

# American Journal of **Economics** (AJE)



## **An Analysis of Consumer Willingness to Pay for Sorghum-Pigeon Pea Flakes: A Case of Makueni and Busia Counties, Kenya**

*Catherine Mueni Peter, Gabriel Mwenjeri and Kahi Ngugi*



## **An Analysis of Consumer Willingness to Pay for Sorghum-Pigeon Pea Flakes: A Case of Makueni and Busia Counties, Kenya**

**Catherine Mueni Peter<sup>1\*</sup>, Gabriel Mwenjeri<sup>1</sup> and Kahiu Ngugi<sup>2</sup>**

<sup>1</sup>Department of Agricultural Economics, Kenyatta University- Kenya

<sup>2</sup>Department of Plant Science and Crop Protection, University of Nairobi- Kenya

\*Corresponding Author's Email: [catekikuvi@gmail.com](mailto:catekikuvi@gmail.com)

### **Abstract**

**Purpose:** The study seeks to determine the level of awareness and the highest amount consumers were willing to pay by positioning the novel product ready-to eat-cereals for breakfast Sorghum-pigeon pea processed from locally grown crop.

**Methodology:** Contingent Valuation Method (CVM) to assess consumer willingness to pay (WTP) for sorghum-pigeon pea flakes, which are Ready-to-Eat Cereals (RTEC). Three-stage sampling technique was used in selection of the two counties, and from each county three market places was identified. Glen sample size formula was used to obtain the total number of respondents, whereby a well semi-structured dichotomous questionnaire was used on 223 consumers from Makueni and Busia counties in Kenya. Double bounded logit model was employed in determining consumers' willingness to pay (WTP) for SPPF.

**Findings:** Results from the WTP assessment showed that consumers in both counties were willing to pay for the Sorghum-Pigeon Pea Flakes. The average WTP value in Busia and Makueni Counties was 140 and 136 Kenya Shillings, respectively. Further, nearly half of the respondents in both counties were aware of the ready-to-eat breakfast cereal SPPF for nutritional improvement. According to the findings of the double-bounded logit regression, being male, marital status, awareness of SPPF, and living in Busia County all positively influenced WTP for SPP. Having formal employment and household expenditure, on the other hand, had a negative impact on the WTP for SPPF.

**Recommendations:** The study recommends nutritional training to raise awareness of the benefits of consuming SPP. Furthermore, policies should focus on raising awareness of the nutritional benefits of SPPF among families, particularly those in Makueni.

**Keywords:** *Willingness to pay, Sorghum-pigeon pea flakes/ Ready-to-Eat breakfast cereals*

## 1.0 INTRODUCTION

Food and nutrition security and malnutrition are a key human development problem in developing countries, especially in sub-Saharan Africa. Kenya's rapid growth in population, changing patterns in climate and urbanization are stretching existing food and agricultural systems, and thus leaving rural and urban populations to struggle in providing food and nutritional security (Gido *et al.*, 2017). Quality of food, levels of safety plus food availability are globally considered as key facets to human development. All this entails access to nutritious and balanced diet that comprises carbohydrates, proteins, roughages, vitamins and minerals. Nutritious food, mostly comprising Carbohydrates along with proteins which are energy providers and body builders respectively, is said to be an essential requirement for human health and labor output (Gómez *et al.*, 2003). Of the three meals recommended in the Intensive Behavioural Interventions (IBI) studies, breakfast provides 20% of calories and on average about 20% daily proteins, total fats and saturated fats as well as dietary fibre (Gibney *et al.*, 2018). A study by Rito *et al.* (2019), shows that consumers who take Ready-to-Eat-Cereal (RTEC) for breakfast ingest more total energy per day than breakfast skippers or consumers of other breakfast alternatives.

According to Neumann *et al.*, (2007), meat consumption serves as a better source of protein for future but it is faced with challenge of poverty and low income among many developing countries, which are left to predominantly rely on protein from high fibre and phytate plant-based staples. Pigeon pea is one of such plant protein sources, which when used partially in complementing sorghum in producing bakery products namely RTEC flakes, biscuits, bread and other confectionery products, could aid in improving nutritional quality of the product.

According to Kinyua *et al.* (2016), sorghum (*Sorghum bicolor* (L.) Moench) is utilized as key staple food where climatic conditions are unfavourable for the growth of maize in many regions of Africa. It is ranking stands fifth in terms of production and acreage globally. It's well established genetically in hot and dry agro-ecologies where there are difficulties in growing other foods grains like maize. Sorghum grain has been used in preparing many traditional foods and bakery products like bread, cakes and biscuits as well as flakes (Archimède *et al.*, 2011). However, from a study by Hariprasanna and Rakshit (2016), sorghum consumption as food declines due to changes in consumer tastes during the process of economic development while utilization in feeding animals and various industrial purposes increases. Pigeon pea [*Cajanuscajan* L.) on the other hand ranks sixth most supreme legume crop worldwide, with its production averaged at 4.89 million tons by 2014.

Sorghum-pigeon pea flakes are developed as a RTEC from Composite flour technology (sorghum and pigeon pea), intending to replace wheat flour totally Noorfarahzilah *et al.* (2014) and Milligan *et al.* (1981). This definition was as well supported by Shittu *et al.* (2007) because composite flour is composed of either binary or ternary mixtures of flours from other crops with or without wheat. The FAO reported that the use of composite flour in various food products would be economically advantageous if the importation of wheat could be reduced or even eliminated, and that demand for bread and pastry products could be met by the use of domestically grown products in place of wheat Jisha and Padmaja, (2011). With the growing market for confectionaries, there is increasing use of locally grown raw material to substitute wheat (Balasubramanian *et al.*, 2011). However, despite the economic importance of RTEC products from composite flours, knowledge and information on consumption, value addition and market linkages on sorghum-pigeon pea flakes (SPPF) is limited.

