

# Behavioral Determinants of Biofortified Food Acceptance: The Case of Orange-fleshed Sweet Potato in Ghana

**Chinonso Etumnu**

# Outline

- Motivation
- Research Question
- Literature Review
- Data Collection
- Empirical Model and Hypotheses
- Results and Discussion
- Conclusions and Policy Implication

# Motivation

- Micronutrient malnutrition is a major nutritional and health problem in developing countries.
- Globally, more than **2 billion** people are affected (Qaim, 2007).
- A common form of micronutrient malnutrition is **Vitamin A deficiency**.
- About **250 million** preschool children are vitamin A deficient worldwide (WHO, 2015).

# Motivation

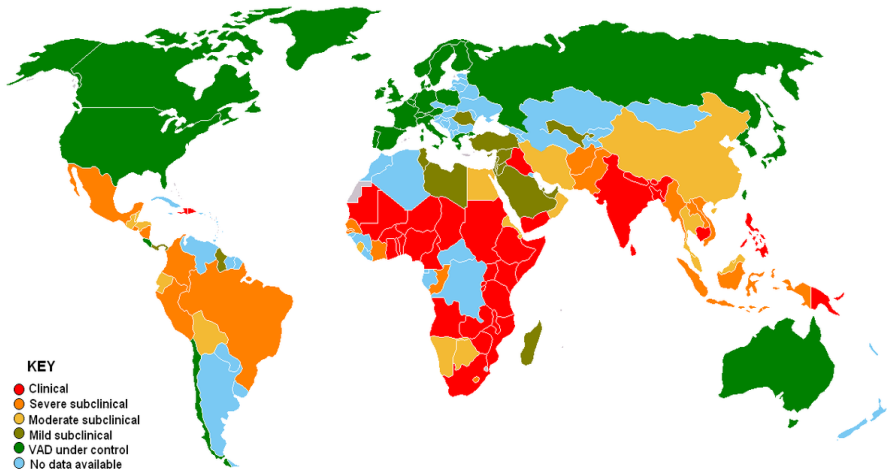


Figure 1: Map of the World Showing Prevalence of Vitamin A Deficiency

# Motivation

- To combat vitamin A deficiency:
  - provision of supplements
  - fortification of products
  - biofortification**
- Biofortification is a term used to describe a breeding strategy that aims to increase the micronutrient content of staple food crops (Nestel et. al., 2006).
- Orange-fleshed sweet potato is an example of a biofortified crop.

# Research Questions

- Are consumers willing to pay for orange-fleshed sweet potato in Ghana?
- What are the determinants of consumer acceptance of orange-fleshed sweet potato in Ghana?

- **Advantages of Biofortification**

(Stevens and Winter-Nelson, 2008; Mwaniki, 2009; Meenakshi et al., 2010)

- **Acceptance of Biofortified Foods**

(De Groote et al., 2011, Stevens and Winter-Nelson, 2008; Oparinde et al., 2014; Chowdhury et al., 2011; Naico and Lusk, 2010)

- **Methods to Estimate Willingness to Pay**




Contingent Valuation, Experimental Auctions and Choice Experiment (Hausman, 2012; Haab et. al, 2013; Lusk and Shogren, 2007; Lancaster, 1966)

# Data Collection

- Study Area: Northern and Upper East Regions of Ghana.
- The villages are Nayoku, Golinga, Voggu-Kushibu, and Dimabin in the northern region, and Binduri, Naaga, Gaani and Damentenga in the upper east region.
- Conducted a choice experiment and a survey in collaboration with the International Potato Center.



## A Sample of Choice Experiment Card

6]ROOTS	Option A	Option B	Option C	Option D
				I would choose none of the Options
Price/3kg (GHC)	3	2	3	
I would choose	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

# Empirical Model

- By Lancaster (1966) and McFadden (1973), individual  $i$ 's indirect utility from choosing sweet potato option  $j$  is

$$U_{ij} = V_{ij} + \epsilon_{ij} \quad (1)$$

$$V_{ij} = \beta_j + \alpha_{ij}P_{ij} + \theta_iX_i + \theta Z_i \quad (2)$$

- The probability that individual  $i$  chooses alternative  $j$  is

$$\text{Prob}\{V_{ij} + \epsilon_{ij} \geq V_{ik} + \epsilon_{ik}; \quad \text{for all } k \in C_i\} \quad (3)$$

- The probability of choosing alternative  $j$  is

$$\text{Prob}\{j \text{ is chosen}\} = \frac{\exp^{V_j}}{\sum_{k \in C} \exp^{V_k}} \quad (4)$$

