KOKO Plus, a Market-based Approach to the Improvement of Infants Nutrition: Will Mothers Buy It?

A Summary of Okonogi, S. and Sakurai, T. 2019. "Demand Analysis of a Supplementary Food Product for Infants: Experimental Evidence in Ghana." Journal of Rural Economics, 91(1): 77-82 (in Japanese).

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1. Introduction

Nutritional improvement of children, particularly that of infants is an important policy issue in developing countries. Ghana is not an exception since about 20% of children under 5 were stunted in 2014 (GSS et al. 2915).

Exclusive breastfeeding is recommended during the first six months, then complementary feeding is required because breastfeeding alone cannot give enough nutrition to infants after six months. During this stage, it is difficult to improve child nutrition through complementary feeding since infants' diet is still restricted. Therefore, it is suggested that the use of nutritionally enhanced processed foods for infants may be an effective way of the improvement of child nutrition.

In this regard, one of the most common approaches adopted by the governments and/or international donors in developing countries is free distribution of nutritionally enhanced processed foods. However, the free distribution sometimes causes concern about the sustainability of such a project and crowding private players out. As a sustainable way to improve child nutrition, it is desirable to distribute complementary food products through the market. We call it "market-based approach" as shown in the title.

Thus, naturally we have two questions. First, will mothers buy such a complementary food product? Second, will mothers buy enough amount of such a product so that it has a positive effect on infants' growth?

In order to answer these questions, we conducted a sales experiment in rural Ghana. This summary is from a paper about the first question only, although we already have a positive result as to the second question.

2. Objective

The objective of this study is to explore the possibility of improvement in child nutrition through the market without depending on grant aid.

For this purpose, we chose a particular product, KOKO Plus, for infants because it is an ideal complementary food product to meet our objective.

We analyze the demand for it based on the data collected through a sales experiment and nutritional education to mothers.

3. Data

3.1 KOKO Plus

Ajinomoto, a Japanese company, developed KOKO Plus during its nutrition improvement project phase 1 (2009 – 2011) in Ghana. After the project phase 2 (2011 – 2015), KOKO Plus has become available in the market in the project phase 3 since 2016.

Koko is a thin porridge made from fermented maize and widely consumed as breakfast in Ghana. Koko is also used as complementary food for infants, but it does not have enough nutrition, particularly protein and micronutrient, for infants. KOKO Plus is to mix with koko as a supplementary food to improve the nutrition profile of koko (Tano-Debrah et al., 2019). It has been already proved that KOKO Plus intake improves infants' nutritional status if the amount is sufficient (Gosh et al., 2019).

As far as we know, KOKO Plus is the first supplementary food product available in the market. There are several commercial complementary food products for infants, but they are consumed as food such as formula milk and nutrition added cereals. In this sense, KOKO Plus is a novel product for consumers, and we do not know if consumers are willing to buy it.

3.2 Study Sites

We chose two districts in Ashanti region: Ahafo Ano South district and Asante Akim South district (Figure 1). A highway from Kumasi, the capital of Ashanti region and the second largest city of Ghana, passes through both districts. Ahafo Ano South district is about 30 km away from Kumasi through a west-bound highway, while Asante Akim South district is about 50 km away from Kumasi through an east-bound highway.

Both districts are located in rural area, and the majority of households are engaged in agriculture. But as shown later, the share of non-agricultural households is not so low, reflecting the proximity to the capital city, Kumasi.

One important reason why we chose these districts is that KOKO Plus was not available in the market when we conducted our sales experiment. That is, they obtained KOKO Plus only through our sales experiment.

In each district, we chose 6 villages with a health facility, either a health center or a community Community-based Health Planning and Services (CHPS) center, for our study site. Note that there were 9 such villages in Ahafo Ano South and 13 such villages in Asante Akim South when we

conducted the study. The 6 villages were chosen so that they were distributed geographically evenly within the district.