The prime determinants of malnutrition in Sub-Saharan Africa are low availability of nutritious foods and inadequate consumption of protein rich diets (Bain *et al.*, 2013). Among the finest answers towards solving protein energy malnutrition for third world countries is supplementing cereals with protein rich legumes. To supplement cereal food products, one of the best tested and proven legume sources of high-level proteins and iron (Fe) is Pigeon pea flour, Harinder and Sharma, (1999). Sorghum provides staple food for a large population in the semi-arid parts of Kenya. It has low protein content and compositing sorghum with pigeon pea flour improves its protein quality and could help in alleviating protein energy malnutrition Kinyua *et al.*, (2016). Under a composite flour technology, sorghum assumes a novel importance as a food and industrial crop, which is a positive direction on marginalized crops towards a sustainable food and nutritional security in coming years.

The Government nutrition policy in Kenya (GoK, 2011) stipulates that “food and nutrition security is a state of affair where every person, always accesses enough, safe and nutritious food, thus physically and economically fulfilling their diet requirements as well as food desires to attain an active and healthy life”. However, Kenya continues to suffer from constant food insecurity and deficient nutrition with over 10 million people in need of assistance Mohajan (2014) and Kenya Food Security Act (2017). Thus, the introduction of sorghum-pigeon pea flakes in Kenya would enhance the achievement of the quantity and quality of an affordable source of nutrient rich food product in the country. Deciding on the price of any new product in the market is normally a difficulty proposition. Matching the cost of the product and the consumers’ willingness to accept the product (highest price accepted by consumer to buy a good) many a times is challenging towards success of new products in the market.

Price is a significant variable for both seller (sales volume and profits) and consumer buying decisions (income allocation). In the past, the approach used when analysing this problem of price determination was the elasticity and demand curve analysis (Kotler *et al.*, 1990; Cant & Sephapo, 2016; Velissimo & Glikman, 2020). However, with recent studies about consumer psychology in the purchasing behaviour, the methods of analysis lack the understanding of consumers’ awareness of value, a notion widely recognised as a more effective predictor of future consumer behaviour which is a key component of pricing (Kotler & Armstrong, 2010). Thus, the Willingness-to-Pay (WTP) approach when analysing this problem of price determination is a more robust method.

This study applies the WTP concept to determine prices for sorghum-pigeon pea flakes (SPPF), with a view to supporting government efforts of achieving quality nutrition towards optimum health to all Kenyans. To determine consumers’ willingness to pay for SPPF in Makueni and Busia Counties in Kenya, the study seek to position a nutritious ready-to-eat-cereal (RTEC) in the form of Sorghum-Pigeon Pea Flakes (SPPF) as a food in the market through price customization that will promote accessibility and affordability.

## **2.0 MATERIALS AND METHODS**

### **2.1 Study Area**

The study was carried out in two Kenyan counties, Makueni and Busia. Makueni is located in the eastern part of Kenya, and its capital and largest town is Wote (Figure 1). According to the Kenya Population and Housing Census (2009), the county has an area of 8,008.9 km<sup>2</sup> and a population of 884,527 people (Male - 49 percent, Female - 51 percent). It has a population density of 110.4 people per square kilometre and a national percentage of 2.29 percent. Subsistence agriculture, beekeeping, small-scale trade, dairy farming and limited coffee

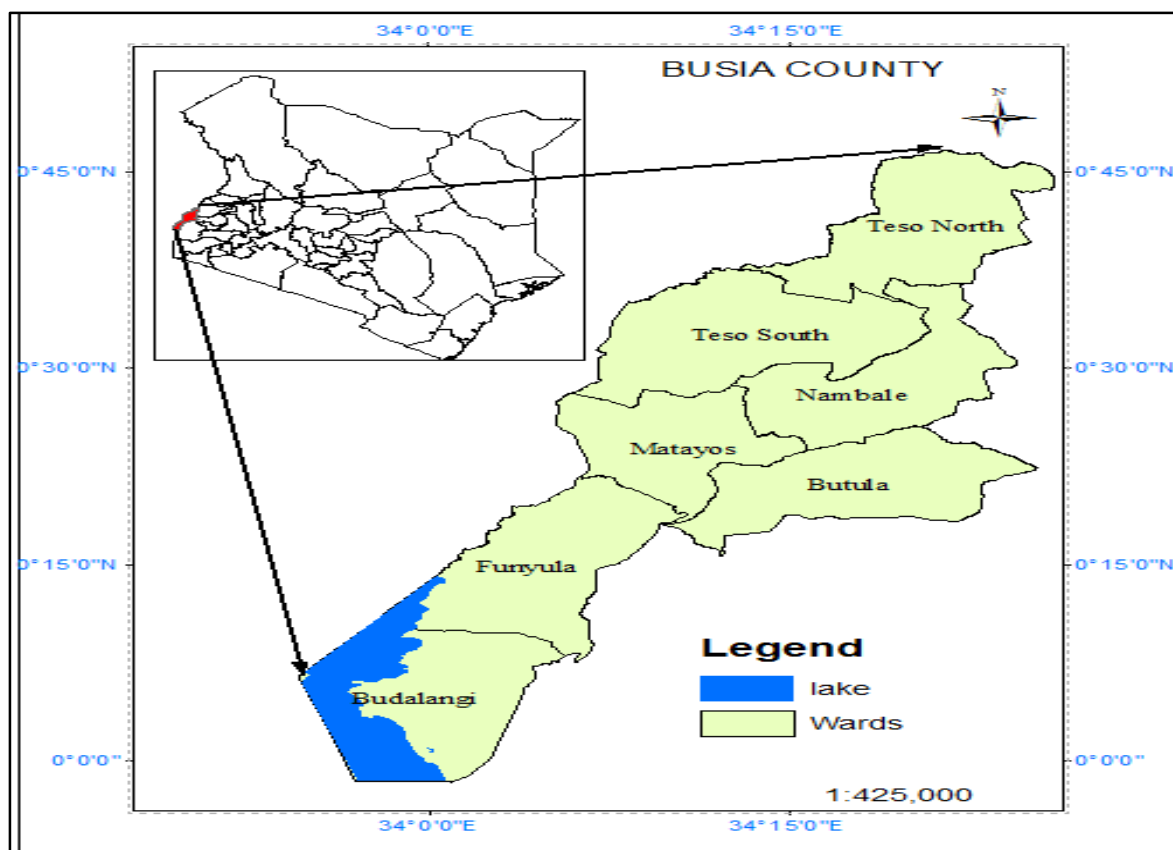
growing, eco-tourism, and commercial businesses are among the main economic activities. Agricultural products such as maize, sorghum, cow peas, beans, and pigeon peas are grown, as are fruits such as mangoes and pawpaw's, as well as daily farming products.



