of the VITA bread (namely, compactness, shape, golden crust, yellow colour, and smell/aroma of bread) met the recommended threshold for acceptability in the JAR scale. They received JAR scores of 70% or higher (see Table 8). However, six characteristics (i.e., hard texture, sweetpotato smell, sweetpotato flavour, sourness, sweetness/sugariness, and size) scored even below 50% on JAR scale. These characteristics need refinement to improve the appeal of VITA bread. These findings partially corroborate those of a similar study conducted in Nairobi where some of the attributes namely, texture, sweetpotato smell, sweetpotato flavour and sourness did not meet the acceptability threshold in OFSP bread (Lagerkvist et al., 2021; Okello et al., 2021).

The current results show that, of the attributes that failed to meet the acceptability threshold, slice heaviness, hard texture, sweetpotato smell, sweetpotato flavour, wheat flavour, sourness, sweetness, mouthfeel, and size(rising) of the bread, were assessed as ‘too little’, and need to be adjusted upwards. However, airy texture and soft texture attributes were assessed as ‘too much’ and thus need to be adjustment downwards. Evaluation of saltiness is somewhat ambiguous as male respondents found it to be just-about-right while female respondents assessed it as ‘too much’. The difference in saltiness evaluations is not statistically significant. However, literature suggests that a more airy and softer bread tend to be saltier since these characteristics affect the release of sodium ions (Pfalum et al., 2013).

Results also indicate that there is a significant gender difference in sensory evaluation of the OFSP-based bread with respect to slice heaviness. Relatively more male (38%) than female (28%) respondents observed that the weight of a slice of the VITA bread is ‘too little’. The scoring of the slice heaviness as “too little” is contrary to our expectations. The VITA bread is expected to be denser than non-OFSP bread because of the reduced level of gluten which is only available in insignificant quantities in OFSP puree used in making VITA bread.

Table 8: Proportion of non-OFSP bread buyers in different JAR score categories by sensory characteristic and gender

% JAR responses for VITA bread by gender	Female (n=82; 45.7%)					Male (n=86; 54.3%)					P-value*
	MTL	TL	JAR	TM	MTM	MTL	TL	JAR	TM	MTM	
1. Compactness	1.2	11.0	75.6	11.0	1.2	0	16.3	68.6	12.8	2.3	0.95
2. Shape	0	12.2	70.7	12.2	4.9	0	7.0	84.9	5.8	2.3	0.58
3. Slice heaviness	3.7	24.4	51.2	15.9	4.9	2.3	36.0	50.0	9.3	2.3	0.09
4. Airy texture	2.4	15.9	57.3	15.9	8.5	2.3	16.3	62.8	15.1	3.5	0.47
5. Golden crust	1.2	7.3	68.3	13.4	9.8	0	11.6	70.9	15.1	2.3	0.23
6. Yellow colour	0	2.4	69.5	17.1	11.0	0	7.0	72.1	12.8	8.1	0.16
7. Smell of bread	1.2	6.1	72.0	15.9	4.9	1.2	7.0	73.3	10.5	8.1	0.80
8. Hard texture	9.8	36.6	41.5	11.0	1.2	3.5	48.8	37.2	7.0	3.5	0.77
9. Soft texture	1.2	8.5	63.4	19.5	7.3	1.2	9.3	67.4	17.4	4.7	0.50
10. Sweetpotato smell	28.0	32.9	25.6	9.8	3.7	37.2	34.9	18.6	4.7	4.7	0.12
11. Sweetpotato flavour	18.3	37.8	31.7	9.8	2.4	24.4	38.4	26.7	7.0	3.5	0.31
12. Wheat flavour	7.3	15.9	62.2	13.4	1.2	3.5	10.5	72.1	10.5	3.5	0.29
13. Sourness/sourdough	30.5	13.4	51.2	3.7	1.2	31.4	18.6	46.5	3.5	0.0	0.53
14. Saltiness	4.9	11.0	65.9	12.2	6.1	1.2	15.1	70.9	8.1	4.7	0.56
15. Sweetness/sugary	22.0	23.2	43.9	9.8	1.2	18.6	15.1	57.0	7.0	2.3	0.31
16. Mouthfeel	9.8	13.4	61.0	13.4	2.4	4.7	19.8	62.8	9.3	3.5	0.81
17. Size (rising)	11.0	34.1	46.3	6.1	2.4	11.6	34.9	48.8	3.5	1.2	0.67

* Mann-Whitney U test (Female vs Male). MTL=Much Too Little; TL=Too Little; JAR=Just About Right; TM=Too Much; MTM=Much Too Much

Valuation (willingness to pay for OFSP-based products)

Figure 5 shows the proportion of respondents of the non-OFSP products who accepted to pay some amount of money to replace the non-OFSP products they had selected with the OFSP mandazi or VITA bread. The results show that significantly higher number (93.8%) of mandazi than bread buyers (51.2%) were willing to pay some additional money (i.e., a premium) to make the replacements. Several factors could have contributed to the higher number of respondents willing to pay for OFSP-based mandazi than OFSP-based bread.

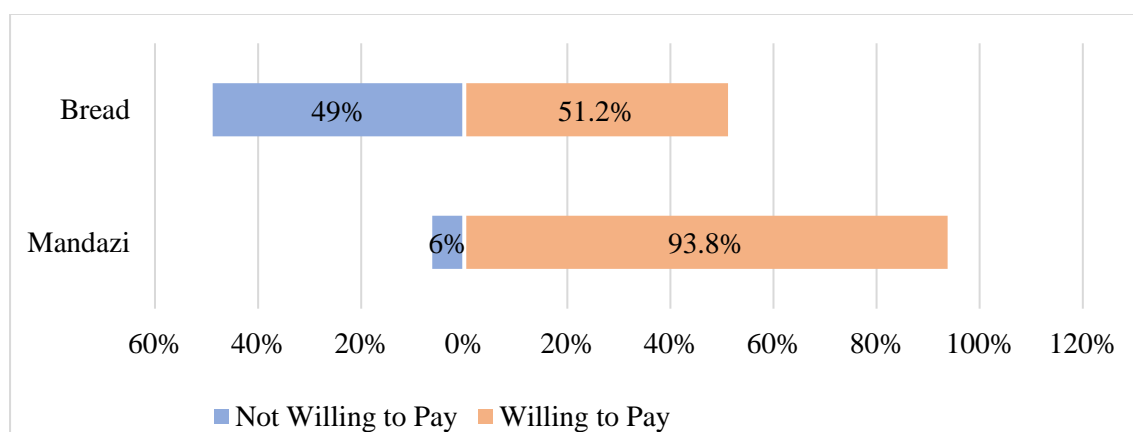


Figure 5: Proportion of the non-OFSP product buyers willing to pay for the OFSP products in Kigali

The distribution of the willingness to pay premiums for the OFSP-based products for the whole sample by gender is presented in Figure 6. The premiums ranged between RWF 0 – RWF 500 for OFSP mandazi and RWF 100 – RWF 1500 for VITA bread). This is due to the difference in prices of the two products. Mandazi used in the study sold at RWF 300/piece while VITA bread was selling at RWF 1000 – RWF 1200/loaf. Results indicate that more male than female respondents were willing to pay some premium to trade the selected product for OFSP-based product. The premium bids were on average higher (with greater variation) for male than female respondents for the two OFSP-based products. The average willingness to pay (WTP) premium for OFSP-based mandazi was RWF 235. The mean WTP for OFSP-based mandazi were not statistically significantly different for male and female respondents.

