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Improving Child Nutrition through Quality Certification of Infant Foods: Scoping Study for a Randomized Trial in Ghana

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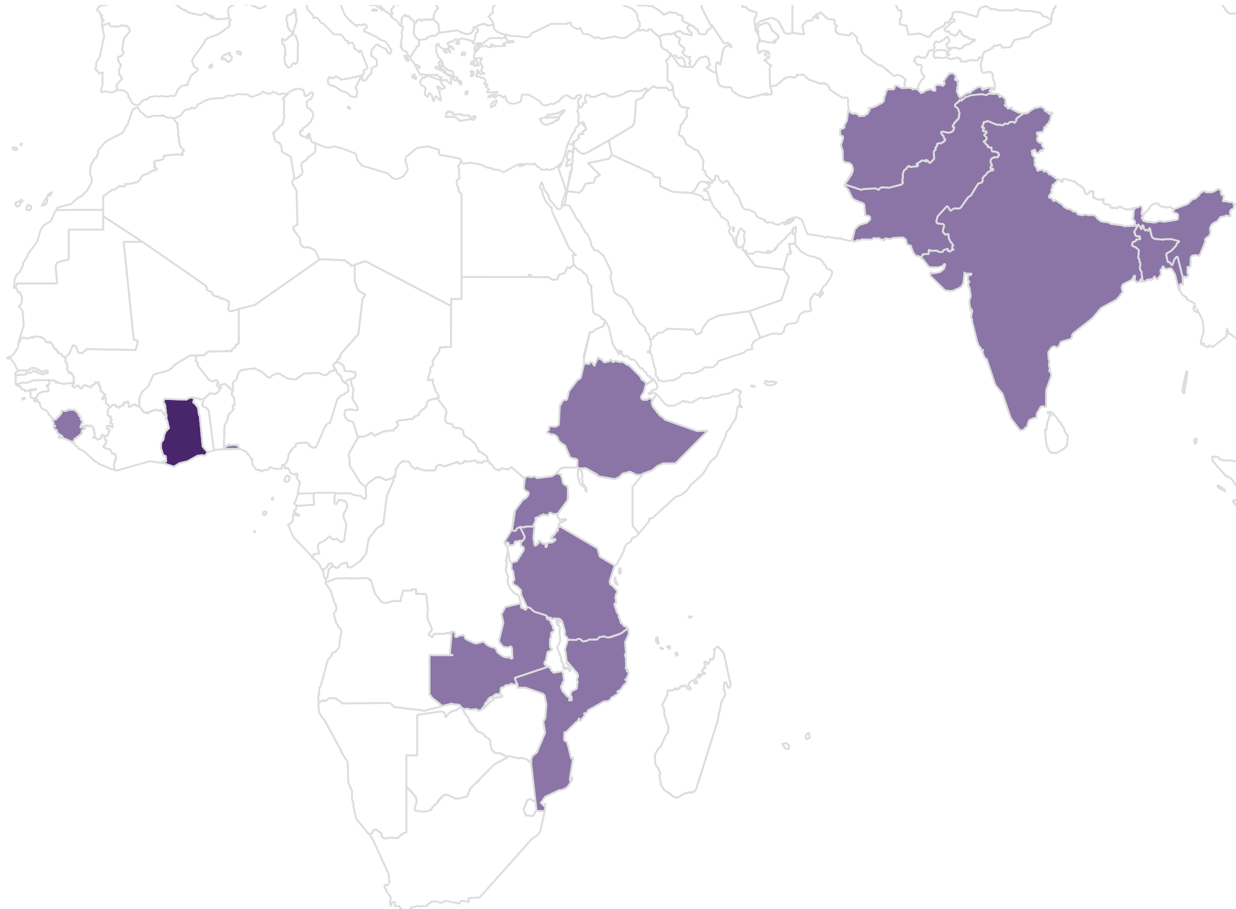

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1. Introduction and summary

This scoping study aims to lay a foundation for the introduction and randomized trial of third-party quality certification of infant foods in Ghana. The products whose quality would be certified are the cereal-based complementary foods recommended for infants between 6 and 24 months of age, when healthy growth requires foods of exceptionally high nutrient density and digestibility. These specialized infant foods are needed from the time when the child's needs outpace the nutrients available in breast milk, to the time when the child can digest sufficient quantities of more commonly-available foods.

Complementary foods for infants are typically made from a low-cost starchy staple mixed with more expensive vegetable or animal sources of protein, fats, and micronutrients. Traditional techniques for preparing complementary foods at home are labor-intensive, and the market for mechanically-mixed products is dominated by expensive branded products such as Nestlé's Cerelac. Many low-income households cannot afford either enough time for home preparation or enough money for brand-name foods to meet their children's needs. The resulting shortfall in nutrient intake contributes to the increasingly severe wasting and stunting that is widely observed among infants between 6 and 24 months.