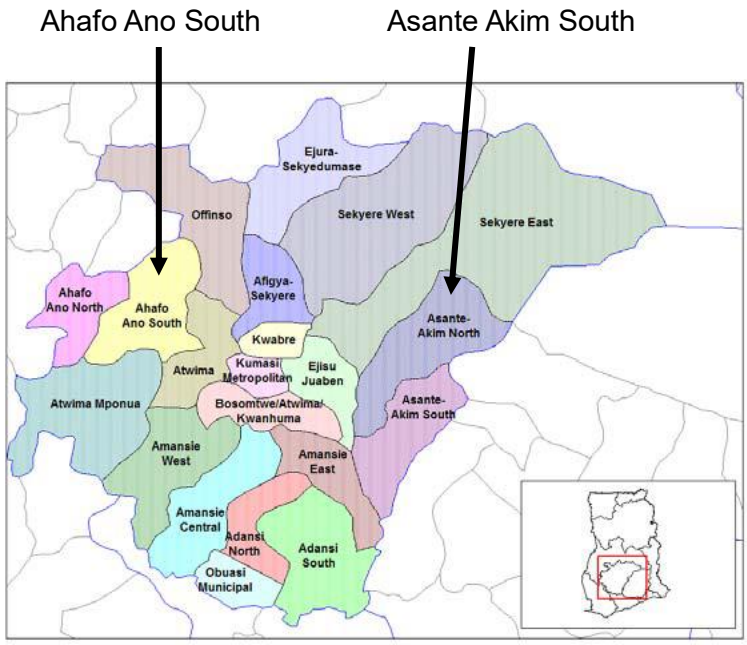

Figure 1 The Location of Study Sites (source: Wikipedia)

3.3 Experiment

First, we conducted a census in order to create a list of all the mothers who had an infant less than one year old. Then, from the list we randomly chose 36 mother-infant pairs in each village. Thus, total number of samples is 432. We excluded mothers with twins or Irish twins (having a sibling within a year). Over the households of the 432 mother-infant pairs, a standard household survey was conducted in March-April 2016.

Before starting sales experiment, we randomly divided the 6 villages into three groups in each district: two villages for sales experiment only (treatment 1), two villages for sales experiment plus educational intervention to mothers (treatment 2), and two villages without intervention (control). Since this paper is to answer the first question, i.e. demand for KOKO Plus, we do not use the data collected in control villages. Thus, hereafter control villages are not included in the description.

In September 2016, sales experiment and educational intervention were started, which continued for six months. When the sales experiment started, the infant age ranged from 6 months to 18 months old.

As the sales experiment, we gave the chance to buy KOKO Plus every week for 24 weeks to all the sample households in the treatment 1 and 2. The sale price was the same as market price, i.e 0.5 GHS (about 0.13 USD) per sachet of KOKO Plus. One sachet contains sufficient amount of nutrient for a day for infant. We introduced random discounting. Every week we randomly selected households to give a discount price: 0.3 GHS per sachet for 1/12 households and 0.4 GHS per sachet for 1/6 households.

The sales were done at the health facility in each village. Sample mothers were requested to come with her baby to the facility every week, then an enumerator did a short interview including body measurement of the baby and gave a chance to buy KOKO Plus. We hired a health worker of each health facility as the enumerator cum salesperson. The maximum number of sachets that a mother can buy in a week was limited to 7 to avoid potential resales since one sachet per day is enough. If a mother does not come, an enumerator must visit her house to do the same.

In the villages of treatment 2, nutritional education was conducted additionally. When mothers came to the health facility, they received a lecture on nutrition (in the first and third weeks of a month) and a demonstration of cooking complementary foods for infants using local materials (in the last weeks of a month). It is important to note that the nutritional education was very general and did not contain any promotion of KOKO Plus at all.

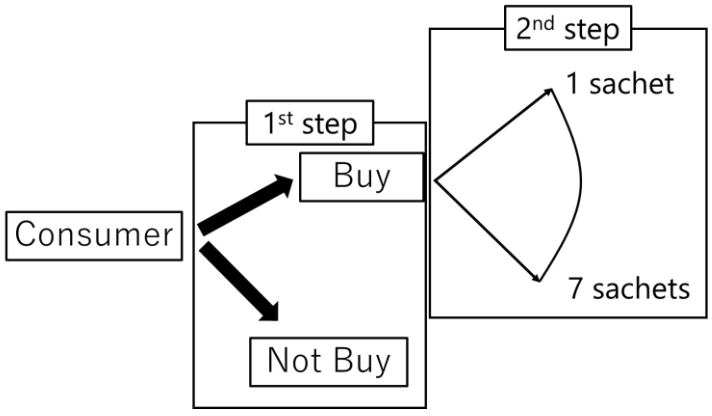

Figure 2 Conceptual Framework of a Consumer's Choice

4. Analysis

4.1 Empirical Model

We assume a two-step decision making structure on purchasing behavior of KOKO Plus (Figure 2). The first step: Whether to buy KOKO Plus or not? And the second step: Given the decision of buying Koko plus, how many sachets to buy?