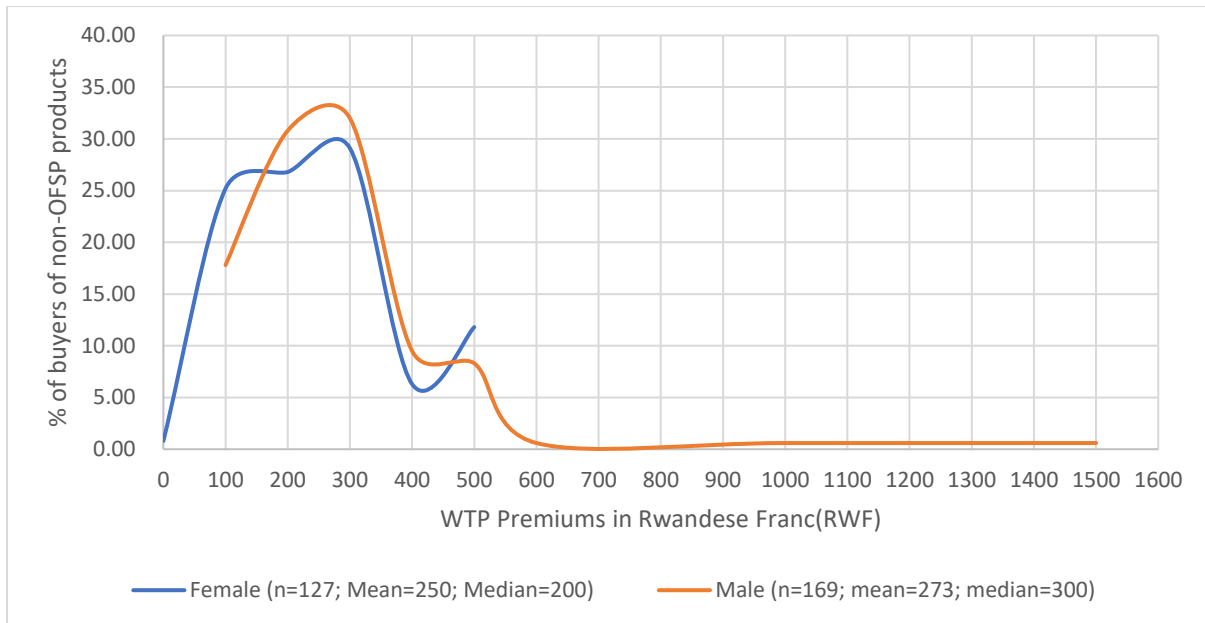


Figure 6: Distribution of WTP premiums for OFSP-based products by gender

Analysis by product shows that there is also no significant difference in mean WTP premium for OFSP-based mandazi between female (RWF 288) and male (RWF 248) respondents (see Figure 7). The mode WTP premium for male and female respondents was RWF 300. We also found no significant difference in mean WTP for OFSP-based mandazi between low and middle-high income groups.

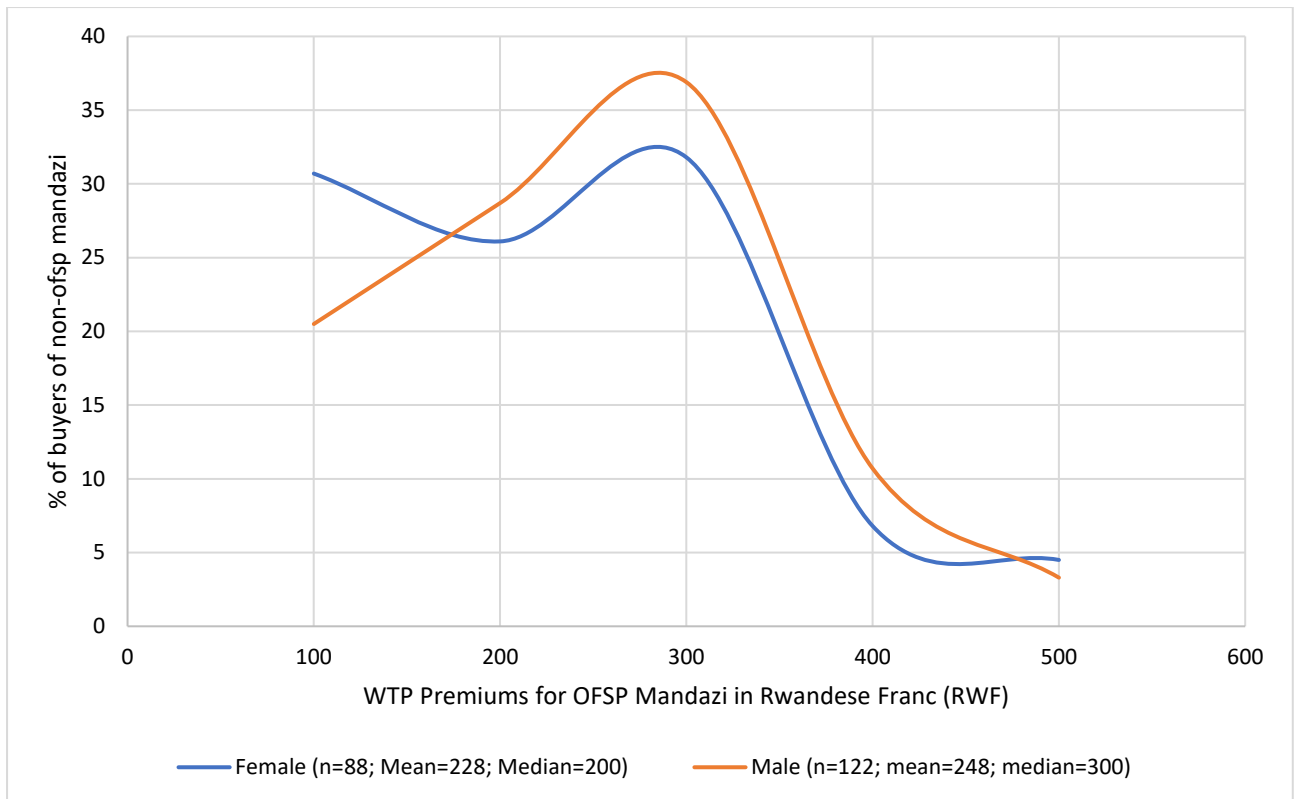


Figure 7: Distribution of WTP premium for OFSP-based mandazi among by gender

The average WTP premium for VITA bread was RWF 320, with RWF 200 and RWF 500 as the most frequent bids (Figure 8). This indicates that respondents were willing to pay extra RWF 320 to replace the non-OFSP bread with the VITA bread. Female respondents had a lower WTP premium (i.e., RWF 300) bid for the VITA bread than their male counterparts (RWF 338). However, there were no differences in the distribution of the WTP premiums for the VITA bread by gender and income level.