The development and spread of low-cost complementary foods has been a focus for nutrition intervention in Ghana and elsewhere for several decades. In Ghana, for example, home-produced "Weanimix" was heavily promoted by the Ministry of Health in the 1980s and 1990s. The cost of production for such products can be as low as one-fifth the price of popular brand names such as Cerelac, but when sold on local markets these low-cost alternatives have had limited success in displacing established brand names – even among consumers who cannot afford enough of the branded products to avoid under-nourishment.

An important explanation for why consumers might choose a small quantity of an expensive brand instead of a larger quantity from a cheaper source is asymmetric information: if consumers cannot detect product quality, they may not believe that the off-brand product is worth anything at all. Economic analysis of such markets is due to Akerlof (1970), who made the striking prediction that the quantity sold of unbranded products with unobservable high quality would be zero, because sellers could always substitute a cheaper version for any price that buyers might pay. In these settings, creating a market requires third party quality assurance, using laboratory tests and inspections to certify that the off-brand products are actually worth their price.

Akerlof's original analysis applied to automobiles in the 1960s, to explain why new cars were widely sold by heavily-advertised brands at high prices, while second-hand cars were difficult to sell at any price. Akerlof described this as a 'market for lemons', in which buyers' fears about auto quality and safety lead them to pay a high premium for quality guarantees. The corresponding prediction for infant foods is that a dominant name brand such as Nestle's Cerelac will be widely available, despite its high price, while low-cost alternatives will be harder to find and perhaps sold only through personal relationships, unless a quality certification system is introduced.

Quality certification of infant foods could help care-givers meet their children's nutrient needs more cost-effectively, by providing reliable information about the actual nutrient density of the foods they buy. This would overcome asymmetric information between buyers and sellers, by which buyers' inability to observe ingredients and production methods leads them to rely on sellers' brand reputation and high prices as a signal of product quality. Third-party certification allows the entry of "generic" competitors, which for infant foods would include small-scale manufacturers using local ingredients.

The impact of a hypothetical quality-certification program for infant foods in Africa was tested by Masters and Sanogo (2001), using a market experiment in Bamako, Mali. In that experiment, very low-income and mostly illiterate mothers were found willing to pay an average of US$1.75/kg for quality assurance, which accounted for about one-third of the total price they were paying for brand names such as Nestlé's Cerelac. In other words, only two-thirds of the price paid was for the product itself, and the rest was for brand reputation to guarantee that the ingredients and production methods were consistently satisfactory. That study estimated that third party testing and certification services could be provided for less than US$0.40/kg, implying that introducing third-party certification in Mali could reduce the cost of high-quality infant foods by over US$1 per kg, potentially leading to a large increase in consumption and improvement in child nutrition, health and welfare.

Quality certification programs are widely used in Ghana and around the world, for many kinds of products. Among food products they typically focus on avoiding harm from toxins, or on process attributes such as organic production methods. Most are introduced without formal analysis of their efficacy, in response to consumer or industry demand. In the case of infant foods, research offers an opportunity to anticipate those demands and improve outcomes on a large scale, in Ghana and around the world. Ghana's food science and nutrition-research community has already provided important leadership in the development of new, lower-cost and more effective approaches to nutrition improvement, through Weanimix and other products. Introducing and testing certification services could offer a dramatic step towards impact on a large scale, by making the entire commercial infant-food market more competitive in supplying locally-made products to international standards.

This scoping study is intended to provide both the motivation for introducing a new infant-foods quality certification program in Ghana, and the design for how to do so in a way that would provide state-of-the-art data on its impact on household purchases and child health. Quality certification is a market-level intervention, so measuring its impact would require the sequential rollout of certification services at randomly selected locations. Producers and consumers would then choose freely whether to take advantage of these services, and impact assessment would involve measuring that response first in terms of quantities purchased, and then in terms of child growth. Sequential rollout of certification services would allow for feedback and learning on the way to a national program for Ghana itself, in addition to providing the basis for rigorous assessment of cost-effectiveness.

The study proceeds by describing:

- the existing infant-food production and marketing chain in Ghana, assessing the extent of market failure through a survey of infant-food availability and laboratory tests of their nutrient density; and
- a design for randomized sequential rollout of infant-food certification services, with accompanying surveys of infant feeding practices, child growth monitoring and health outcomes. Identification of long-term impacts relies on the timing of exposure, as each surveyed child may or may not have benefited from certification services in their market area when they passed through the relevant age range.

2. Literature review

The target age range for high-density complementary foods is 6 to 24 months of age (Dewey et al., 2001), which is the age range when children are most at risk of nutritional deprivation (Victora et al., 2010). Some infants may receive solid foods earlier, but for most children the risks of displacing breast milk too early outweigh the gains from greater nutrient density in solid foods. Some children may also need high-density foods after 24 months, but most can digest sufficient quantities of the family diet. Continued breastfeeding during complementary feeding is advisable but cannot in itself provide sufficient nutrients for healthy growth and development, leaving a shortfall that is associated with over half of all child deaths in developing countries and stunts growth for an estimated one-third of surviving preschool children (UN and IFPRI, 2000). Improving the quality and reducing the cost of complementary foods is therefore a key element of the WHO/UNICEF Global Strategy on Infant and Young Child Feeding (WHO, 2002).

