Journal of Health Economics 31 (2012) 62–71

Contents lists available at SciVerse ScienceDirect

Journal of Health Economics

journal homepage: www.elsevier.com/locate/econbase

Using a discrete choice experiment to elicit the demand for a nutritious food: Willingness-to-pay for orange maize in rural Zambia

J.V. Meenakshi[a,*], A. Banerji[a], Victor Manyong[b], Keith Tomlins[c], Nitya Mittal[a], Priscilla Hamukwala[d]

[a] Delhi School of Economics, University of Delhi, India
[b] International Institute of Tropical Agriculture, Tanzania
[c] Natural Resources Institute, University of Greenwich, United Kingdom
[d] University of Zambia, Zambia

ARTICLE INFO

Article history:
Received 13 June 2010
Received in revised form
17 December 2011
Accepted 5 January 2012
Available online 14 January 2012

JEL classification:
C35
C93
D12

Keywords:
Discrete choice experiments
Vitamin A deficiency
Biofortification

ABSTRACT

Using a discrete choice experiment, this paper estimates the willingness to pay for biofortified orange maize in rural Zambia. The study design has five treatment arms, which enable an analysis of the impact of nutrition information, comparing the use of simulated radio versus community leaders in transmitting the nutrition message, on willingness to pay, and to account for possible novelty effects in the magnitude of premiums or discounts. The estimation strategy also takes into account lexicographic preferences of a subset of our respondents. The results suggest that (a) orange maize is not confused with yellow maize, and has the potential to compete with white maize in the absence of a nutrition campaign, (b) there is a premium for orange maize with nutrition information, and (c) different modes of nutritional message dissemination have the same impact on consumer acceptance.

1. Micronutrient malnutrition and biofortified orange maize in Zambia

Micronutrient malnutrition is widely recognized as a public health problem in both low-income and middle-income countries. Vitamin A deficiency, in particular, accounts for 6% of all deaths and 5% of the total disease burden among preschool children (Black et al., 2008). As in much of Sub-Saharan Africa, Zambia has a high prevalence of vitamin A deficiency: more than half of preschool children in Zambia are at risk (Micronutrient Initiative, 2009).

Biofortification is a new public health intervention that seeks to improve the micronutrient content of staple foods consumed by the majority of poor people using conventional plant-breeding techniques, thus increasing dietary intakes of these critical nutrients. Recently, plant breeders have developed biofortified varieties of maize that contain higher concentrations of provitamin A and are therefore orange in color. Since maize is a staple food in Zambia, as in much of Sub-Saharan Africa, the successful introduction of biofortified provitamin A maize could have a significant impact on reducing the prevalence of vitamin A deficiency in these areas. However, its success will depend on whether it is accepted by the target populations. This may be a particular problem if orange maize is confused with yellow maize. In Southern Africa, yellow maize is believed to have inferior taste, perceived as "drought" food and associated with bad times (Muzhingi et al., 2008).

This provides the context for the present study, which attempts to elicit the willingness to pay (henceforth WTP) for orange maize and to quantify the magnitude of its premium/discount relative to white and yellow maizes. We compare the WTP across scenarios in which information on the nutritive value of the orange maize was given through (a) radio messages, (b) community leaders, or (c) withheld.

A survey of 478 respondents in two provinces of rural Zambia forms the basis of analysis. The survey was conducted in two different settings: central-location testing (where consumers in a market test the new product and respond to the questionnaire) and home-use testing (where consumers were given the product to try at home for a few days before answering the enumerator's questions). This enables an assessment of whether longer exposure to the product influences willingness to pay estimates.

* Corresponding author. Tel.: +91 11 2766 6533; fax: +91 11 2766 7159.
E-mail addresses: j.meenakshi@cgiar.org, meena@econdse.org (J.V. Meenakshi).

0167-6296/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
doi:10.1016/j.jhealeco.2012.01.002

As detailed later, the paper uses a discrete choice experiment using a fractional factorial design as the framework of analysis, and has the following noteworthy aspects:

- It uses prototypes of the actual product to elicit willingness to pay.
- It incorporates sensory perceptions of taste in the econometric analysis.
- It accounts for differences in preferences exhibited by a subset of our sample who appear to have lexicographic orderings.
- It contributes to the relatively limited literature applying this framework to the analysis of public health issues in general and in rural Africa in particular.

The paper is organized as follows: Section 2 explains the survey design, sampling, and the experimental procedure. Section 3 reviews the use of discrete choice experiments and the empirical specifications used to assess willingness to pay. Section 4 presents results and briefly explores the role of differential endowments in influencing WTP estimates. Section 5 summarizes the main findings and presents conclusions.