**Figure 1: Map of Makueni County, Kenya**

Busia County is located in Western Kenya, bordering Uganda on the west, north, and east, and Lake Victoria on the south as shown in figure 1. According to the 2009 Kenya Census, there were 743,946 people, with a population density of 439 people per Km<sup>2</sup> and an annual growth rate of 2.9 percent. The age ranges from 0-14 years (47.9%), 15-64 years (48.4%), and 65+ years (3.7 percent). With a total area of 1,695 km<sup>2</sup>. In a year, rainfall ranges from 750mm at the lowest to 1,800mm at the highest. Agriculture, tourism, fishing along Lake Victoria's shores, and trade are all economic activities (cross border). Sorghum, maize, cassava, millet, sweet potatoes, beans, rice, and livestock are examples of agricultural products.





**Figure 2: Map of Busia County, Kenya.**

## 2.2 Study Design and Sampling

The two Kenyan counties of Makueni and Busia were chosen using a three-stage sampling procedure. In the first stage, Busia was selected purposively due to its sorghum production potential, whereas Makueni was chosen due to the county's preference for sorghum and pigeon due to their drought resistance ability. The second stage involved using a stratified random sampling frame to select three markets from each county that served as a common converging point for the majority of consumers. To maximize consumer availability, respondents were chosen at random from three different sub-counties in Makueni County (Wote, Kathonzweni, and Makindu) and Busia County (Mundika, Butula, and Bumala) for interviews in the third stage. The study adopted Glenn (2013) formula to calculate the sample size;

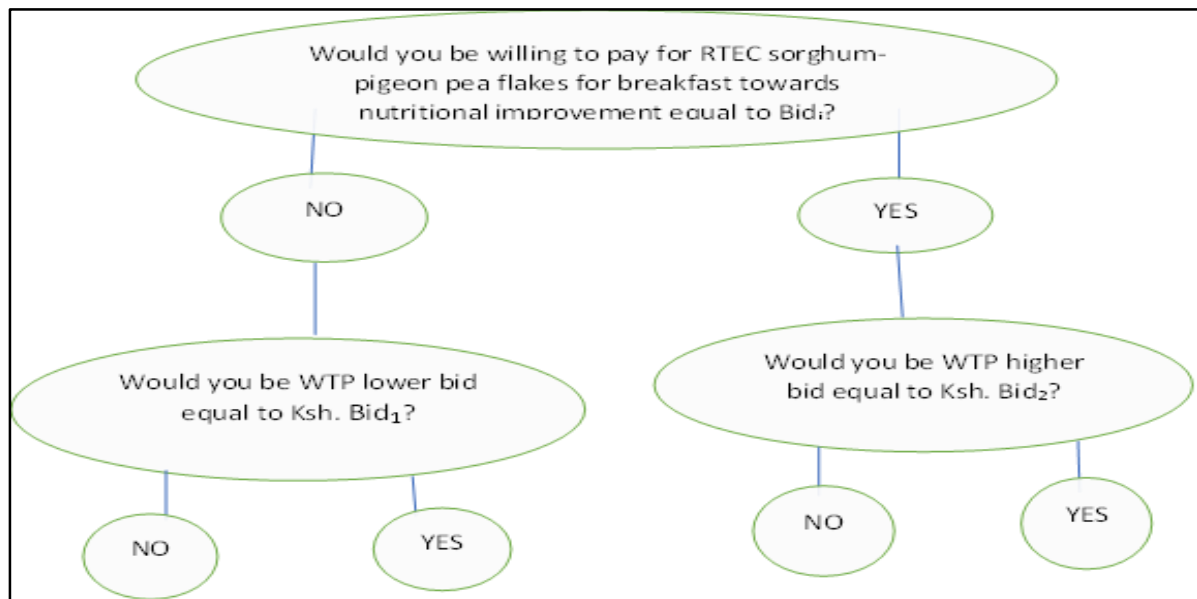
$$n = \frac{N}{1+N(e^2)} \dots \dots \dots \text{equation 1}$$

A total of 223 consumers were interviewed in this study.

Cerda and Garca, (2021) state that research on a person's WTP is dependent on a few variables such as individual preferences, tastes, income, attitude, awareness, and socio-demographic characteristics. As a result, the survey questionnaire for this study was divided into five sections: socio-demographic characteristics, value addition process knowledge, their awareness, WTP, and economic benefit. In this study, a consumer was defined as anyone who came to the market during the day to buy either food or non-food products. Further, to make the respondent understand what the survey is all about, a demonstration (product marketing) of the ready-to-eat breakfast cereal Sorghum-Pigeon pea flakes was performed. The data was obtained after the respondents completed the questionnaire.

### 2.3 Data Collection on Willingness to Pay (WTP)

The WTP data was collected through double-bounded dichotomous format where there was a follow-up question in order to mimic normal market scenario if the product was to be in the market, which provided starting bid and final bid used in analysing the data as shown in the proceeding figure. The process on how different payment values (bids) were offered where;  $Bid_i$  = Initial payment vector,  $bid_1$  = Lower bid respect to initial payment vector and  $Bid_2$  = Higher bid in respect to initial payment bid. For  $i = 100, 125$  and  $150$  (quantity of offers).



**Figure 3: Process on how different payment bids were offered.**

### 2.4 Contingent Valuation Method (CVM) for WTP

According to Witt (2019), contingent valuation is a stated-preference form of non-market valuation designed to measure how much individuals would maximally pay in scenarios where normal market forces are not operating or are operating sub-optimally. Contingent valuation method objective is to determine the value of compensatory variation or equivalent variation in association with change by presenting a non-market public good. In other words, contingent valuation certifies whether change in presenting ready-to-eat breakfast cereal SPPF infers a change in level of nutritional safety, Cerda and Garcia (2021). This change in the level of nutritional security was estimated through the WTP for the contingent or hypothetical benefactor, in this case ready-to-eat cereal sorghum-pigeon pea flakes. The choice of estimation technique to be used is dependent on the nature of good to be valued and the resource availability (Madani & King, 2007).