Traditional infant feeding practices clearly recognize infants' need for foods with unusually high nutrient density and digestibility. Grains are often germinated, fermented, processed and cooked in various ways to improve density and digestibility, and are mixed with oilseeds or animal products according to the availability of each ingredient (Haïdara, 1989; 1990). Preparing these labor-intensive products at home requires specialized skills, and the actual nutrient densities of home-prepared infant foods have been found to fall short of what infants need (Bauer et al, 1997, Gerbouin-Rerolle and Chauliac, 1996).

Manufactured infant foods can provide consistent nutrient density and digestibility using a wide range of recipes, but the resulting product's ingredients, production methods and food quality are not directly observable by the buyer. Akerlof (1970) provided the first complete description of how this asymmetry of information between sellers and buyers leads to market failure. In the case of infant foods, quality is unknown even after purchase, since many causes other than low nutrient density could also cause a child's failure to thrive. Such products are known in economics as 'credence' goods (Darby and Karni, 1973).

The purchase of credence goods depends on signals of underlying quality that are typically provided by brand names, high prices and advertising (Milgrom and Roberts, 1986). As a result, credence goods are provided by monopolies with low sales volumes, unless a third party conducts laboratory tests and offers a common quality-assurance label to competing suppliers (Deaton 2004). Making the market more competitive in that way leads to lower prices and wider availability, and in the case of infant foods would allow artisanal and industrial producers to enter the market using local ingredients. This type of intervention has the potential to transform the entire market for infant foods, achieving the large-scale cost reductions and increased accessibility needed for improved health (WHO, 2008).

The feasibility of third-party certification depends on the premium consumers are willing to pay for quality information, compared to the cost of sampling, testing, and communicating that information. To be cost-effective, the certification program must focus on the most important quality attributes that are otherwise unobservable, such as nutrient density and digestibility. Other traits such as taste and convenience may be equally important, but need not be certified since they are directly observable by consumers. In effect, third-party certification introduces a separate market for information about product quality, allowing consumers to see it directly and inducing suppliers to maintain quality at competitive prices (Caswell and Padberg, 1992).

When testing actually provides valuable information, certification program can operate on a voluntary fee-for-service basis to which sellers subscribe (Crespi and Marette 2000). One leading fee-for-service private certification agency is the Underwriters' Laboratory (UL), founded in 1894 to certify the safety of electrical products in the United States. On a global basis, the largest is the International Organization for Standardization (ISO), founded in 1947 as an association of national certification agencies around the world. Several ISO standards apply to food products, but the agri-food sector also has a number of specialized agencies serving particular groups of buyers or sellers. For example, the U.S. Food Grain Inspection Service offers to certify various products exported from the United States (Marchione, 2000), separately from the domestic programs run by the U.S. Department of Agriculture and the U.S. Food and Drug Administration.

Voluntary certification programs can be organized and funded at various stages of the marketing chain. In industrialized countries, a growing number of supermarket chains are turning to third party certifiers to address consumer concerns about unobservable attributes of their food supply (Tanner, 2000; Barrientos et al., 2001; Bredahl et al., 2001). The most prominent example is probably EUREPGAP, founded in 1997 by the EUREP consortium of mainly British supermarket chains to promote a set of standards for Good Agricultural Practices (GAP) among their suppliers. In 2007 the program was renamed GlobalGAP, aiming to provide a single standard for worldwide agricultural supply chains. Other kinds of retailer certification are widespread, however. For example, the U.S. supermarket chain Whole Foods uses a third party certifier, Quality Assurance International (QAI), to audit its suppliers (Blank, 2003), and various NGOs offer standards and certification systems for social and environmental practices. Examples include the Social Accountability Accreditation Service and the Ethical Trading Initiative (Barrientos et al., 2001).

Focusing on nutritional quality, the closest precursor to what would be needed for infant foods is the more general seal of nutritional excellence promoted in Latin America by INCAP, the Institute of Nutrition in Central America and Panama (Tartanac, 2000), but that program has not been a significant focus for INCAP. As noted by Auriol and Schillizi (2000), a major challenge for certification programs is the size of market demand: infant foods are a niche product, and even within that market only lower-income consumers would need certification, since higher-income parents can buy enough of the name-brand products to meet their children's needs. Due to the market's small size and consumers' low incomes there is no popular clamor to introduce infant-food certification, even though we can predict that if it existed it would have a major impact on child health and be much appreciated by both consumers and producers. The producers who would benefit are small-scale local entrepreneurs for whom the lack of quality assurance is most constraining (Unnevehr and Hirschhorn 2000, Barrett et al., 2002).