2. Study design and survey protocol

The study was designed with five arms, summarized in Table 1, which also provides the sample size in each arm. The five arms correspond to two different settings related to product experience, and whether or not respondents were informed about the nutritive value of orange maize.

2.1. Comparing central-location testing with home-use testing

Test marketing of new products typically takes places in a marketplace or a similar community venue, in a format referred to as "central-location testing" (CLT). One potential drawback of using CLT is that consumers have only a short period of time to evaluate a product (typically 30 min). Consumers may be willing to pay a premium to try out a new product for the first time, so that the estimated willingness to pay may not reflect the product's intrinsic value. As Stevens and Winter-Nelson (2008) note in their study of biofortified orange maize in Mozambique, "measurement of acceptance may reflect an attraction to novelty than true acceptability of the product". Time and experience with the product may well reflect declining premiums.

For this reason, "home-use testing" (HUT) is also conducted, where the new product is tried in home situations for a few days, and consumers are asked subsequently to characterize it. The degree of researchers' control over the experiment is lower in HUT, so that it is possible that any observed variation across respondents is not necessarily because of intrinsic differences on how the product is perceived but on how the product was processed and consumed within the home. But since in-home testing more closely mimics actual product use, it may be considered the gold standard. However, the costs of administering home-use testing are orders of magnitude greater than those associated with central-location testing; the question is whether these additional costs are justified.

This paper attempts to account for product experience by comparing behavior in two different settings: at home (where consumers tried the product for a few days at home; arms (1), (2) and (3) in Table 1) and in a central location (where consumers were exposed to the new maize only once; arms (4) and (5) in Table 1).

2.2. Role of nutrition information

The study also assesses the role of nutrition information within both the CLT and HUT settings. Nutrition education can play a significant role in driving consumer acceptance, and can be effected using several methods, including mass media, local theatre, and community-level agents. Each of these varies widely in impact and cost.

For example, since community leaders occupy positions of trust and respect within the community (Zimicki, 1997), using them to disseminate information is believed to have high impact. However, outside of a pilot setting, mobilizing community leaders on a wide scale is difficult, and the monitoring costs of ensuring that messages are not diluted or distorted are extremely high. In Zambia, "camp officers" provide the natural entry point for introducing new agricultural technologies: in one treatment arm, they provided information to the respondents about the biofortified maize.[1]

At the other end of the spectrum are radio messages, which enable a wide reach with relatively low investment and high degree of control over the content of the message (although there is less control over who will hear the message). However, radio messages represent an anonymous voice that consumers may not trust, and therefore they may not be effective. Two-thirds of the sample possessed a radio, suggesting that this could be a viable means of disseminating information.

To quantify the magnitude of this differential impact, respondents were randomly allocated to arms that (a) received no information (arms (1) and (4) in Table 1), (b) received information from (simulated) radio messages (arms (2) and (5) in Table 1), or (c) received information from community leaders (arm (3) in Table 1).

Information on the potential health benefits from consuming orange maize was developed by local nutritionists working on public health campaigns. The Zambia National Broadcasting Corporation then wrote and produced a 5-min program, recorded in the study area's three local languages—Bemba, Lenje, and Tonga. Since orange maize varieties are yet to be released, the radio message could obviously not be broadcast nor could the project ensure that only the selected households heard the message. Therefore, the message was recorded on MP3 players. We term this 'simulated radio'.

2.3. Study location and sampling procedure

The survey was conducted in the Central and Southern Provinces of Zambia, which were selected because they have the highest production (and consumption) of maize and also have a relatively high percent of their populations in poverty. In each province, a list-

Table 1
The study design and sample size.

	No nutrition information	Nutrition information through:	
		Simulated radio	Community leaders
Home-use testing	(1) 103	(2) 88	(3) 82
Central-location testing	(4) 105	(5) 100	X

Figures in parentheses refer to the treatment number, and those outside refer to the sample size in each treatment arm.

[1] In a developed-country context, health information is typically conveyed through the use of written labels, but this is not practical in the context of rural Zambia, given low levels of literacy, costs of labeling, and maize being sold in open sacks. Using community leaders and radio messages for conveying health information is more realistic than using enumerators to read out the nutrition message. Since it is not possible to replicate the use of community leaders to impart nutrition information in a central location setting, the CLT arm of the design considers only the impact of the provision of nutrition information through simulated radio messages.