Then, we apply Heckman's sample selection model for the empirical model to identify the two-step decision making structure: Equation (1) correspond to the first step, and equation (2) corresponds to the second step.

$$D_{ijt}^{*} = \gamma_0 + \gamma_1 Price_{ijt} + \gamma_2 Cons\_pc_{ij} + \gamma_3 Treat_j^{Edu} + \boldsymbol{Other\_Comp\_Products}_{ij}\gamma_4 + \boldsymbol{X}_{ij}\gamma_5 + \theta_j + \mu_{ijt} \quad (1)$$

if $D_{ijt}^{*} > 0$

$$y_{ijt} = \beta_0 + \beta_1 Price_{ijt} + \beta_2 Cons\_pc_{ij} + \beta_3 Treat_j^{Edu} + \boldsymbol{Other\_Comp\_Products}_{ij}\beta_4 + \theta_j + \varepsilon_{ijt} \quad (2)$$

where subscript i is for household, j is for village, and t is for week. Equation (1) implies that the first step decision (D_{ijt}^{*}, whether to buy or not) depends on the budget constraint ($Cons\_pc_{ij}$, household consumption per capita), the price of KOKO Plus ($Price_{ijt}$), nutritional education ($Treat_j^{Edu}$), experience of other complementary food products at the time of baseline survey ($\boldsymbol{Other\_Comp\_Products}_{ij}$), and household's preferences captured by the household characteristics at the time of baseline survey ($\boldsymbol{X}_{ij}$) controlling for village fixed effect (θ_j). But as equation (2) shows the purchase amount (y_{ijt}, number of sachets of KOKO Plus purchased) is assumed not to be influenced by household's preferences. The definition of each variable is given in Table 1.

The vector of household characteristics includes age and education level of household's head and mother, and child's age and sex. The vector of other complementary food products includes formula milk, ordinary milk powder, and cereal based complementary foods.

The impact of nutritional education will be captured by $Treat_j^{Edu}$. Please note that this is a village-level dummy variable. Since not every mother in the Treatment 2 villages attend the nutritional education program, the impact will be Intention-to-Treat (ITT).

Table 1. The Definition of the Variables	
Variable Name	Definition
Dependent Variables	
Y_{ijt}	Number of sachets of KOKO Plus purchased in week t
D_{ijt}	Dummy variable which takes 1 if $Y_{ijt} > 0$
Explanatory Variables	
$Price_{ijt}$	Price of KOKO Plus in week t (GHS/sachet)
$Cons\_pc_{ij}$	Monthly expenditure per capita of household i (GHS/month)
$Other\_Comp\_Products_{ij}$	
Exp. On Formula Milk	Expenditure on Formula Milk in a year (GHS/year)
Exp. On Powder Milk	Expenditure on Ordinary Milk Powder in a year (GHS/year)
Exp. On Comp. Foods	Expenditure on Other Comp. Foods in a year (GHS/year)
Household's Characteristics (X_{ij})	
Non-Farm Dummy	Dummy variable which takes 1 if household is not farmer
hh size	Number of household members
age of hhead	Age of household head
education of hhead	Household head's years completed in school
age of mother	Age of mother
education of mother	Mother's years completed in school
age of child	Age of the child
sex of child	Dummy variable which takes 1 if the child is girl

Note: The variables without subscription "t" are from baseline survey (It means there is no variation across t).

As mentioned above, this paper uses the data from Treatment 1 and Treatment 2. We have 276 sample households excluding ones with incomplete data, and conducted 24 weeks of sales experiment. Therefore, we have household-level panel data with a total of 6624 observations. However, sometimes an enumerator cum salesperson fails to meet some of the sample mothers. In such cases, we could not have any sale record. Although it is obvious that mothers did not buy any KOKO Plus in such cases, we treat them as the cases of temporary attrition. Thus, excluding such attritions, total number of observations becomes 4,707, which constitute unbalanced panel data.

4.2 Results

The descriptive statistics is given in Table 2. The first row shows the results of KOKO Plus sales. It indicates that a household purchased about 19.2 sachets of KOKO Plus during the 24 weeks of sales experiment, or less than a sachet per week. But the difference between Treatment 1 (without educational intervention) and Treatment 2 (with educational intervention) is significant, and as

expected the average number of sachets of the latter is significantly higher than that of the former. There is no other significant difference, which suggests the village-level randomization was well done. As mentioned earlier, more than 20% of sample households are non-farmers.