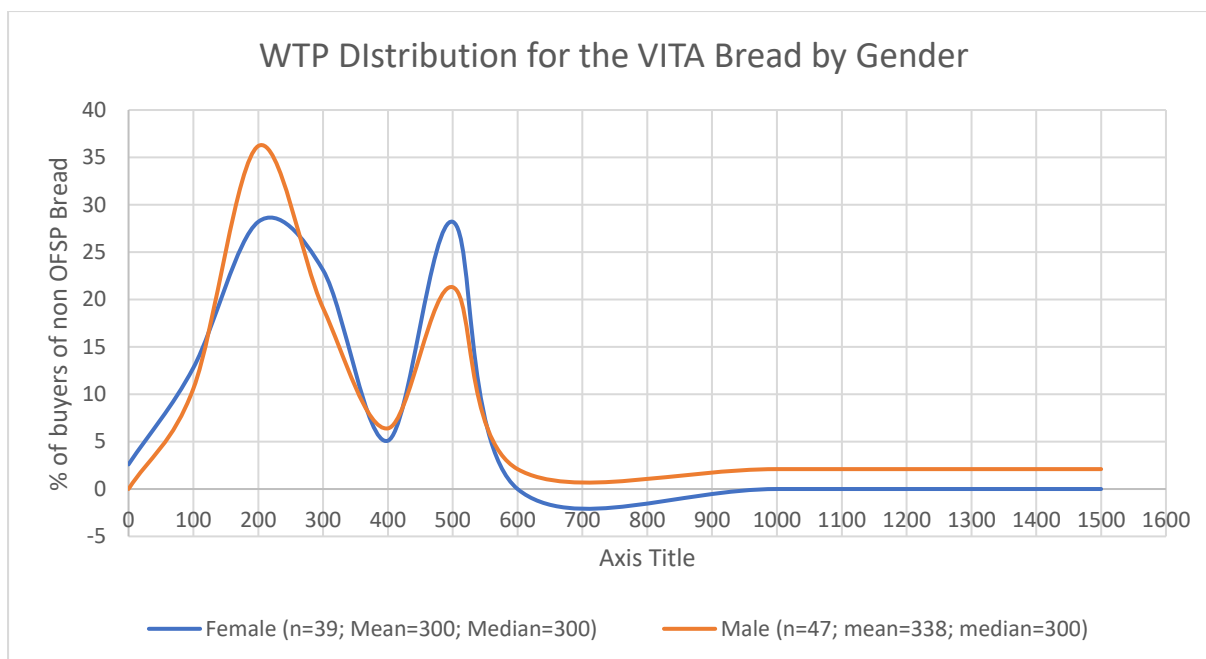


Figure 8: Distribution of WTP Premiums for VITA bread by gender of the respondent

Qualitative influencers of willingness-to-pay

The respondents were asked to assess what would influence their intention to buy OFSP-based products after being receiving information about vitamin A and biofortification of OFSP. The assessment was based on 20 constructs/statements about OFSP-based products generated during pre-survey FGDs with bread and mandazi consumers in the city of Kigali. The results of the assessment are presented in Figure 9. As shown, a large majority of the respondents agreed (somewhat or fully) with most of the statements/constructs. At least 81% of the respondents agreed with statements relating to their perception of OFSP-based products as: having high amounts of vitamin A; increasing food energy, preventing of eyesight problems; reducing VAD burden in society; and ensuring healthy eating among children. Nutritional and sensory benefit aspects dominated the top ten influencers of intention to purchase the OFSP products. Specifically, seven out of the top ten influencers of intention to purchase OFSP-based products were nutrition and sensory related. They include: reduce VAD (with 90% agreeing – somewhat or fully), prevent eyesight problems (88%), tasty (8%), appealing color (81%), no added sugar (80%), no artificial colors (84%), and high fiber (75%). These findings therefore indicate that consumers decision to purchase OFSP-based products in future will be strongly informed by nutrition and sensory attributes.

Results further indicate that economic factors associated with the benefits to root producers and society are likely to be key influencers of intention to purchase the OFSP-based products. These factors include improve local production of bread/mandazi ingredients (with 90% agreeing somewhat or fully), improve livelihood (90%), shorten transportation of inputs for bread/mandazi making (80%). Aspects related to nostalgia fared relatively less with only about 60% of the respondents agreed (somewhat or fully) that nostalgic feelings about a mandazi/bread made from sweetpotato would influence their intention to purchase the two OFSP-based products. There were no significant gender differences in all these results relating to influencers of intention to purchase OFSP-based products.