3. Status of infant feeding in Ghana

Current infant feeding practices in Ghana involve nearly universal breastfeeding, with 98 per cent of infants receiving at least some breast milk and almost two-thirds (63 per cent) of children being exclusively breastfed to at least six months of age (Ghana Demographic Health Survey, 2008). WHO guidelines are well known to recommend the introduction of complementary foods at six months (eg, Alabi et al., 2007), but in Ghana about one-quarter of children receive no complementary foods until after nine months of age (Ghana Demographic Health Survey, 2008). Furthermore, the Infant and Young Child Feeding (IYCF) practices recommends that breastfed children be fed from three or more food groups at least twice a day when aged 6-8 months, and at least three times a day when aged 9-23 months. In Ghana, most children (59 per cent) do not meet these guidelines. The resulting shortfalls lead to stunting in 28 per cent of Ghanaian children under five (Ghana Demographic Health Survey, 2008, p.10).

The degree of shortfall in nutrient intake among Ghanaian children can be estimated from data provided by Nti and Lartey (2007), as shown in Table 1 below:

Table 1: Mean nutrient intake as a percentage of WHO recommended needs, by age group

Nutrients Consumed		6-8 months	9-11 months	12-18 months
Energy	(kcal)	84%	90%	91%
Protein	(g)	89%	99%	88%
Calcium	(mg)	66%	69%	78%
Iron	(mg)	33%	44%	75%
Vitamin A	(IU)	535%	663%	443%
Vitamin B1	(mg)	59%	67%	60%
Vitamin B2	(mg)	48%	50%	35%
Niacin	(mg)	53%	41%	44%

Note: Data shown are mean values for a sample of 400 children in Eastern Ghana.

Source: C.A. Nti and A. Lartey (2007). "Young child feeding practices and child nutritional status in rural Ghana." International Journal of Consumer Studies, 31: 326-332.

Table 1 shows vitamin A to be the only nutrient for which average intake is more than adequate at all ages. Average intake of protein reaches 99 per cent of the WHO recommendation during the 9-11 month period, but otherwise the mean energy and protein intakes fall well below what would be needed for healthy growth and development, and shortfalls for micronutrients are even more severe. Several other studies have also found widespread shortfalls in dietary intakes, and have demonstrated the value of increased nutrient intake for child growth and development (Ferguson and Darmon, 2007; Lartey et al., 1999; Adu-Affarwuah et al., 2007).

4. The market for nutrient-dense infant foods in Ghana

As in many developing countries, the formal market for complementary foods in Ghana is dominated by Nestle's Cerelac brand. There are no public data on Cerelac sales, but their market share relative to other pre-packaged infant cereals is very large, probably over 90 percent. An interview with Cerelac's brand manager confirmed that their concern is with the total size of the market as households transition from home preparation to a purchased product, rather than large-scale competition from other brands. The small quantities sold by other producers include a few similar products imported into Ghana, and also a wide variety of local substitutes produced by home-based enterprises and emerging food manufacturers.

Beyond Cerelac, the other multinational brands are typically stocked only in supermarkets and pharmacies, but may sometimes be found in smaller shops and kiosks. Specific brands we found sold in several supermarkets around Accra in January 2010 were Purity and ProNutro from South Africa, Bledilac from France, and Nutrilon from Brazil. We also found the ABIDO brand of rice powder from Lebanon sold for infants in MaxMart supermarkets, and we found Cow & Gate products from Britain available in selected pharmacies. The pattern of availability for these products is clearly tied to a larger distribution channel for other goods. For example, Purity and ProNutro appear primarily in supermarkets operated by South African firms, while Bledilac appears in stores that are closely linked to Francophone West Africa, the MaxMart chain is heavily stocked with other Lebanese products, and it seems likely that Cow & Gate flows to pharmacies through the same channels as medicines from the UK.

The local manufacturers' complementary foods are sold through four distinct marketing channels: large supermarkets, small shops and kiosks, vendor's stalls in open markets, and vendors at public health clinics. The brands we found currently stocked in large supermarkets are Selassie (the most widely available), Finer Foods (occasionally available in supermarkets) and Yedent (found at MaxMart only). We also obtained samples of products directly from three other makers, namely TIMS, Blessed Child, and RAWC-MEC. The operators of TIMS and Blessed Child explained that they sell mainly through local shops and kiosks, while RAWC-MEC sells mainly at health clinics. In our visits to those types of outlet, we purchased other samples from additional makers. Two samples of an unlabeled product aimed were bought from a vendor at Madina market, and two different products labeled as being produced by Mrs Romartey were bought from a vendor at Abokobi Health Clinic.

Many of Ghana's locally-manufactured infant foods are described as Weanimix, a term that dates from the mid-1980s when the Ghana Health Service (GHS) and Ghana's Food Research Institute (FRI), in collaboration with the FAO, WHO, UNICEF and others, undertook large-scale campaigns to popularize the feeding of infants with a 4:1 mixture of any cereal grain (often maize, millet and sorghum, but also wheat) with any legume (initially beans, groundnuts and cowpeas, but also soybeans). The cereal and legume grains were typically precooked by roasting, then ground, sieved to remove chaff, mixed and stored as dry flour for daily use. Projects popularizing this approach typically focused on home production by individual mothers or women's groups, and were often conducted in conjunction with vaccination and growth-monitoring campaigns around community health clinics. Public health nurses also produced their own Weanimix for sale at the clinics where they work. The Ghana Health Service now officially discourages this practice to limit conflicts of interest, but many vendors still use the clinics' weigh-in days as a convenient marketplace for their Weanimix-type products.