Table 2. Discreptive Statistics and Balance Check

	Whole Sample		Treatment 1		Treatment 2		p-value	
	Ave.	SD	Ave.	SD	Ave.	SD	H0: C = T	
Total purchased amount of Koko plus (sachets)	19.2	21.9	15.3	18.2	23.1	24.5	0.003	***
Cons_pc (GHS / month)	116.3	59.0	113.9	56.9	118.6	61.1	0.507	
Other_Comp_Products								
Expenditure on formula milk (GHS / year)	58.2	146.6	54.7	131.9	61.7	160.3	0.690	
Expenditure on powder milk (GHS / year)	18.6	35.2	21.2	38.4	16.1	31.6	0.225	
Expenditure on other complementary food products (GHS / year)	39.2	79.9	43.1	91.2	35.3	66.8	0.417	
Household Characteristics (X)								
Non-Farmer (= 1 if yes)	0.225	0.418	0.254	0.437	0.196	0.398	0.250	
Household size	6.3	2.9	6.3	3.1	6.3	2.8	0.935	
Age of household head (in years)	43.2	15.2	42.4	14.2	44.1	16.1	0.344	
Education of household head (number of years in school)	7.1	4.3	7.1	4.2	7.1	4.4	0.956	
Age of the mother (in years)	28.2	7.1	28.4	7.2	28.1	6.9	0.715	
Education of mother (number of years in school)	6.9	3.6	6.9	3.6	6.9	3.7	0.987	
Age of the child (in months)	7.2	2.8	7.0	2.8	7.5	2.9	0.178	
Sex of the child (= 1 if the child is girl)	0.540	0.499	0.551	0.499	0.529	0.501	0.718	
Observations	276		138		138			
Note: *** is significant at 1% level.								

Table 3 is the estimation of results of equations (1) and (2). Main findings are summarized as follows. First , the decision “How many to buy?” is significantly affected by the budget constraint (price and income) but the decision “Whether to buy or not?” is not affected by the budget constraint. Second, nutritional education increases the probability to buy KOKO Plus but does not affect the amount of purchase. Third, households with educated household head are more likely to buy Koko plus. Fourth, households with educated mother are less likely to buy KOKO Plus. We observe son preference on purchasing behavior of KOKO Plus.

4.3 Conclusions

Our study shows: The budget constraint does not affect the first step decision. This means that poverty may not be a severe constraint for the adoption of complementary food products such as KOKO Plus. In other words, there may be some households who would not buy KOKO Plus regardless of its price or their income level. It urges us to study other factors preventing the adoption of KOKO Plus than the budget constraint.

Our study also shows: On the one hand, the nutritional education increases the probability of buying KOKO Plus. On the other hand, educated mothers are less likely to buy Koko. This result seems to be less intuitive. We need to investigate why it happens.

Table 3. Results

	(1)		(2)		(3)	
	Y_{ijt}	D_{ijt}	Y_{ijt}	D_{ijt}	Y_{ijt}	D_{ijt}
Price	-1.607 **	-0.343	-1.777 ***	-0.374	-1.622 *	-0.616 **
	(0.668)	(0.325)	(0.662)	(0.326)	(0.917)	(0.271)
Cons_pc	1.829 ***	0.083	1.601 **	0.051	0.317	0.025
(×1,000GHS)	(0.697)	(0.384)	(0.812)	(0.428)	(0.994)	(0.313)
$Treat^{Edu}$	0.247	0.537 ***	0.362 *	0.550 ***	1.504 ***	0.298 ***
	(0.212)	(0.088)	(0.219)	(0.088)	(0.272)	(0.076)
Other_Comp_Products						
Exp. On Formula Milk			0.261	0.201	1.247 ***	0.303 ***
(×1,000GHS)			(0.286)	(0.160)	(0.372)	(0.115)
Exp. On Powder Milk			-4.313 ***	-1.495 **	-5.637 ***	-1.591 ***
(×1,000GHS)			(1.393)	(0.661)	(1.885)	(0.544)
Exp. On Comp. Foods			0.464	-0.436	-1.436 *	-0.707 ***
(×1,000GHS)			(0.566)	(0.294)	(0.781)	(0.234)
Household Characteristics (X)						
Non-Farm		-0.045		-0.052		-0.016
		(0.060)		(0.063)		(0.023)
hh size		-0.006		-0.007		-0.004
		(0.009)		(0.009)		(0.004)
age of hhead		0.002		0.001		0.000
		(0.002)		(0.002)		(0.001)
education of hhead		0.020 ***		0.015 **		-0.001
		(0.006)		(0.007)		(0.002)
age of mother		0.009 ***		0.007 *		-0.003 **
		(0.003)		(0.004)		(0.001)
education of mother		-0.013 *		-0.017 **		-0.005 *
		(0.007)		(0.008)		(0.003)
age of child		0.000		0.006		0.001
		(0.007)		(0.008)		(0.003)
Sex of the child (1=girl)		-0.081 **		-0.078 *		-0.027 *
		(0.041)		(0.042)		(0.015)
Location Dummy	Yes		Yes		Yes	
Temporary Attrition	Not included		Not included		Included	
ρ	-0.246		-0.141		0.994	
pseudo log-likelihood	-5553.6		-5539.9		-6228.9	
observations	1,553	4,707	1,553	4,707	1,577	6,624

Note: Robust standard errors are in parentheses. *, **, *** are siginificant at 10%, 5%, and 1% respectively.