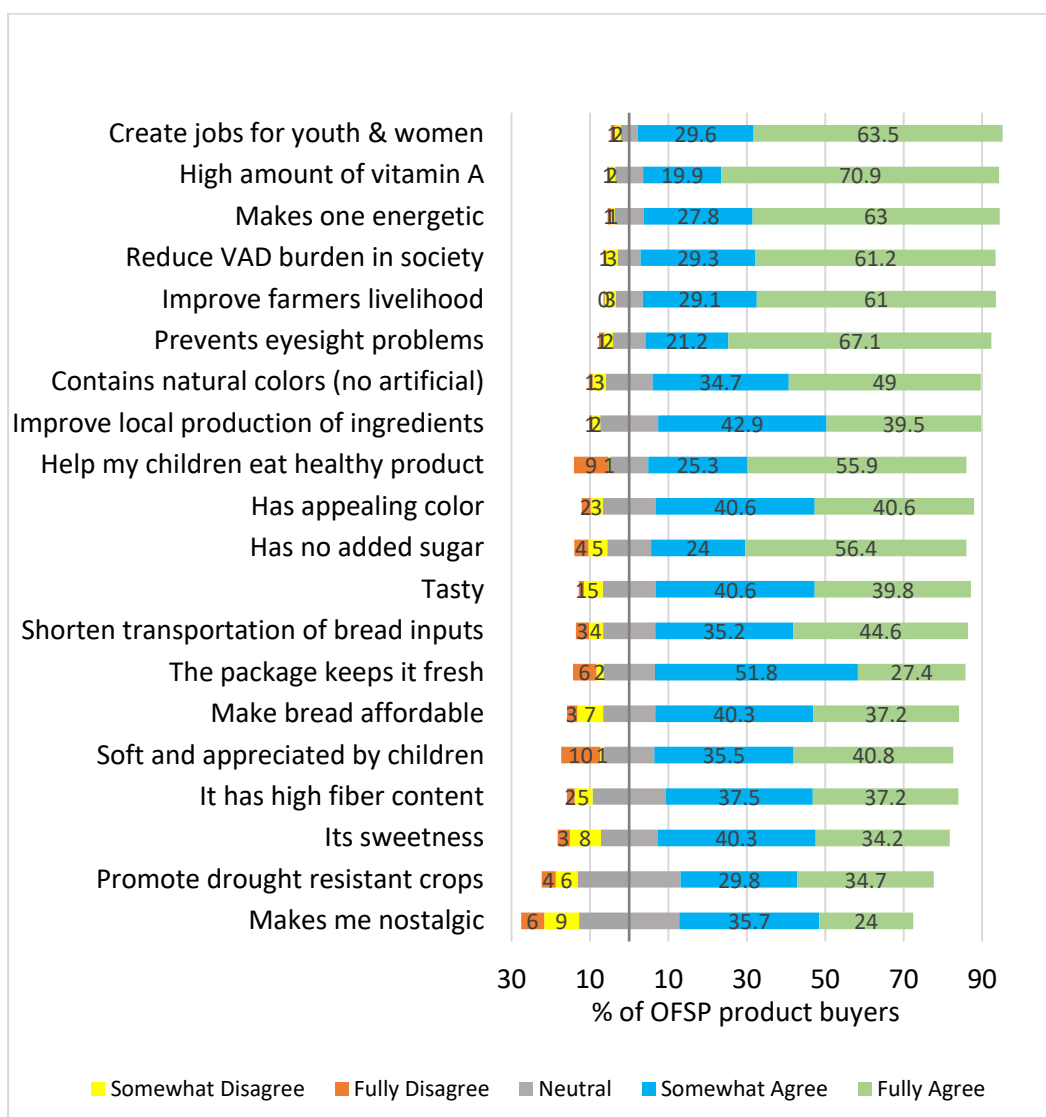


Figure 9: Respondents' agreement with potential influencers of intention to buy OFSP-based products

Reasons for not replacing the non-OFSP products

As expected, some of the respondents declined to replace the product they had selected with OFSP-based product when requested to do so. Figure 10 shows the reasons given by the respondents for disinterest in trading the selected product with OFSP-based products. Results indicate that majority of the respondents who declined to replace selected products with OFSP-based products were making the purchases on behalf of others (32.2%). Twenty seven percent and nine percent of bread and mandazi buyers, respectively, declined to replace the selected non-OFSP bread with VITA bread because they had been sent to buy the specific type they had selected. Difference in the size of OFSP-based and the product selected at the outset also played a role. Approximately 18% and 17% of respondents decided against replacing the selected bread and mandazi, respectively, with OFSP-based counterparts because the latter were smaller in size. Other reasons for declining to replace the selected product with OFSP-based product included sugar content, health conditions (e.g., diabetes), distrust of the manufacturer, dislike of sweetpotato or the colour of the product.

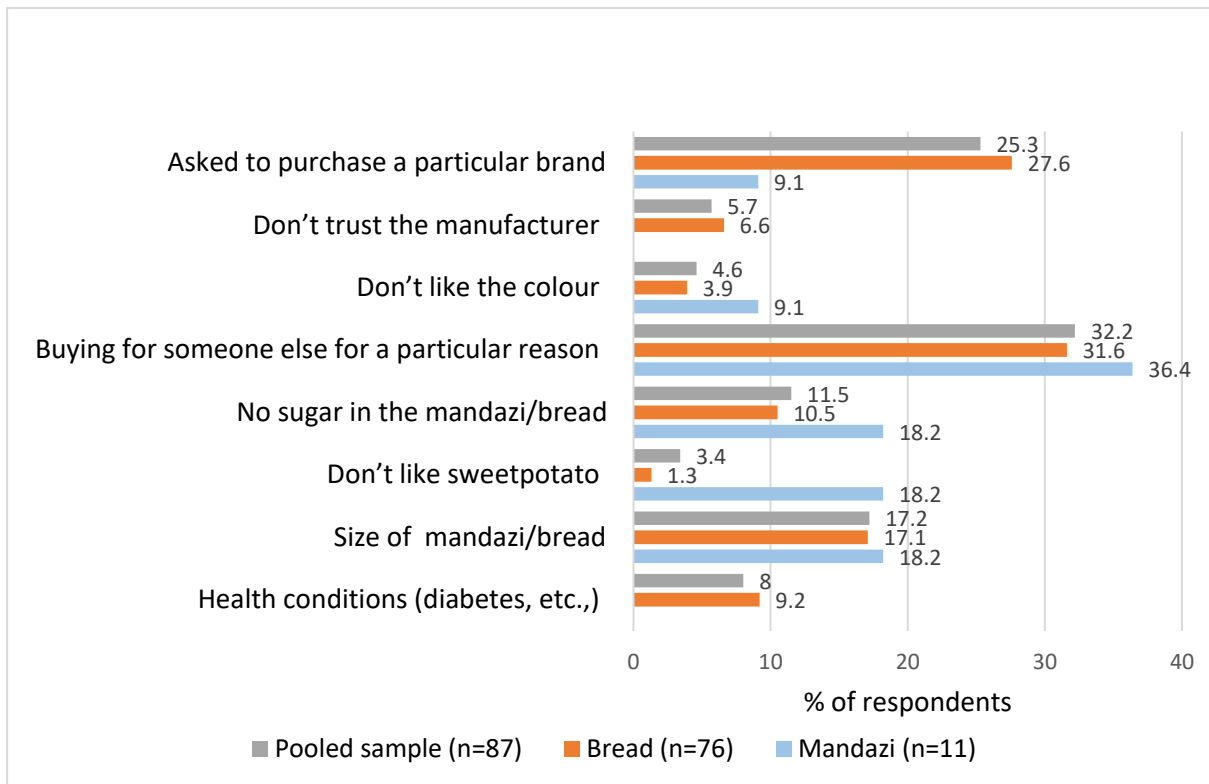


Figure 10: Reasons for declining to replace the selected non-OFSP products with OFSP mandazi/VITA bread

The respondents also mostly disagreed statements relating to the potential reasons for not wanting to replace selected product with OFSP-based products as shown in Figure 11 and Figure 12. Respondents specifically strongly disagreed that OFSP-based mandazi caused heartburn/stomach upset (with 82%, n=11 completely disagreeing) or did not contain vitamin A (82%, n=11). Respondents also totally disagreed with the statement that they did not purchase OFSP mandazi of lack of concern about nutrition (73%, n=11) and preference for salty (rather than) sweet/sugar bread (73%, n=11). Notably, however, 36% (n=11) and of the respondents attributed their decision not to substitute OFSP-based mandazi with what they had selected to dislike for sweetpotato and to the perception that OFSP products are unpopular.