The dichotomous choice question was the most adequate. In this case of novel ready-to-eat breakfast cereal SPPF, CVM by dichotomous choice with follow up bid was the most suitable for study, the change in nutritional security through its presentation in the market by considering paying and not paying for the flakes at a given cost. The name of this method comes from the fact that the values elicited are contingent to the hypothetical scenarios presented to the respondents according to Portney (1994) and Feldman (2012).

If the individual answers yes to the first question ( $bid_1$ ), then the follow up question offers higher amount ( $bid_2$ ). But if the answer is no to the first question then a lower amount ( $bid_1$ ) is offered as bid two. This implies that the second question is endogenous in the sense that the amount asked depends on the answer obtained for the first question (which is exogenous). The method fetches two answers for each individual, which provides more information but at the same time makes the econometric estimation slightly more complicated than before. Hence the current study employed dichotomous question with follow-up in order to obtain efficient WTP estimations.

The only shortcoming of this CVM lies in its hypothetical nature, since the respondent may fail to answer truthfully (for example, a person may believe that if he or she indicates will pay, then they might be disqualified for a free product if it was to be provided or a biasness coming from what the individual indicate will be willing to pay and the actual behaviour), therefore this biasness was eliminated by allowing the consumers to take home the sample product used for brief marketing before the interviews .

## 2.5 Data Analysis of WTP for SPPF

Based on the study, WTP is regarded as individuals' willingness to lay out money personally, i.e., 'out of pocket,' to obtain proteins from sorghum-pigeon pea Flakes in order to enhance health benefits for themselves. The WTP elicitation employed a double-bounded dichotomous choice CV Method (DCCVM) where the consumers were asked questions that narrowed down WTP progressively, because the method showed efficient generation of estimates more compared to single-bounded method Hanemann, (1991), eliminating Protest answers' on WTP and introduction of the 'would not' option allowed submission without any bias in the WTP estimations Watson and Ryan, (2007).

The study assumed that each respondent  $i$  had WTP of sorghum-pigeon pea flakes equal to  $Y_i$  related to the respondents characteristic  $X_i$  as follows;

$$Y_i^* = X_i\beta + \varepsilon_i \dots \dots \dots \text{equation 2.}$$

Where  $\varepsilon_i$  is assumed to be mean zero and is normally distributed.

By assuming that  $t_1$  is the first bid and  $t_2$  is the second bid then it follows that the respondent who answered yes to the first question and no to the second,  $t_2 > t_1$  hence  $t_1 \leq WTP < t_2$  while the respondents who answered yes to the first question and yes to the second, means  $t_2 \leq WTP < \infty$ . Where the respondent answered no to the first question and yes to the second, then  $t_2 < t_1$  in this case  $t_2 \leq WTP < t_1$  and the respondent who answered no to the first and second questions, then  $0 < WTP < t_2$ , according to Lopez-Feldman, (2012).

### 2.5.1 Double-bounded Logit Model specification

In order to estimate consumers' WTP for sorghum-pigeon pea flakes, the double-bounded logit model was used. Data generated by the double-bounded format can be modelled as shown in equation 4 by Haab and McConnell, (2002).

$$WTP_{ij} = u_i + \varepsilon_{ij} \dots \dots \dots \text{equation 3.}$$

Where  $WTP_{ij}$  is the  $j$ th respondent's WTP and  $i=1, 2$  represents the first and second equation.

The  $j$ th contribution to the likelihood function is expressed as follows:



$$L_j(u|B) = \Pr(u_1 + \varepsilon_{1j} \geq B_i, u_2 + \varepsilon_{2j} \geq B_i^u)^{yy} * \Pr(u_1 + \varepsilon_{1j} < B_i, u_2 + \varepsilon_{1j} < B_i^l)^{nn} * \Pr(u_1 + \varepsilon_{1j} \geq B_i, u_2 + \varepsilon_{1j} < B_i^d)^{yn} * \Pr(u_1 + \varepsilon_{1j} < B_i, u_2 + \varepsilon_{1j} \geq B_i^u)^{ny} \dots \dots \dots \text{equation 4.}$$

Where  $u_1$  and  $u_2$  are the first and second response means. The setting  $u_{ij} = X'_{ij}\beta_i$  allows the means to be influenced by the consumer and good characteristics. The empirical model for estimating mean WTP with double-bounded logit is as follows:

$$WTP = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 \dots \dots \dots + \beta_nX_n + \varepsilon_j \dots \dots \dots \text{equation 5.}$$

The two bids and their responses were the dependent variables in the double-bounded logit. The maximum likelihood method was used to estimate the model's coefficients. This was done in two stages, with the first stage involving regressing the dependent variable, which included the two bids and their responses, to generate mean WTP. The WTP value indicated how much consumers were willing to pay. The second stage included independent variables to determine the factors that significantly influence a respondent's WTP (Fieldman, 2012).

The missing values in the second bid were filled in by the second lower bid and its response. Maximum likelihood estimations were used to estimate the coefficients in double-bounded logit. The estimation process is divided into two stages. The dependent variables were regressed by in the first step to generate mean WTP, which is equal to the amount consumers are willing to pay. The second stage included independent variables such as education level, sorghum-pigeon pea flakes awareness, sorghum-pigeon pea flakes nutritional value awareness, expenditure, age, marital status, distance to nearest market, and household size to determine the factors that significantly influence a consumer's WTP Fieldman, (2012).

### 3.0 RESULTS AND DISCUSSION

#### 3.1 Socio-demographic Characteristics of Consumers

Table 1 shows the socio-demographic characteristics of Busia and Makueni County consumers, as well as the overall sample. The average age of respondents in Busia was around 39 years, while in Makueni the average age was 37.4 years. This can be attributed to the fact that most developing countries have a population that is dominated by young people, a demographic characteristic that has significant implications for labor-market opportunities, public resource accessibility, and access to family resources.

Only 23.8 percent of the study's respondents were married. When compared to Busia, Makueni had a significantly higher proportion of married respondents (35.7 percent). Marital status is an important factor in female food insecurity and body weight. According to Hanson *et al.* (2007)'s study on gender and marital status clarifying associations between food insecurity and body weight, dissolution of marriages or long-term partnerships may aggravate food insecurity and thus affect the ability to cope with it. As a result, it is clear that Busia and Makueni Counties may face food insecurity and, as a result, malnutrition, because food insecurity is defined as the limited or uncertain availability of nutritionally adequate and safe food as a result of financial resource constraints.

