

# Integrating Consumer Choice Experiments and SD Supply Chain Modeling to Increase Vegetable Consumption in Kenya

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## Background

In Kenya, fruit and vegetable consumption is below the amount recommended by the World Health Organization (WHO) of 400g per day across all educational attainment levels reported in the Global Dietary Database. The low and stagnant levels of vegetable consumption in Kenya provide motivation for an *ex-ante* evaluation of interventions to increase consumption. Previous literature has identified three categories of drivers of fruit and vegetable consumption both more generally and specifically in the Kenyan context: availability, affordability and desirability. The lack of a systematic evaluation of the product attributes in Kenya constrains the assessment of interventions designed to result in sustained increases in fruit and vegetable consumption. Given limited information about consumer preferences, previous analyses with a supply-chain SD model (Nicholson and Monterrosa, 2023) developed with Group Model Building posited hypothetical proportional changes in product attributes and conducted extensive sensitivity analyses for consumer responses.

## Objectives

This study extends previous work, combining choice experiments with Kenyan consumers to identify attributes influencing spinach purchase probabilities and quantities with SD modeling of the spinach supply chain. Spinach and other leafy greens are an accepted component of diets in Kenya, which suggests that increases in consumption are possible and might address vegetable consumption below recommended levels. The specific objectives of this paper are:

- To determine the impact of selected spinach attributes (price, quality, convenience in use, convenience of acquisition and safety/hygiene) on purchase probabilities and intended purchase quantities of spinach in Kenya.
- Evaluation of potential impacts of interventions that improve product attributes on spinach consumption using an SD model of the spinach supply chain.

Which of the following two kinds of spinach would you buy?

	Spinach A	Spinach B
<b>Quality</b>	Excellent	Average
<b>Convenience</b>	Bulk	Pre-cut
<b>Safety</b>	No pesticides and grown with clean water	No information
<b>Time cost</b>	30 minutes required to purchase	5 minutes required to purchase
<b>Price</b>	10 KSh/bunch	15 KSh/bunch

I would buy Spinach A  
 I would buy Spinach B  
 I would not buy either A or B

Figure 1. Example Choice Experiment Questions in Survey of Kenyan Consumers

## Methods

Survey data were collected using a questionnaire constructed on the Qualtrics platform and administered to respondents at vegetable points of sale. The questionnaire included an introduction accompanied by a consent form, a discrete choice experiment (Figure 1), and socio-demographic questions capturing participants' information such as state location, gender, education level, household income, household size, marital status, and employment status.

The survey questionnaire asked respondents to report the quantity they expected to purchase after they made each specific choice (either alternative A or B). We estimated a panel-data Tobit model to examine the impact of various product attributes and participants' characteristics on their expected purchase quantity.

Information from the Tobit model was incorporated into an SD model of the spinach supply chain developed through Group Model Building with relevant Kenyan stakeholders (Nicholson and Monterrosa, 2023). The model structure includes multiple linked supply chain agents (farmers, intermediaries, vendors and consumers).

Improvement in spinach attributes is hypothesized to increase consumption, activate a reinforcing "emotional benefits" feedback loop, but also increase costs in the supply chain (Figure 1).

## Results

Improvement of quality and safety of spinach had the largest impact on intended purchase quantities (Table 1), followed by acquisition time and convenience (pre-cut product). The impact of price on purchase quantity was negative but relatively small compared to other product attributes.

Improvement of all five product attributes is simulated to increase mean per capita consumption of spinach by Kenyan households between 3% and 17% over five years, with much of the increase occurring in the first year and sustained over time.

Improvement is sustained despite increases in supply chain costs and spinach prices, given that Kenya households' willingness to pay for attribute improvements is aligned with estimates of supply chain costs.

Sensitivity analyses with uncertain parameters for spinach demand elasticity and cost increases indicated overlap in the projected consumption increases for the top four attribute improvement strategies.

Despite these increases, mean per capita consumption would remain below WHO-recommended amounts.

## References

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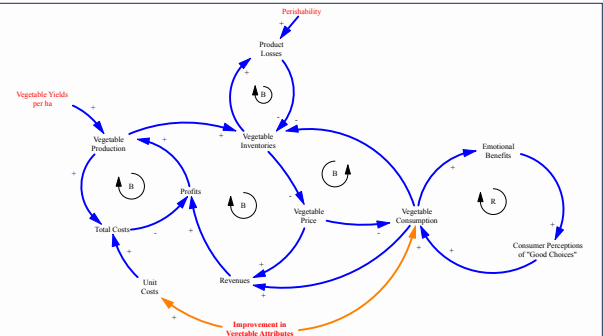


Figure 2. Core Feedback Loop Structure for Spinach Supply Chains and Impacts of Attribute Improvement

Table 1. Impacts of Spinach Attributes on Intended Purchase Quantities Estimated with Tobit Models on Choice Experiment Survey Data

Variable	Impact on Expected Purchase Quantity (Bundles)	s.e.
Price	-0.113***	0.024
Quality Excellent	5.385***	0.390
Quality Average	4.400***	0.428
Convenience Pre-cut	1.116***	0.312
Safety Information	4.527***	0.336
Acquisition Time Average	3.993***	0.316

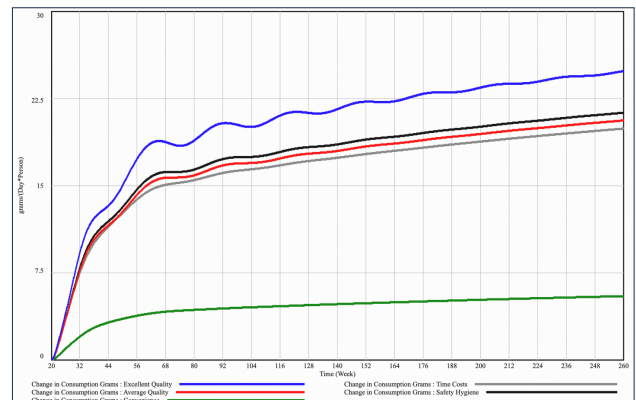


Figure 3. Simulated Change in Spinach Consumption with Five Improvements in Product Attributes, Five Year Time Horizon

Acknowledgement: This project was funded in by the Dutch Ministry of Foreign Affairs, Activity number 400005271.