An important aspect of the Ghana market for composite flours is the blurred distinction between fortified flour as an infant food, and other fortified flours that might be used in the family diet. For example, the process of roasting a grain before milling it into flour is also used for Ghana's distinctive adult food known as Tom Brown[1], and both products are similar in nature to the corn-soy mix (CSM) that has long been widely available in Ghana from U.S. food aid. As a result, market vendors may use all three associations to describe the same product, calling it 'Weanimix' when wanting to associate the food with infant feeding programs, 'Tom Brown' when wanting to describe it as an adult food, and describing it as maize-soy mix when wanting to reflect the qualities associated with US food aid.

In addition to making composite flours, Ghana has a long tradition of processing starchy staples though roasting, fermentation and/or malting. The main infant-feeding product that Weanimix was intended to replace is koko, a cereal-based porridge also consumed by adults. Koko is usually made from maize, millet or sorghum that has been fermented to improve digestibility and limit spoilage. Weanimix uses dry roasting, milling and sieving to achieve some of these benefits, while facilitating fortification with a legume. The relative market shares of the various foods are not well known. Maxwell et al. (2000) provide results from a 1996-97 survey of caregivers in Accra, in which about two-thirds of sampled infants still received koko as their first food other than breast milk. About 12 per cent received Weanimix or other cereal-based product, 11 per cent received a yam-based food (mpotompoto), 8 per cent received an industrial infant formula, and 2 per cent received a maize-cassava mix (banku).

Classification of foods is made difficult by the use of various names for the same product. For example, one of the manufacturers we interviewed, RAWC-MEC, produces a classic Weanimix-type product that is marketed mainly to mothers at public health clinics, and yet is packaged under the name Tom Brown. Another local manufacturer makes a product labeled Weanimix that is not labeled as an infant food and is stocked by supermarkets with their adult cereal mixes, while also making a similar product marketed for specifically infants under the name Special Cereal Mix. That same company and several others also produce a dry flour made with millet and soy under the name *Hausa Koko*, and these cereal-based products are in many ways similar to fortified *gari* flour made from cassava. To complicate the picture even further, Cerelac itself has become a popular snack food for adolescents and adults, especially since Nestle Ghana began to package it in strips of 50g sachets that are sold alongside similar sachets of flavored milk and other small luxuries.

From our survey of retailers and manufacturers, it is clear that many local firms produce composite fortified flours. Many of these are now formulated and marketed specifically for infants, but even more could potentially be attracted into this sector as an extension of their current product lines.[2] Almost all of these products are fortified only with legume grains and other foods, as opposed to concentrated sources of micronutrients. To our knowledge, the only micronutrient-fortified infant food that was being locally produced in January 2010 was *Maisoy Forte*. We found only one bag of this product in Accra, at a MaxMart supermarket, and its packaging had broken so it could not be used as a sample. Our interview with the manufacturer, Yedent, confirmed that it is rarely sold in Accra.

1 The origin of this curious name was not known to any of our interview subjects, and we could find no written explanation either. The name could come from the color caused by roasting, perhaps by association with the novel "Tom Brown's School Days" (1857) which was widely used as assigned reading in British colonial schools.

2 For example, three local manufacturers whose processed cereal mixes were found in supermarkets as "Tom Brown" and not labeled for infants are Neat Foods (ph. 021 25 79 08), Meanna Foods (ph. 0244 28 05 27), and Angela Home Services (ph. 0243 06 12 95).

Many additional products have or could be introduced to the Ghanaian market beyond what is currently available. For example, in 2006-07 the World Food Programme provided grinding mills plus a stock of vitamin premix to two communities in northern Ghana, to help them produce micronutrient-fortified cereal flours (Emma Anaman, pers. comm.). The Ajinomoto Corporation, a Japanese multinational pioneer in the food additives industry, is pursuing the commercial introduction of lysine-fortified beverages and other concentrates aimed at children (Ajinomoto 2010). Their work in Ghana began in 2007, and is being conducted in collaboration with the Department of Nutrition and Food Science at the University of Ghana, and the International Nutrition Foundation at Tufts University (University of Ghana, 2009).

4.1 An informal survey of local infant-food makers in Accra, Kumasi and Tamale

Prior to our formal surveys in January 2010, we conducted an informal survey of a few local makers of Weanimix-type infant foods in three cities, so as to describe their products and the approximate scale of these enterprises. These respondents were located through enquiries around public health clinics at their weigh-in days, and at public markets. Results are reported in Table 2. Out of the 10 home-based food enterprises interviewed, one (our respondent #2) was a clinic nurse who asked to remain anonymous due to Ghana Health Service policies discouraging staff from selling their own products. She reported selling a very small quantity, about 24 kg/month, in small units (50 kg sachets). Other respondents were happy to give their names but are listed here by number. About half of them sold their products only in bulk, from large 2.5 kg bowls. The others used larger sachets of 0.2-1.0 kg in size. Self-reported volumes sold were as high as 1,000 kg per month for one woman in Tamale, but typically under 500 kg per month.