**Table 1: Socio-demographic characteristics of the respondents**

Variable	Busia (n= 108)	Makueni (n= 115)	Pooled (n= 223)
Sex of respondent (% male)	58.3	71.3 **	65.0
Average age (years)	38.8 (13.3)	37.4 (13.7)	38.1 (13.5)
Household size (number)	4.6 (1.8)	4.3 (1.8)	4.4 (1.8)
Occupation of respondent (% formal)	21.7 ***	38.3	27.8
Marital status of respondent (% married)	11.1	35.7 ***	23.8 (42.7)
Education level (% above primary level)	19.4	37.4 ***	28.7 (45.3)
Distance to nearest market (Kms)	11.4 (77.1)	3.3 (4.0)	7.2 (53.8)
Distance to nearest health center (Kms)	36.3 (131.3) **	9.8 (54.1)	22.7 (100)
Awareness of flakes (% yes)	50.9 (50.2)	49.7 (50.2)	50.2 (50.1)
Awareness of flakes' nutrition value (% aware)	41.7 (49.5)	48.9 (50.2)	45.3 (50.0)
Receive any form of income (% yes)	11.1	56.5 ***	34.5
Household expenditure (Kshs)	22,807.31 (16,197.35)	25,911.03 (16,484.72)	24,407.88 (16,383.29)

Notes: *Standard deviations are in parenthesis. Asterisks\*\*\*, \*\*, \* denote significance deference in means between Counties at 1%, 5% and 10%, respectively. Kshs 110 were equivalent to USD (\$) 1 at the time of the survey.*

Source: Survey Data (2020).

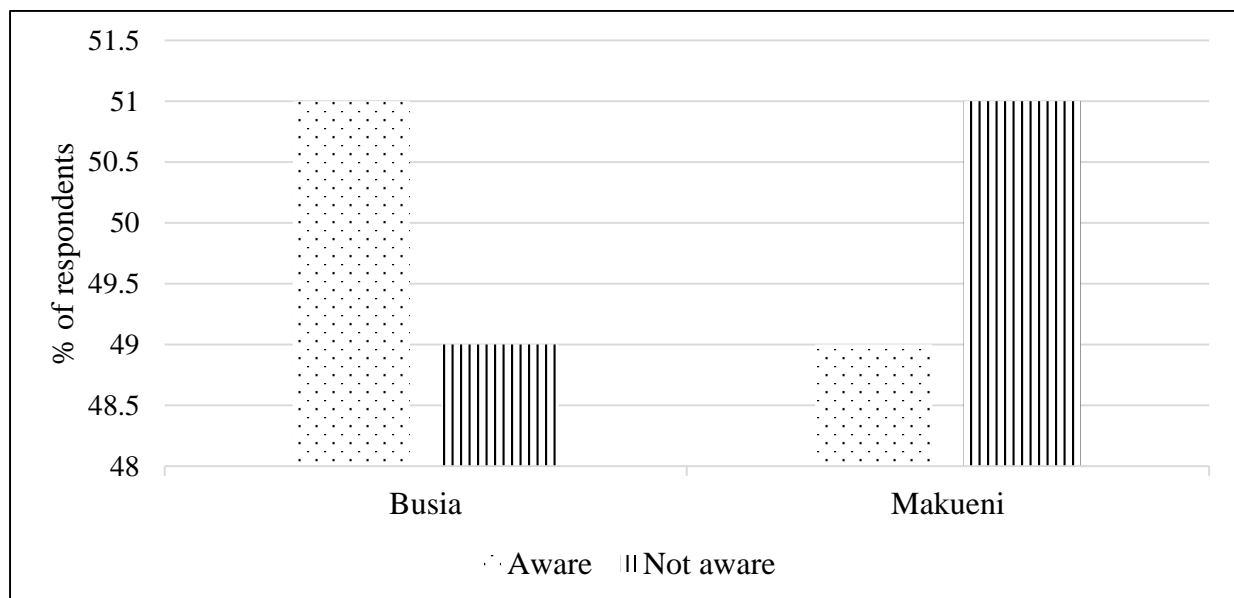
The average household size was four people, indicating that households were smaller. According to Pelto *et al.* (1991), household size is an important catalyst in reducing malnutrition, particularly among infants and young children in developing countries, whereas large household sizes are considered a risk factor for malnutrition. As a result, the novel breakfast Sorghum-Pigeon Peas Flakes RTEC may have a better chance of acceptance and, as a result, of alleviating malnutrition in Busia and Makueni counties.

Although 64.2 percent of consumers had completed secondary school, the proportion in Makueni (72 percent) was significantly higher than in Busia (56 percent). According to Hanley and Wyatt, (2021), education is a key factor in a consumer's ability to accept new technology, and it is also argued in the literature that achieving a high education level increases the likelihood of accepting improved products. Because only about one-quarter of the respondents in the pooled sample had formal jobs, the majority of the consumers worked in informal jobs. In comparison to Busia, Makueni had a significantly higher proportion of respondents with formal employment (38.3 percent) (21.7 percent). Rashad and Sharaf (2019) discovered a stronger and significant association between maternal employment and poor nutritional status

among children, indicating that they value taking care of their children by working for themselves.

### 3.2 Awareness on Sorghum-Pigeon Pea Flakes for Nutritional Improvement

Figure 4 illustrates awareness of the ready-to-eat breakfast cereal SPPF towards nutritional improvement in the two counties, demonstrating that Busia County had the highest percentage of respondents who were aware (51 percent) of the novel flakes, followed by Makueni County at 49 percent. According to Keller, (1993), product awareness is important at any point during the introduction of a new product, and with more than half (50%) of the respondents being aware, it creates ease of entry of the sorghum-pigeon pea flakes in the two counties, because product awareness plays an important role in buying decision making, where the consumer recalls the product category in a given context, increasing the chance of being considered. This is supported by Keller, (1993) and Moisescu, (2009) who emphasize brand awareness as the first and most important dimension in any consumer's brand knowledge system.