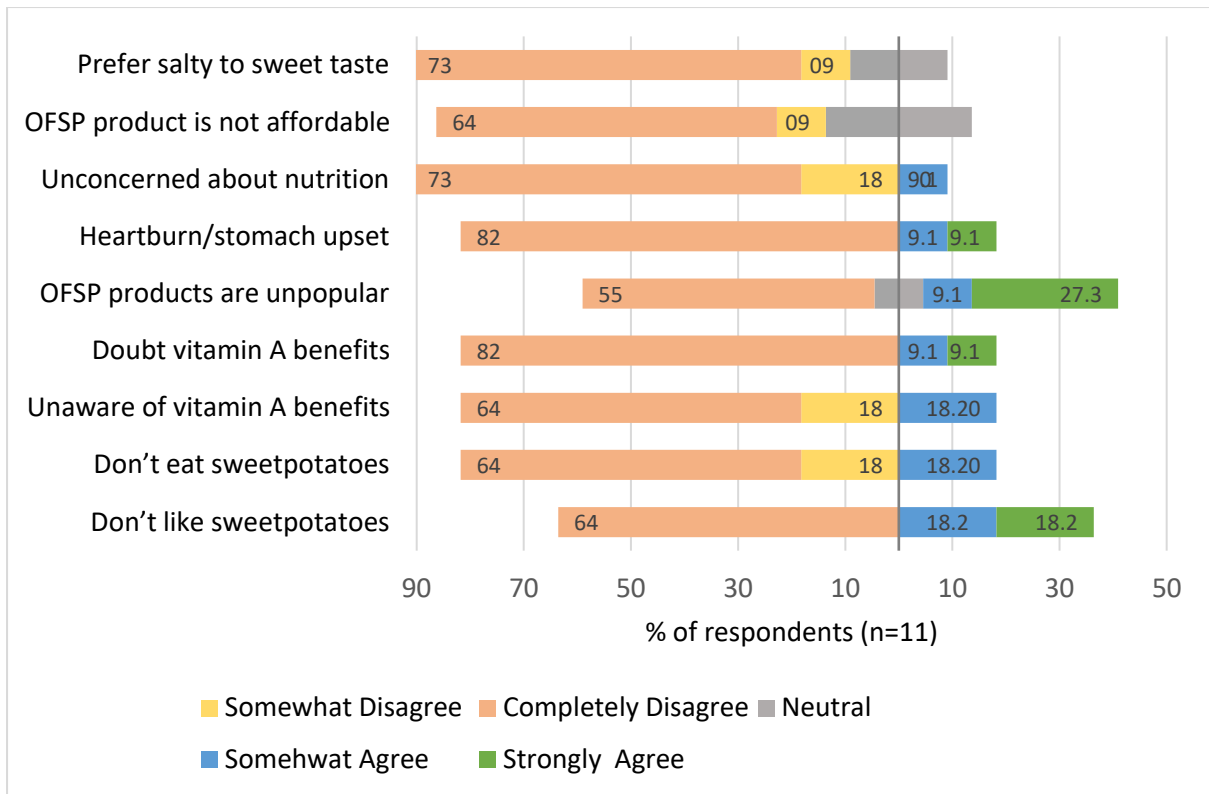


Figure 7: Respondents' agreement with reasons for declining to replace selected non-OFSP with OFSP-based mandazi

For the case of OFSP bread, the major reason stated for disinterest in replacing selected bread with VITA bread was that sweetpotato products are unpopular. About 36% (n=76) of the respondents either agreed (somewhat or fully) with this statement. Majority of the respondents however disagreed (somewhat or fully) that they declined to substitute OFSP bread for non-OFSP bread because they “don't eat sweetpotato” (95% agreeing somewhat or fully), are unconcerned about nutrition (97%), heartburn/stomach upset (94%), and doubt about vitamin A content (91%). Notably, 90% of the bread purchasers disagreed (somewhat or fully) with the statement that they declined to replace selected product with OFSP-based produce because of being “unaware of vitamin A benefits” indicating that knowledge of the benefits of Vitamin A was quite high among the respondents recruited for the bread component.

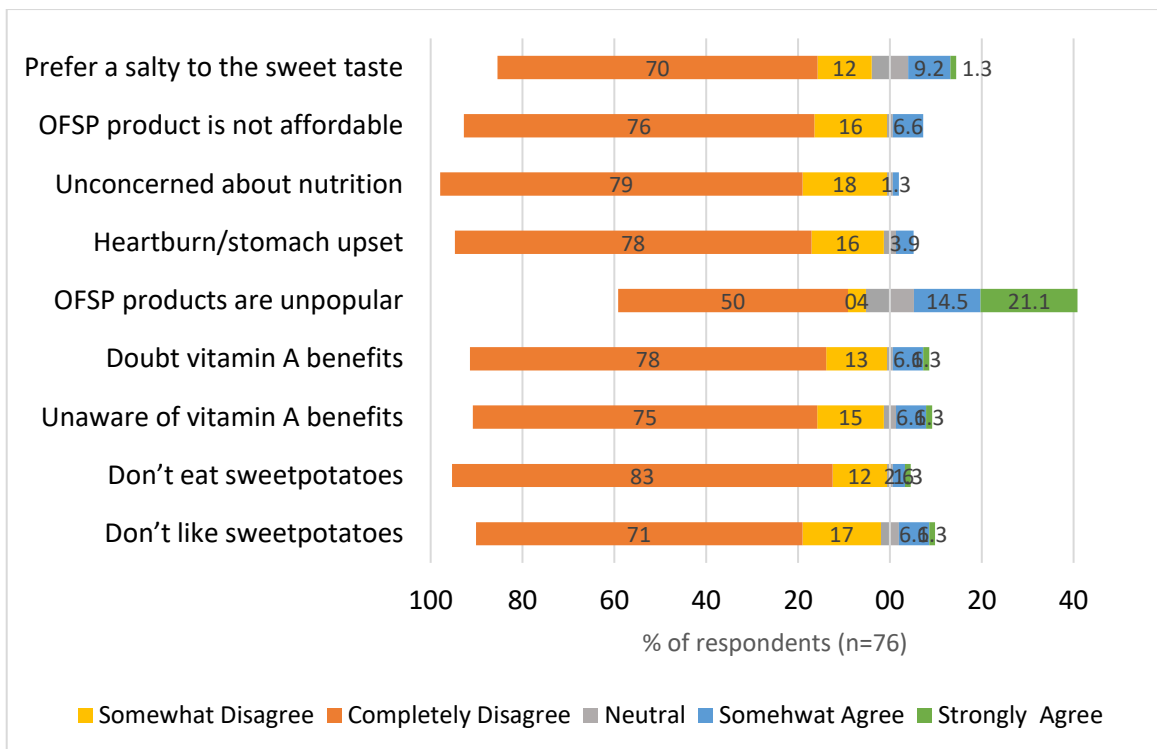


Figure 8: Respondents' agreement with some (prelisted) reasons for declining to replace selected non-OFSP bread with OFSP bread