Table 2. Monthly cereal-based infant food production levels of local home-based manufacturers

Location and name	Prod. vol. (kg/mo.)	Ingredients	Packaging & unit size	Price/unit (Gh.c.)
Accra				
1	850	Maize, rice, groundnuts, soy, fish	200g sachets	1.0
2	24	Wheat, millet, maize, rice, groundnuts, soy, fish	50g sachets	0.5
Kumasi				
3	120	Rice, maize, soy, groundnuts	300g sachets	1.5
4	n.a.	Millet, soy, rice	400g sachets	2.0
Tamale				
5	403	Maize, soy, groundnuts	2.5kg bowl	2.5
6	1,008	Maize, groundnuts, soy	2.5kg bowl	1.5
7	552	Maize, groundnuts, soy	2.5kg bowl	2.0
8	280	Maize, groundnuts, soy, fish	400g sachets	2.0
9	168	Maize, groundnuts, soy, fish, cowpea	2.5kg bowl	1.5
10	168	Maize, groundnuts, soy, cowpea	1kg sachets	2.0

Source: Authors' survey results.

The ingredients shown in Table 2 are self-reported, in the approximate order of volume per unit. Recipes used in Tamale were maize-based, but in Accra and Kumasi other cereals were used as well. All recipes used soybeans, most also used groundnuts. A few added fish and/or cowpea.

4.2 Inventory of registered infant-food makers and their products

At the same time as the informal survey described above, we also obtained an inventory of all local makers of infant foods who had registered their products with the Food and Drugs Board (FDB). Registration is legally required only for imported products. It is encouraged but not required of domestic producers, but only registered firms may go further to seek ISO-compliant certification for their manufacturing processes from the Ghana Standards Board (GSB).

It turns out that relatively few small-scale manufacturers seek registration, and even fewer seek certification. Conversely, not all registered or certified products are actually available in the market. Table 3 below provides a complete list of all cereal-based infant foods whose producers had registered that product with the FDB, and whether they had obtained certification for their production processes from the GSB. After concerted efforts to contact all of these firms, we were actually able to meet with only five of them: Yedent, TIMS, RAWC-MEC, Blessed Child and Selassie. Of these, only Yedent had sought certification from the GSB. Registration and certification depends principally on payment of fees and inspection of documents, with some site visits but no on-going testing of a sort that would be known to potential buyers as an effective guarantee of nutritional quality.

Table 3: List of Cereal-Based Infant Foods Registered with the FDB, as of January 2010

Source: Food and Drugs Board file data.

Name of Product	Manufacturer	GSB Certified?
Priscadel Weanimix	Priscadel Ventures, Takoradi	No
Risorghum Beverage Meal	Fruitful Bough Ltd., Gbestile	No
Maisolet; Koko Cornforte; Maisoy Forte	Yedent Agroprocessing, Sunyani	Yes
Unimix Cereal Maize	May-Just Industries Ltd., Tema	No
Corn Soya Blend (CSB)	Yedent Agro Processing Sunyani	Yes
Original Pure Tombrown Wheat& Soya Blend	Dakel Industry, Madina	No
Keeland Porridge	Keeland Limited, Nkawkaw	Yes
Celebrated Ceremix	The Celebrated Company Limited, Kumasi	Yes
Aduanepa Soya Wheat Powder	Aduanepa Vegetarian African Herb Shop, Accra	No
Cereal Mix Cereal Foods	Casbea Production Ent. Nungua	No
TIMS Nutritious Weannimix	TIMS Ltd., Tema	No
Maize Grits, Fortified Corn Soya Blend, Fortified Maize Mill	General Mills Co. Ltd., Accra	No
Selasie Weanimix, Selasie Special Cerealmis	Selasie Farms and Groceries, Accra-North	No
Rawc-Mec Tombrown	Rawc-Mec Ent., Kasoa	No
Sotea Instant Soya Beverage	Blessed Child Foods, Accra	No
Ceresoya Soya Rich Porridge	Finer Foods, Accra	No
TIMS Enriched Roasted Corn Flour	Text Imaging Media Solutions Limited, Tema	No

In addition to registering local firms, Ghana's Food and Drugs Board is very actively engaged in mass fortification of food staples. The principal programs aim to fortify wheat flour and vegetable oil with Vitamin A, Iron, Folic Acid, B12, Thiamin-B1, Riboflavin-2, Niacin, and Zinc. These involve partnerships with the Global Alliance for Improved Nutrition (GAIN) which helps supply fortificants, and with importers and manufacturers through the National Fortification Alliance (NFA). Bulk imports of vegetable oil and wheat products are already being fortified in-country, while pre-packed vegetable oil and wheat flour is expected to be fortified at source before importation. Legislation to provide for mandatory fortification of all wheat flour and vegetable oil has been submitted to parliament for passing into law. In the interim however, the Minister of Health issued a Directive that came into force on 1 February 2010, mandating new standards for fortified wheat flour and vegetable oil.