**Figure 1: Awareness depiction for ready to eat breakfast cereal SPPF by County**

### 3.3 Willingness to Pay for Sorghum-Pigeon Pea Flakes as Alternative to Alleviating Malnutrition.

#### 3.3.1 Willingness to Pay for Bid Prices

According to Table 2, the initial bid of Kshs 125 was accepted by 85 percent of Busia County consumers and 80.9 percent of Makueni County consumers. This can be explained in part by the two countries' different economic situations. In addition, 60% of Makueni respondents who accepted the initial bid also accepted the higher bid of Kshs 150. In Busia County, however, 82.4 percent of respondents who said yes to the first bid accepted the second/higher bid of Ksh. 150. This indicated that consumers were willing to pay more than the market price at the time.

**Table 2: WTP for bid prices by County**

	Busia County			Makueni County		
	Current market price (CMP)	CMP+25 (Yes to CMP)	CMP-25 (No to CMP)	Current market price (CMP)	CMP+25 (Yes to CMP)	CMP-25 (No to CMP)
<b>Yes (%)</b>	85.2	82.4	81.3	80.9	60.0	63.6
<b>No (%)</b>	14.8	17.6	18.8	19.1	40.0	36.4

*Note: One US dollar was equivalent to Ksh.102 at the time of the survey.*

*Source: Survey Data (2020).*

### 3.3.2 Mean WTP Values for Sorghum-Pigeon Pea Flakes

Busia County consumers were willing to pay an average of KSh 140 for SPPF, which was higher than the current market price of Kshs 125. Furthermore, Makueni sorghum-pigeon pea flakes consumers were willing to pay Kshs 136 for SPPF. As a result, if sorghum-pigeon pea flakes become available, they are more likely to purchase them. The high average mean WTP values indicated that sorghum-pigeon pea flakes would be purchased in the market if presented. This could be due to the perception that sorghum-pigeon pea flakes have a high nutritional value, which results in its products. The findings are consistent with Alemu *et al.* (2017) recent study on consumer preference and demand for cricket flour buns in Kenya, which discovered that consumers were willing to pay more for cricket flour bans.

### 3.3.3 Factors influencing Willingness to Pay for Sorghum-Pigeon Pea Flakes

Table 3 shows the factors hypothesized to influence consumers' WTP for sorghum-pigeon pea flakes. The overall results from the pooled data are presented because the data failed the separability test to split the data based on location by County. As a result, pooling the data and including location as an independent variable in model estimation yields better results. The diagnostic test returned a prob>chi2 value of 0.000, indicating that the double bounded logit model was correctly fitted. The wald test resulted in a score of 36.31. The explanatory variables had a value greater than zero, according to the wald test results. WTP for sorghum-pigeon pea flakes was significantly influenced by the initial bid. This meant that raising the initial bid increased the likelihood of an increase in the consumer WTP amount.

The gender of the respondent (male) was found to have a positive influence on the WTP for sorghum-pigeon pea flakes. This means that male respondents were more likely to pay for the product than female respondents. Males were found to be more receptive to the use of insects than females, who were found to be more fearful of insects, according to Schosler *et al.*, (2012). Males prefer well-known foods over time, according to Beardsworth *et al.* (2002), and they are willing to pay more if the food is more nutritious and healthier.

**Table 3: Maximum likelihood estimate of factors influencing WTP for sorghum-pigeon pea flakes**

<b>Variables</b>	<b>Coefficient</b>	<b>Significance</b>
Bid 1 (Initial bid)	27.761 (2.427)	0.000 ***
Sex	13.428 (4.774)	0.005 ***
Age	-.299 (0.205)	0.144
Household size	-.341 (1.184)	0.773
Occupation	-12.431 (6.291)	0.048 **
Marital status	11.591 (6.343)	0.068 *
Education	6.414 (6.111)	0.294
Distance to nearest market	.434 (0.486)	0.372
Awareness	8.273 (4.605)	0.072 *
Expenditure	-.001 (0.001)	0.095 *
County (1= Busia)	17.815 (5.001)	0.000 ***
Constant	148.106 (9.954)	0.000 ***
<i>Prob&gt; chi<sup>2</sup></i>	0.000	
<i>Wald chi<sup>2</sup></i>	36.31	
<i>Log likelihood</i>	-224.104	
<i>N</i>	223	

*Note: Standard errors are in parenthesis. Asterisks \*, \*\*, \*\*\* denote significance at 1%, 5% and 10% levels respectively.*

The respondent's occupation was discovered to have a negative influence on the WTP for sorghum-pigeon pea flakes. Respondents with formal employment were more likely to pay for the product than those with other occupations. Because people with more formal occupations are expected to earn more money, occupation can be used to hypothesize income. As respondents' income increased, their willingness to pay a higher price for the sorghum-pigeon pea flakes decreased. As a result, as income rises, the price of sorghum-pigeon pea flakes falls, which could be due to consumers viewing the flakes as a less superior choice when compared to other similar products. According to previous research, income has a significant negative impact on WTP Rubey and Lupi (1997). According to Nikolova, (2019), transitioning to the informal sector (self-employment) provides both physical and mental health benefits, resulting in a high percentage of WTP allocated to protein nutrient gain for healthy living.

The respondent's marital status was discovered to have a positive influence on the WTP for SPPF. This means that married consumers were more likely to pay for the product than unmarried consumers. In contrast, previous research, such as Boys *et al.*, (2014), found a negative relationship between marital status and WTP. A plausible explanation is that married respondents have higher WTP because they prefer nutritionally superior products such as SPPF over alternatives due to the nutrition benefits obtained from consumption. Marriage is a



fundamental social status that plays an important role in many people's lives, according to Wood *et al.* (2007) and Manfredini *et al.* (2017), and thus marital status contributes to better health outcomes and increases life expectancy. This could explain why people are willing to pay more for products that are nutritionally superior.

Consumers' willingness to pay for SPPF was also significantly influenced by their awareness of the benefits of consuming sorghum-pigeon pea flakes. This implies that consumers who were aware of the nutritional benefits of eating SPPF were willing to pay more for the product. As a result, this study concludes that being aware of the nutritional benefits of eating has a positive effect on WTP. The findings are consistent with those of Adawiyah *et al.*, (2021), who found that an increase in consumer awareness has a positive effect on consumer interest in buying the product. Past studies Debela *et al.*, (2017, De Groote *et al.*, 2017a, and Chege *et al.*, (2019) have also shown that access to nutrition information increases consumers' willingness to pay. This means that people who are aware of the nutritional benefits of various foods are more likely to purchase them and may be willing to pay more than those who are unaware.