Summary and Conclusions

This study examined urban and peri-urban consumers evaluation of OFSP-based products and their willingness to pay. It focused on sweetpotato-based bread [VITA bread] manufactured by the CARL Group Ltd and OFSP-based mandazi manufactured by Urbwitso Ltd. The study comprised two components. First, focus group discussions were conducted among consumers in Kigali city to validate constructs and attributes related to bread and mandazi and also to validate the survey tool. Second, consumer survey data was collected from a random sample of bread and mandazi consumers recruited at the point of purchase targeting grocery/supermarket stores (for the bread) and SINA Gerrard stores (for mandazi).

The study finds that majority of the respondents consume bread and mandazi three or more days per week. In addition, the share of respondents consuming bread at least three days per week was higher than that of mandazi. Therefore, in terms of nutrition, the two products are no doubt important vehicles for provision of key micronutrients to the communities where the study was conducted, i.e., the Kigali city population. If produced using OFSP, the two products can be useful in reaching households and populations that are prone to vitamin A deficiency.

Majority of the study respondents also associated the OFSP-based mandazi and bread with positive human characteristics, suggesting strong evidence of anthropomorphism. They associated the two products with characteristics such as active, brilliant, energetic, intelligent, creative, determined, brave, wise, confident, and loving. These human characteristics provide marketers and manufacturers with the tools for promoting the two products.

Results of just-about-right (JAR) analysis indicate that most of the sensory characteristics are below consumers' expectations for the OFSP-based mandazi. In particular, airy texture, yellow color, hard texture, soft texture, sweetpotato smell, sweetpotato flavor, sourness, and sweetness/sugariness were scored significantly lower than the threshold under JAR which is 70%. For these characteristics, the average scores were lower than 50% indicating that there is still much scope for improving/refining this production to drive demand even higher. The VITA bread (an OFSP-based bread) fared better than OFSP-based mandazi with a number of characteristics attaining the threshold JAR score of 70%. These characteristics included compactness, shape, yellow color, and aroma (smell). Male and female respondents scored the bread differently for these characteristics, implying gender differences in the evaluation of this OFSP-based product. The rest of characteristics assessed under this study were scored below the threshold and therefore can be improved to increase demand. These findings lead us to conclude that there is still great opportunity for the OFSP-based mandazi and bread producers to refine these two products.

More than 90% of respondents for both bread and mandazi were willing to pay a premium for the vitamin A-enriched OFSP-based products. The average WTP for OFSP-based mandazi and OFSP-based bread was RWF 235 and RWF 350, respectively, with WTP for OFSP-based bread being much more variable than for OFSP-based mandazi. Among the few respondents that did not prefer to replace the non-OFSP based product with OFSP-based type, the main reason for doing so was because they had been sent to purchase a specific non-OFSP bread. Moreover, assessment of the likely influencers of decision to purchase OFSP-based products in future indicate that most respondents disagreed (somewhat or fully) with all the negative information/statements about the two products. Based on these findings, we also conclude that there is strong demand for two OFSP-based products used in this study (namely, mandazi and bread).

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Appendices

Appendix A1: Pictures of the OFSP Bread and OFSP Mandazi in the stores

i). OFSP bread in the stores




		
<p>The newly branded vita bread</p>	<p>Front side Labelled as follows: “EAT WELL LIVE WELL. VITA BREAD. LOW GLUTEN. ZERO SUGAR”</p>	<p>Back side The label contains a lot of info segmented into “Our story”; Ingredients (<i>Orange fleshed sweet potato, flour, fat, yeast, and salt</i>); Nutrition facts; manufacturing and expiry dates; Barcode; Processor’s address; Mark of certified quality standard; Illustrations on responsible package disposal]</p>



Figure A1.1: Bread section of Teta Mini Supermarket in Gikondo Sector, Kicukiro District, Kigali City province. The arrow points to the location of the VITA Bread



Figure A1.2: Bread section in Deluxe Supermarket in Remera sector, Gasabo district, Kigali City province. The arrow points to the VITA Bread

ii) Mandazi in the stores



Figure A1.3: OFSP mandazi (going for RWF 300) in the blue bucket next to the tray containing the non-OFSP mandazi (going for RWF 200) in Sina Gerard store located in next to Deluxe Supermarket in Gasabo district, Kigali city.



Figure A1.4: OFSP mandazi (going for RWF 300) in the silver tray to the left next to the tray with non-OFSP mandazi (going for RWF 200) in Sina Gerard store located next to City market in Nyarugenge district, Kigali city.

Appendix A2: Product Narrative

This [OFSP] bread/mandazi has been made from sweetpotato and wheat flour. The sweetpotato used is locally produced by smallholder farmers. They are very rich in vitamin A. Vitamin A is an essential nutrient crucial for maternal health and child survival. Vitamin A Deficiency leads to severe visual impairment and blindness, and significantly increases the risk of severe illnesses, and even death, from such common childhood infections as diarrhea disease and measles among children.

Vitamin A deficiency (VAD) remains a major public health problem in Rwanda and many other African countries. One of the immediate causes of VAD is inadequate dietary intake of foods rich in vitamin A such as the orange-fleshed sweetpotato (OFSP) by the vulnerable groups. Thousands of preschool children and pregnant women are currently at risk of VAD in Rwanda. Pregnant women are more vulnerable to VAD during the last three months of their pregnancy when demand by both the unborn child and the mother is highest.

This [OFSP] bread/mandazi offers the opportunity to fight VAD. It is made by a bakery/company called 'CARL Group' based here in Kigali.