4.2 A formal survey of infant-food availability in Accra

The need for quality certification programs was identified by Akerlof (1970) as arising when buyers cannot detect product quality and so rely on trust in a brand name or a personal relationship. Akerlof's original analysis applied to automobiles: new cars are widely sold by heavily-advertised brands at high prices, while second-hand cars are sold on 'a market for lemons' in which buyers have little trust so that even high-quality cars are sold at low prices if at all. The corresponding prediction for infant foods is that a dominant name brand such as Nestle's Cerelac will be widely available, despite its high price, while low-cost alternatives will be harder to find and perhaps sold only through personal relationships.

To test Akerlof's remarkable hypothesis, we used a gridded map of Greater Accra to randomly select a sample of quadrants, within which we then enumerate all sellers of any kind of infant food available for sale anywhere in that quadrant. This approach allows for a complete census of all infant-food sellers within the quadrant, to avoid any selection bias in choosing where or who to survey. The quadrants are identical in geographic size, but vary widely in the density and type of economic activity. To provide a benchmark measure of commercial density, we also enumerated all establishments selling either toothpaste or soap. In most neighborhoods, the vendors of infant foods (or of toothpaste/soap) are informal enterprises with one or two workers, located by the roadside or at a residence, but some quadrants have large supermarkets which we included in the survey.

Our unit of observation in this survey is a quadrant measuring approximately 0.1 square kilometers, spanning 0.0025 degrees of latitude and longitude around a central point. Street maps and satellite images for randomly-generated quadrants of this type can be conveniently made using Google Maps.[3]

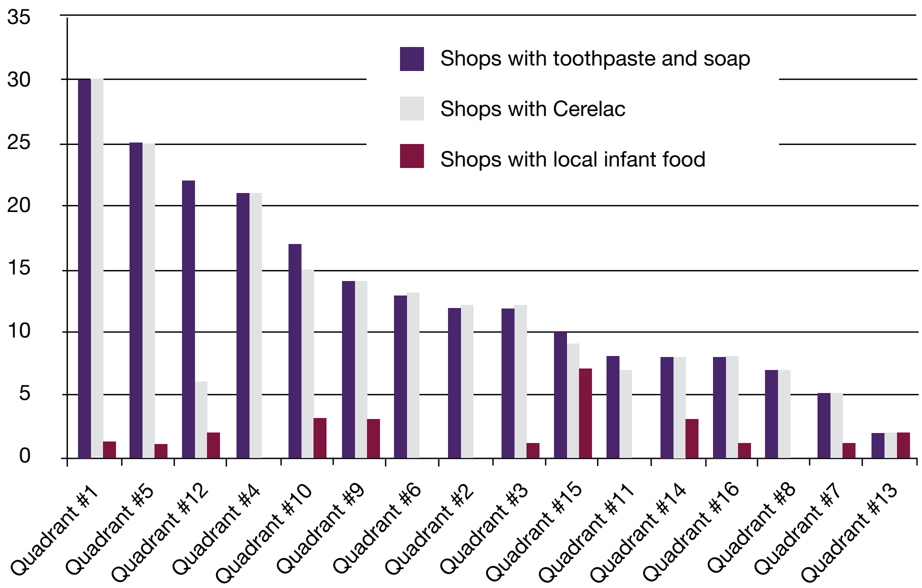
To create our sample of grid cells, we began by defining an arbitrary rectangle around Accra, running from 5.527144 to 5.677144 degrees of latitude and from -0.151792 to -0.261792 degrees of longitude. We then generated a sequence of randomly-located maps inside that rectangle, and enumerated all of the shops in each of those quadrants, visiting each quadrant in their randomly-generated sequence until our sample of locations provided a universe of more than 200 shops selling toothpaste or soap against which we could compare the availability of infant foods. This turned out to be a total of 16 quadrants, containing a total of 232 shops of all kinds. Of these, 207 vendors sold toothpaste and/or soap, 194 sold Nestle's Cerelac, 25 sold a locally-produced infant food of some kind, and 13 sold an imported infant food other than Nestle's.

3 The Google Maps software uses the following format to define a URL for each map:
http://maps.google.com/maps?&ll=5.558740,-0.253961&spn=0.0025,0.0025&pw=2
In this format, the quadrants' central point is specified as latitude and longitude in decimals, followed by the span lengths in decimals. The code "pw=2" indicates that the resulting output is to be printed as a street map. Omitting that code generates a satellite view of the quadrant.

A graphical image of relative availability is provided by Figure 1, in which quadrants are ordered from left to right in descending order of commercial density as measured by the number of toothpaste/soap vendors. As it happens, the very first quadrant we visited had the most vendors, and the quadrant with the fewest vendors was the 13th that we visited. Of course, many quadrants had no vendors of any type, but these are omitted from the chart. Figure 1 reveals that in almost all quadrants, Cerelac is as widely available as soap or toothpaste. Generally the same shops stock all three products, although in quadrants 10, 11 and 15 there were a few shops that had soap or toothpaste but did not have Cerelac, and in quadrant 12 less than a third of the shops had Cerelac.