Household expenditure had a negative impact on WTP for sorghum-pigeon pea flakes. Expenditure may reflect a household's economic situation, and thus households with higher expenditure may be less willing to contribute to the SPPF due to a lower economic ability to pay. This could be because consumers with higher food expenditures may not be able to afford to pay a higher price. When compared to those who spend less, they are less likely to pay for the products. Zhang *et al.* (2018) discovered a negative relationship between household expenditure and WTP.

The WTP for sorghum-pigeon pea flakes was positively influenced by the respondent's county of residence. Busia consumers were willing to pay more than Makueni consumers. In comparison to Makueni, the Busia location increases the likelihood that a consumer will be willing to pay for the product. A plausible example is that Busia is one of Kenya's main sorghum producing areas, so consumers in the County may be already accustomed to consuming sorghum, a key ingredient in the SPPF, and thus understand the nutritional benefits of the products. This may have an impact on their WTP for the SPPF product. Furthermore, this could be due to respondents in Busia being more aware of the benefits of SPPF, which was higher than in Makueni. As a result, respondents were probably more willing to pay for the SPPF because they perceived it to be of high nutritional quality.

#### **4.0 CONCLUSIONS AND POLICY RECOMMENDATION**

The descriptive results revealed that the majority of consumers were young people, indicating that both counties were dominated by young generation. The majority of respondents were unmarried and had four-member households. Despite having a higher level of education, Makueni had a significantly higher proportion than Busia. Because education is a key factor in a consumer's ability to accept new technologies and products, achieving a high level of education increases the chances of accepting improved products.

Despite the fact that the majority of respondents in the study had informal employment, Makueni had a significantly higher proportion of respondents with formal employment than Busia. A double bounded logit model was used in the study to assess the factors influencing the WTP for SPPF. The double-bounded logit regression results revealed that being male, married, aware of SPPF, and living in Busia County all had a positive influence on WTP for SPPF. Having formal employment and household expenditure, on the other hand, had a negative impact on the WTP for SPPF.

Based on the results, there is a need to raise consumer awareness about the existence of SPPF products and the benefits associated with their consumption in order to increase their consumption and utilization. This can be accomplished by the government, in collaboration with the private sector, organizing food shows and exhibitions aimed at consumers. Nutritional training is also required to raise awareness of the benefits of consuming SPPF.

### **Acknowledgement**

We would like to thank the National Research Fund (NRF) for providing financial support to enable data collection through the University of Nairobi, Kenya.

### **Compliance with ethical standards**

### **Conflict of interest**

The authors declare that they have no conflict of interest.

### **Ethical considerations**

This study did not involve use of human or animal sample materials. All interviewed persons gave their informed consent prior to their inclusion in the study.

### **REFERENCES**

- Adawiyah, R., Najib, M., and Ali, M. M. (2021). Information effect on organic vegetable purchase interest through consumer preferences and awareness. *The Journal of Asian Finance, Economics, and Business*, 8(2), 1055-1062.
- Alemu, M. H., Olsen, S. B., Vedel, S. E., Pambo, K. O., and Owino, V. O. (2015). *Consumer acceptance and willingness to pay for edible insects as food in Kenya: the case of white winged termites* (No. 2015/10). IFRO Working Paper.
- Archimède, H., Eugène, M., Magdeleine, C. M., Boval, M., Martin, C., Morgavi, D. P., .. and Doreau, M. (2011). Comparison of methane production between C3 and C4 grasses and legumes. *Animal Feed Science and Technology*, 166, 59-64.
- Bain, L. E., Awah, P. K., Geraldine, N., Kindong, N. P., Siga, Y., Bernard, N., & Tanjeko, A. T. (2013). Malnutrition in Sub-Saharan Africa: burden, causes and prospects. *Pan African Medical Journal*, 15(1).
- Balasubramanian, S., Vishwanathan, R., and Sharma, R. (2011). Post harvest processing of millets: An appraisal
- Beardsworth, A., A. Bryman, T. Keil, J. Goode, C. Haslam, and E. Lancashire (2002). Women, Men and Food: The Significance of Gender for Nutritional Attitudes and Choices: *British Food Journal*, 104(7), 47–91.
- Boys, K. A., Willis, D. B., and Carpio, C. E. (2014). Consumer willingness to pay for organic and locally grown produce on Dominica: Insights into the potential for an “Organic Island”. *Environment, development and sustainability*, 16(3), 595-617.
- Cant, M. C., Wiid, J., and Sephapo, C. M. (2016). Key Factors Influencing Pricing Strategies For Small Business Enterprises (SMEs): Are They Important? *Journal of Applied Business Research (JABR)*, 32(6), 1737-1750.
- Cerda, A. A., and García, L. Y. (2021). Willingness to Pay for a COVID-19 Vaccine. *Applied Health Economics and Health Policy*, 19(3), 343-351.