# Empirical Model and Hypothesis

$$V_{ij} = \beta_1 OFSP_j + \beta_2 WFSP_j + \beta_3 YFSP_j + \alpha P_j + \gamma X_i + \theta Z_i + \epsilon_{ij} \quad (5)$$

$OFSP_j$  takes the value of 1 if alternative  $j$  is an OFSP

$WFSP_j$  takes the value of 1 if alternative  $j$  is a WFSP

$YFSP_j$  takes the value of 1 if alternative  $j$  is YFSP

$P_j$  is the price of alternative  $j$

$X_i$  is a vector of socio-economic characteristics

$Z_i$  is a vector of nutritional information

# Empirical Model and Hypothesis

- Holding all other attributes constant, WTP for the orange, white and yellow-fleshed relative to 'none' is

$$WTP_{OFSP} = \beta_1/\alpha;$$

$$WTP_{WSFP} = \beta_2/\alpha$$

$$WTP_{YSFP} = \beta_3/\alpha.$$

- Thus, marginal WTP for OFSPs versus WFSPs and YFSPs are

$$WTP_{OFSP} - WTP_{WFSP} = (\beta_1 - \beta_2)/\alpha,$$

$$WTP_{OFSP} - WTP_{YFSP} = (\beta_1 - \beta_3)/\alpha.$$

# Results

Table 1: Summary Statistics of Selected Demographics By Gender

Variable	Gender		
	Full Sample	Male	Female
Gender (%)	100	48	52
Age (years)	40	39	41
No formal education (%)	85	80	89
Household income (GHC/month)	204	261	151
Personal income (GHC/month)	103	135	75
Land owned (acres)	4	6	3
Household size	14	15	13
Children under 5	4	4	4
Prior information (%)	72	83	63
“During” information (%)	48	51	45
Number of Respondents	628	303	325

# Results

Table 2: Conditional Logit Estimates of the Utility Function by Gender

Variable	Gender		
	Full Sample	Male	Female
Price of the sweet potato	0.0393	-0.0404	0.0985*
White-flesh relative to “none”	4.0027***	3.6154***	4.3269***
Orange-flesh relative to “none”	8.0998***	8.0284***	8.3446***
Yellow-flesh relative to “none”	3.9721***	3.7761***	4.3269***
Observations	12560	6060	6500
Choices	3140	1515	1625
Respondents	628	303	325
Log-likelihood	-1871.5612	-804.0485	-1059.6676
Pseudo- $R^2$	0.6911	0.7250	0.6621

The standard errors are robust due to clustering

Table 3: Willingness to Pay (WTP) for Sweet Potato

	Respondents
Total WTP (GHC/kg)	
White-flesh	30
Orange-flesh	66
Yellow-flesh	31
Marginal WTP (GHC/kg)	
Orange versus White	36 (55%)
Orange versus Yellow	35 (53%)
White versus Yellow	-1 (-3%)

The numbers in parentheses are the percentage change over the second variety

## Determinants of Sweet Potato Acceptance 1

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Male	Female	Full Sample	Male	Female
Price	0.0421	-0.0352	0.103**	0.0394	-0.0322	0.0926*
White-flesh	3.998***	3.607***	4.480***	4.043***	3.633***	4.546***
Orange-flesh	8.091***	9.014***	7.722***	6.900***	7.190***	6.806***
Yellow-flesh	3.967***	3.768***	4.318***	4.014***	3.799***	4.384***
Household income	-0.157	-0.280	-0.197	0.335	0.359	-0.109
Land owned	-0.0200	-0.0315	-0.0777	-0.0498	-0.0424	-0.0555
Education	-0.0772	-0.172	-0.0219	-0.128	-0.163	-0.0870
Age	0.00251	-0.00792	0.0118	-0.00446	-0.0117	0.00209
Household size	0.0380**	0.0443	0.0409	0.00752	-0.000752	0.0197
Under 5 children	-0.100	-0.177*	-0.0322	-0.0352	-0.0643	0.00523
Prior information				1.188***	1.213*	1.119**
During information				3.912***	4.070***	3.736***
Pseudo R-squared	0.693	0.729	0.665	0.734	0.765	0.707

Robust standard errors

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1



# Conclusions and Implication

- Ghanaian consumers **are willing to pay** for biofortified orange-fleshed sweet potato
- Socio-economic characteristics of consumers are not crucial for OFSP acceptance
- Providing **nutritional information** is extremely important for acceptance of OFSP.
- Nutritional information campaigns will be integral to the success of biofortification.

# Thank You!!! Special thanks to



CHANGE THE WORLD FROM HERE



Prof. Bruce Wydick



Professor Elizabeth Katz (my advisor)



International  
Potato Center



Prof. Alessandra Cassar

IDEC CLASS OF 2016



Ghana Team

IDEC CLASS OF 2016