Appendix 2: The list of human characteristics used in analyzing anthropomorphism

active	determined	lazy	proud
adventurous	dishonest	logical	quiet
afraid	disrespectful	lonely	respectful
angry	dull	loud	responsible
artistic	energetic	loving	rude
bold	fair	loyal	sad
bossy	friendly	lucky	selfish
brave	fun	mature	sensitive
brilliant	funny	mean	serious
busy	generous	mischievous	shy
calm	gentle	mysterious	silly
careful	gloomy	nervous	smart
caring	greedy	nice	sneaky
cautious	happy	noisy	spoiled
charming	helpful	nosy	successful
cheerful	honest	obnoxious	sweet
clumsy	hopeful	optimistic	talented
confident	humble	organized	talkative
confused	humorous	outgoing	thoughtful
cooperative	hyper	patient	timid
creative	imaginative	peaceful	tolerant
cruel	immature	persuasive	trustworthy
curious	impatient	playful	unkind
daring	intelligent	polite	wild
demanding	jealous	popular	wise

Appendix 3: The trinity matrix

	Functional	Emotional	Hedonic/Abstract (This bread/mandazi is/has a:)
Label	<u>Labelled with:</u> <ul style="list-style-type: none"> <input type="checkbox"/> Wholegrain <input type="checkbox"/> Unsweetened <input type="checkbox"/> RSB logo <input type="checkbox"/> Organic <input type="checkbox"/> "Free from" (lactose/ Milk etc.) <input type="checkbox"/> Gluten free <input type="checkbox"/> No sugar added <input type="checkbox"/> Clear list of ingredients <input type="checkbox"/> Expiry date <input type="checkbox"/> Bake/manufacture date <input type="checkbox"/> Sweetpotato as ingredient <input type="checkbox"/> Nutritional content 	<u>This bread/mandazi makes me:</u> <ul style="list-style-type: none"> <input type="checkbox"/> Active <input type="checkbox"/> Adventurous <input type="checkbox"/> Affectionate <input type="checkbox"/> Aggressive <input type="checkbox"/> Bored <input type="checkbox"/> Calm <input type="checkbox"/> Daring <input type="checkbox"/> Disgusted <input type="checkbox"/> Eager <input type="checkbox"/> Energetic <input type="checkbox"/> Enthusiastic <input type="checkbox"/> Free 	<ul style="list-style-type: none"> <input type="checkbox"/> Tasty <input type="checkbox"/> Freshly baked <input type="checkbox"/> Brown <input type="checkbox"/> White <input type="checkbox"/> Soft <input type="checkbox"/> Hard <input type="checkbox"/> Type of cereal <input type="checkbox"/> Fruit/raisin <input type="checkbox"/> Carrot/olive etc. <input type="checkbox"/> Whole grains <input type="checkbox"/> Nuts/seeds <input type="checkbox"/> A good brand <input type="checkbox"/> Traditional raw material <input type="checkbox"/> Made in Rwanda
Package	<u>This bread/mandazi has a (an):</u> <ul style="list-style-type: none"> <input type="checkbox"/> Appropriate package size <input type="checkbox"/> Plastic package <input type="checkbox"/> Paper package <input type="checkbox"/> Re-sealable package <input type="checkbox"/> Package easy to open <input type="checkbox"/> Package can be used to store the bread/mandazi <input type="checkbox"/> Package keep the freshness <input type="checkbox"/> Package can be used for freezing <input type="checkbox"/> Package is environmentally friendly (biodegradable) 	<ul style="list-style-type: none"> <input type="checkbox"/> Friendly <input type="checkbox"/> Glad <input type="checkbox"/> Good <input type="checkbox"/> Good-natured <input type="checkbox"/> Guilty <input type="checkbox"/> Happy <input type="checkbox"/> Interested <input type="checkbox"/> Joyful <input type="checkbox"/> Merry <input type="checkbox"/> Mild <input type="checkbox"/> Nostalgic <input type="checkbox"/> Peaceful <input type="checkbox"/> Pleased <input type="checkbox"/> Pleasant <input type="checkbox"/> Polite <input type="checkbox"/> Quiet <input type="checkbox"/> Satisfied <input type="checkbox"/> Secure <input type="checkbox"/> Steady <input type="checkbox"/> Tame <input type="checkbox"/> Tender <input type="checkbox"/> Understanding <input type="checkbox"/> Warm <input type="checkbox"/> Whole <input type="checkbox"/> Wild <input type="checkbox"/> Worried 	<ul style="list-style-type: none"> <input type="checkbox"/> Package which provides an anticipation of the taste <input type="checkbox"/> Package which provides an anticipation of the texture <input type="checkbox"/> Package which provides an anticipation about the visual appearance of the bread/mandazi <input type="checkbox"/> Package which can help sense the smell of the bread/mandazi <input type="checkbox"/> Package which relates visual appearance with anticipated eating experience <input type="checkbox"/> Package which provides a "real" feeling of bread/mandazi <input type="checkbox"/> Package easy to handle <input type="checkbox"/> A package that gives a sense of freshness <input type="checkbox"/> A package that is only "being in the way" <input type="checkbox"/> Package which stands out in material <input type="checkbox"/> Package that stands out in appearance and <input type="checkbox"/> Package that demonstrates a difference (superiority?) in the bread/mandazi
Product	<u>This bread/mandazi has an appropriate/is:</u> <ul style="list-style-type: none"> <input type="checkbox"/> Sugar content <input type="checkbox"/> Content of fibre <input type="checkbox"/> Unsweetened <input type="checkbox"/> Sliced <input type="checkbox"/> Portion size (<i>in the case of bread</i>) <input type="checkbox"/> Appropriate size of bread/mandazi <input type="checkbox"/> Appropriate size of slices <input type="checkbox"/> Appropriate form of bread/mandazi <input type="checkbox"/> Appropriate form of the slices <input type="checkbox"/> Lastingness (shelf life) <input type="checkbox"/> Salt content <input type="checkbox"/> Sourdough <input type="checkbox"/> Provide energy <input type="checkbox"/> Does not crumble <input type="checkbox"/> Wholesome <input type="checkbox"/> Amount of preservatives <input type="checkbox"/> Free from nuts <input type="checkbox"/> Appropriate oil content 		<ul style="list-style-type: none"> <input type="checkbox"/> Soft texture <input type="checkbox"/> Airy texture <input type="checkbox"/> Sweetness <input type="checkbox"/> Wheat flavour <input type="checkbox"/> Taste of seeds <input type="checkbox"/> Taste of bread/mandazi <input type="checkbox"/> Chewability (easily chewable) <input type="checkbox"/> Toughness/hard in the hand <input type="checkbox"/> Appealing colour <input type="checkbox"/> Scent of freshly baked <input type="checkbox"/> Sourdough <input type="checkbox"/> Freshness <input type="checkbox"/> Good durability <input type="checkbox"/> New in the market

Appendix 4: The auction protocol used to obtain willingness to pay and willingness to accept bids

Before this interview, you had selected to buy Bread/Mandazi 1 [name of bread/mandazi] and during this interview, you have tasted the VITA BREAD/OFSP Mandazi.

As a token of appreciation for your participation in this study, we are giving you 2000 RWF.

[Enumerator: Provide the payment. Then say...]