- Chege, C. G., Sibiko, K. W., Wanyama, R., Jager, M., & Birachi, E. (2019). Are consumers at the base of the pyramid willing to pay for nutritious foods?. *Food Policy*, 87, 101745.
- De Groote, H., Kariuki, S. W., Traore, D., Taylor, J. R., Ferruzzi, M. G., and Hamaker, B. R. (2018). Measuring consumers' interest in instant fortified pearl millet products: a field experiment in Touba, Senegal. *Journal of the Science of Food and Agriculture*, 98(6), 2320-2331.
- Debela, B. L., Demmler, K. M., Rischke, R., and Qaim, M. (2017). Maternal nutrition knowledge and child nutritional outcomes in urban Kenya. *Appetite*, 116, 518-526.
- Feldman, A. L. (2012). Introduction to Contingent Valuation using Stata MPRA Paper No. 41018, posted 4. September, 2012.
- Gibney, M. J., Barr, S. I., Bellisle, F., Drewnowski, A., Fagt, S., Livingstone, B., ...and Hopkins, S. (2018). Breakfast in human nutrition: The international breakfast research initiative. *Nutrients*, 10(5), 559.
- Gido, E. O., Ayuya, O. I., Owuor, G., and Bokelmann, W. (2017). Consumption intensity of leafy African indigenous vegetables: towards enhancing nutritional security in rural and urban dwellers in Kenya. *Agricultural and food economics*, 5(1), 1-16.
- Glenn, D. (2013). Determining Sample Size, Document, Program Evaluation and Organizational Development. *Institute of Food and Agricultural Sciences: University of Florida, Gainesville, FL, 32611*, 3.
- Haab, T. C., and McConnell, K. E. (2002). Valuing environmental and natural resources: the econometrics of non-market valuation. Edward Elgar Publishing.
- Hanemann, W. M. (1991). Willingness to pay and willingness to accept: how much can they differ? *The American Economic Review*, 81(3), 635-647.
- Hanley, T., and Wyatt, C. (2021). A systematic review of higher education students' experiences of engaging with online therapy. *Counselling and Psychotherapy Research*, 21(3), 522-534.
- Hanson, K. L., Sobal, J., and Frongillo, E. A. (2007). Gender and marital status clarify associations between food insecurity and body weight. *The Journal of Nutrition*, 137(6), 1460-1465.
- Harinder, K., Kaur, B., & Sharma, S. (1999). Studies on the baking properties of wheat: Pigeon pea flour blends. *Plant foods for human nutrition*, 54(3), 217-226.
- Hariprasanna, K., and Rakshit, S. (2016). Economic importance of sorghum. In *the sorghum genome* (pp. 1-25). Springer, Cham.
- Jisha, S., and Padmaja, G. (2011). Whey protein concentrate fortified baked goods from cassava-based composite flours: Nutritional and functional properties. *Food and bioprocess technology*, 4(1), 92-101.
- Keller, K. L. (1993). Conceptualizing, measuring, and managing customer-based brand equity. *Journal of marketing*, 57(1), 1-22.

- Kinyua, P. M., Mwasaru, M. A., Muinga, R., and Gathambiri, C. (2016). Nutritional composition of Kenyan sorghum-pigeon pea instant complementary food. *Journal of Agriculture, Science and Technology*, 17(1), 1-12.
- Kotler, P., Armstrong, G., Harker, M., & Brennan, R. (1990). *Marketing: an introduction* (Vol. 1). Englewood Cliffs, NJ: Prentice-Hall.
- Lopez-Feldman, A. (2012). Introduction to contingent valuation using Stata.
- Madani, V., and King, R. L. (2007, June). Strategies and applications to meet grid challenges and enhance power system performance. In *2007 IEEE Power Engineering Society General Meeting* (pp. 1-9). IEEE.
- Mohajan, Haradhan. "Food and nutrition scenario of Kenya." (2014): 28-38.
- Manfredini, Roberto, Alfredo De Giorgi, RuanaTiseo, BenedettaBoari, Rosaria Cappadona, RaffaellaSalmi, Massimo Galleraniet al. "Marital status, cardiovascular diseases, and cardiovascular risk factors: a review of the evidence." *Journal of Women's Health* 26(6), 624-632.
- Moisescu, O. I. (2009). The importance of brand awareness in consumers' buying decision and perceived risk assessment. *Management and Marketing-Craiova*, (1), 103-110.
- Nikolova, M. (2019). Switching to self-employment can be good for your health. *Journal of Business Venturing*, 34(4), 664-691.
- Neumann, C. G., Murphy, S. P., Gewa, C., Grillenberger, M., and Bwibo, N. O. (2007). Meat supplementation improves growth, cognitive, and behavioral outcomes in Kenyan children. *the Journal of Nutrition*, 137(4), 1119-1123.
- Noorfarahzilah, M., Lee, J. S., Sharifudin, M. S., MohdFadzelly, A. B., &Hasmadi, M. (2014). Applications of composite flour in development of food products. *International Food Research Journal*, 21(6).
- Pelto, G. H., Urgello, J., Allen, L. H., Chavez, A., Martinez, H., Meneses, L., ...and Backstrand, J. (1991). Household size, food intake and anthropometric status of school-age children in a highland Mexican area. *Social Science and Medicine*, 33(10), 1135-1140.
- Portney, P. R. (1994). The contingent valuation debate: why economists should care. *Journal of Economic perspectives*, 8(4), 3-17.
- Rashad, A. S., and Sharaf, M. F. (2019). Does maternal employment affect child nutrition status? New evidence from Egypt. *Oxford Development Studies*, 47(1), 48-62.
- Rito, A.I., Dinis, A., Rascoa, C., Maia, A., de Carvalho Martins, I., Santos, M., Lima, J., Rubey, L., Lupi, F., (1997). "Predicting the effects of market reform in Zimbabwe: Stated preference approach." *American Journal of Agricultural Economics*, 79, 89–99.
- Schosler, H., J. de Boer and J. J. Boersema (2012). Can we cut out the meat of the dish? Constructing consumer-oriented pathways towards meat substitution: *Appetite*, 581(6): 39-47.

- Shittu, T. A., Raji, A. O., & Sanni, L. O. (2007). Bread from composite cassava-wheat flour: I. Effect of baking time and temperature on some physical properties of bread loaf. *Food Research International*, 40(2), 280-290.
- Tato, L. FOOD SECURITY AND NUTRITION IN KENYA: The Role of Population.
- Veríssimo, D., & Glikman, J. A. (2020). Influencing consumer demand is vital for tackling the illegal wildlife trade. *People and Nature*, 2(4), 872-876.
- Watson, V., and Ryan, M. (2007). Exploring preference anomalies in double bounded contingent valuation. *Journal of Health Economics*, 26(3), 463-482.
- Witt, B. (2019). Tourists' willingness to pay increased entrance fees at Mexican protected areas: A multi-site contingent valuation study. *Sustainability*, 11(11), 3041.
- Wood, R. G., Avellar, S., and Goesling, B. (2009). *The effects of marriage on health: A synthesis of recent research evidence*. New York, NY: Nova Science.
- Zhang, B., Fu, Z., Huang, J., Wang, J., Xu, S., & Zhang, L. (2018). Consumers' perceptions, purchase intention, and willingness to pay a premium price for safe vegetables: a case study of Beijing, China. *Journal of cleaner production*, 197, 1498-1507.