There is, now, a chance for you to replace Bread 1/Mandazi 1 and instead leave this place with VITA BREAD/OFSP Mandazi. Doing so will require that you are willing to use some amount of the money (2000 RWF for bread or 500 RWF for Mandazi) you have just received to pay an extra amount needed to purchase VITA BREAD/OFSP Mandazi. A random draw will be made to determine the extra amount for which the exchange will take place and you will leave Bread 1 with us if the exchange takes place. We will provide details and examples in a moment in case you are interested in an opportunity to exchange Bread 1 for the VITA Bread/OFSP Mandazi.

Q1. Are you interested in this option?

1=Yes, I would like to have the opportunity to get the VITA Bread/OFSP Mandazi replacing Bread 1/Mandazi 1,

0= No, I'll keep Bread 1/Mandazi 1

If YES:

Now, please think of how much of the 2,000 RWF (500 RWF *in the case of mandazi*) that you are willing to pay right now to cover the amount needed to replace Bread 1 (Mandazi 1) with VITA BREAD (OFSP Mandazi). Once you decide the amount, we will make a random draw of numbers between **0 and 2,000** (between **1 and 500** *in the case of mandazi*). You will get VITA BREAD (OFSP Mandazi) if the number we draw is lower or equal to the amount that you stated.

An example in the case of bread: If you indicate that you are willing to pay 600 RWF to replace Bread 1, but our draw gives 400 RWF => you take the VITA BREAD home + 1,400 RWF! But..., if our draw had been from 700 RWF or above, you would instead keep Bread 1 + 2,000 RWF – the token of appreciation of your time in the study. Therefore, please be sure that you indicate the amount of money that, according to you, matches the difference in price between the two types of bread.

An example in the case of Mandazi: If you indicate that you are willing to willing to pay 300 RWF to replace Mandazi 1, but our draw gives 200 RWF => you take the OFSP Mandazi home + 200 RWF + your token of 1,500 RWF! But..., if our draw had been from 400 RWF or above, you would instead keep Mandazi 1 + the 1,500 RWF token of appreciation for your participation in the study. Therefore, please be sure that you indicate the amount of money that, according to you, matches the difference in price between the two types of bread.

Please, now give the amount that you are willing to pay to replace bread (mandazi):

[Enumerator: Please complete the questions below]

Q2. Amount willing to pay: RWF_____

Q3. Random number drawn: _____

Q4. Outcome: (1) Leave with Bread 1(Mandazi 1) + RWF [the token of appreciation]

(2) VITA Bread (OFSP Mandazi) + RWF [balance of the token of appreciation]

If “NO”:

We understand that your decision at this stage is to keep Bread 1(Mandazi 1).

Q5. Was this because you are not willing to leave from here with the VITA bread (OFSP Mandazi) for some particular reason but not related to being asked to pay more to get it? Or, is your decision more a matter of you not being willing to actually paying extra to get it?

0=Other reason

1=Not willing to pay extra

Q6. a) [If main reason is “other than price”] What are the main reasons for not being interested in the possible exchange?

- 1 _____
- 2 _____
- 3 _____

Q6. b) Please indicate the extent to which you agree or disagree with the following as the main reason for you not to be willing to replace your initially selected bread(mandazi) with the VITA bread (OFSP Mandazi) using the scale below:

1=Strongly Disagree; 2=Disagree; 3=Neither agree nor disagree; 4=Agree; 5=Strongly Agree.

	1	2	3	4	5
a) I do not like sweetpotatoes					
b) I do not eat sweetpotatoes.					
c) I am not aware of the importance of vitamin A					
d) I doubt vitamin A is that important					
e) This bread/mandazi is not as popular as other breads/mandazis					
f) I get heartburn and/or stomach upset when I eat sweetpotatoes					
g) I do not care about the nutritional content of the bread/mandazi					
h) The bread/mandazi is not affordable to me					
i) I don't like the sweet taste of the bread/mandazi. I prefer salty taste.					

Q7. If main reason is the price:

We understand that you are not willing to pay extra money to get VITA BREAD (OFSP Mandazi) – but would you be interested in accepting to leave from here with VITA BREAD (OFSP Mandazi) for a certain compensation (think of this as a discount that you would seek in order to prefer VITA BREAD (OFSP Mandazi) instead/over of Bread 1 (Mandazi 1) you have selected)? 1=Yes; 0=No

If YES, run a BDM to decide on if the exchange will happen (and the further compensation to be paid to the respondent)

[Add an example....]

[In the case of bread]: Please, now give the amount between 1 and RWF **360** that you are willing to accept as compensation to replace bread 1. Please note that once you provide the price/amount, we will randomly draw a number between 1 and **360**. If the number we draw is LESS than the amount of money you stated, you win **and take the VITA bread home and get paid the amount you stated + the 2,000** that were provided as token of appreciation for your participation in this study. If the number we draw is MORE than the amount of money you stated you **will go home with your bread 1 and the token of appreciation (2,000 RWF) without any additional compensation.**

[In the case of mandazi]: Please, now give the amount between 1 and RWF **150** that you are willing to accept as compensation to replace mandazi 1. Please note that once you provide the price/amount, we will randomly draw a number between 1 and **150**). If the number we draw is less than or equal to the amount of money you

stated, **you win and take the OFSP mandazi home + get paid the amount you stated + the 1,500 RWF** that was provided as a token of appreciation for your participation in this study. If the number we draw is more than the amount of money you stated **you lose** the OFSP Mandazi, go home with your Mandazi 1 + the token of appreciation (1,500 RWF) without any additional compensations. [*Enumerator: Please complete the questions below*]

Q8. Amount willing to accept (discount)

Q9. Random number drawn

Q10. Outcome: a) Leave with Bread 1(Mandazi 1) + RWF [the token of appreciation]

b) VITA Bread (OFSP Mandazi) + RWF [the token of appreciation + compensation]

Appendix 5: Response items used in the Rasch model to assess purchase intentions

I intend to buy this [VITA bread] because...

1. by growing OSFP as an input into bread making will improve the livelihoods (income) of farm household
2. local production of bread ingredients will be improved
3. It will Shorten transportation of inputs for baking bread
4. It will Encourage sweetpotato farming to create jobs for youths
5. It will Promote usage of sweetpotato in breadmaking to make price of bread affordable
6. Consumption of [VITA bread] helps reduce the burden on public system
7. Grow more sweetpotato to increase my family's consumption of traditional foods (I do not see how this statement fit into this section)
8. It will Promote growing of a crop that can withstand droughts (climate climate)
9. Keep buying this [VITA bread] because it of high shelf life (what's the upside to the buyer - can it be reformulated in terms of that the OFSP allows it to stay fresh for longer)?
10. because it has high fiber content
12. Because eating it regularly prevent likelihood eyesight problems
13. because the package keeps it fresh
14. because it is soft and therefore is appreciated by my children
- 15 because it is tasty
16. because it makes me nostalgic
17. because eating it makes one energetic
18. Because it will help my children eating healthy bread
19. because it has appealing color
20. because of its sweetness

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