In contrast to the widespread availability of Cerelac, five of the 16 quadrants had no local infant foods available at all, and another set of five quadrants had only one shop with any local infant food. A complete listing of all shops found in all the quadrants visited is provided in Table 4, and a summary of availability across all sampled quadrants is in Table 5. In summary, about one-third of all quadrants had no local infant foods at all, and less than 40 per cent had more than one shop selling them.

Figure 1: Availability of infant foods by quadrant (number of shops)



Source: Authors' survey results.

Table 4: Availability of infant foods by quadrant (number and percentage of shops)

Quadrant number	Number of shops	Nestle's Cerelac	Imported complementary infant foods	Locally manufactured infant foods
Quadrant #1	30	30 (100%)	4 (13%)	1 (3%)
Quadrant #2	12	12 (100%)	1 (8%)	0%
Quadrant #3	12	12 (100%)	0%	1 (8%)
Quadrant #4	21	21 (100%)	4 (19%)	0%
Quadrant #5	25	25 (100%)	0%	1 (4%)
Quadrant #6	13	13 (100%)	1 (8%)	0%
Quadrant #7	5	5 (100%)	0%	1 (20%)
Quadrant #8	7	7 (100%)	0%	0%
Quadrant #9	14	14 (100%)	0%	3 (21%)
Quadrant #10	17	15 (88%)	1 (6%)	3 (18%)
Quadrant #11	8	7 (88%)	2 (25%)	0%
Quadrant #12	22	6 (27%)	0%	2 (9%)
Quadrant #13	2	2 (100%)	0%	2 (100%)
Quadrant #14	8	8 (100%)	0%	3 (38%)
Quadrant #15	10	9 (90%)	0%	7 (70%)
Quadrant #16	8	8 (100%)	0%	1 (13%)
Share of quadrants without availability of each infant food:		0%	63%	31%

Source: Authors' survey results.

Table 5: Availability of infant foods in Accra, by type of product (all surveyed quadrants)

	Toothpaste and/or soap	Cerelac	Locally made infant foods
Total number of shops stocking that item	207	194 (90.7%)	25 (11.7%)
Average number per quadrant stocking that item	13.38	12.13	1.56
Percentage of quadrants with zero shops stocking that item	0%	0%	31.3%
Percentage of quadrants with zero or one shop stocking that item	0%	0%	62.5%
Percentage of quadrants with more than one shop stocking that item	100%	100%	37.5%

Note: An additional 13 shops stock some kind of imported infant food, such as Nutrilon or Bledilac products.

Source: Authors' survey results.

From the findings reported above in Figure 1, Table 4 and Table 5, it is clear that essentially all Accra residents have convenient access to Nestle's Cerelac, but locally-produced foods are often unavailable despite their familiarity and lower cost. This finding is consistent with the Akerlof (1970) prediction that markets for products of unknown quality would be dominated by trusted brands, albeit at high cost so few units are actually sold, while off-brand alternatives are difficult to sell even at low prices. In this view, the market is limited by consumers' fear of low quality – which might or might not be justified by the actual quality of the small quantities actually sold.

4.3 A formal test of nutrient densities for infant food available in Accra

To assess the underlying quality of the infant foods now available in Accra, we purchased samples of various products and subjected them to laboratory tests for nutrient density and digestibility. A total of 14 samples, including one package of Nestle's Cerelac, were obtained from various market locations. Photographs of the samples are provided in Annex A, and the names of each product and its manufacturer are listed in Table 6 below. Note that the anonymously produced, unlabeled products were purchased from a vendor at Madina market, the products labeled as being produced by Mrs Romartey were bought from a vendor at Abokobi Health Clinic, the products from Selassie and Finer Foods were purchased in supermarkets, and the products from TIMS, Blessed Child, and RAWC-MEC were bought directly from their manufacturers.

Table 6: Manufacturer and product names for 14 samples of infant foods

Manufacturer	Product name	Ingredients (as listed)
Anonymous	None (light color)	No label
Anonymous	None (light color)	No label
Blessed Child	Rice Mix	Rice, soyabeans, groundnuts
Blessed Child	Weanimix	Maize, millet, wheat, groundnuts, soyabeans
Finer Foods	Ceresoya	Soyabeans, wheat, milk
Nestle Ghana	Cerelac	Wheat, milk, additives
RAWC-MEC	Tom Brown	Wheat, rice, millet, groundnuts, maize, soya
Romartey	Illegible label	Soyabeans, rice, groundnuts, wheat
Romartey	Annointing Whinimix	Rice, salt, wheat, groundnuts, soyabeans
Selassie	Special Cereal Mix	Millet, soyabeans
Selassie	Weanimix	Maize, soyabeans, groundnuts
TIMS	Rice Mix	Rice, groundnuts, soyabeans
TIMS	Weannimix	Maize, groundnuts, soyabeans
TIMS	Wheat Mix	Soyabeans, wheat, groundnuts

Note: Names are shown here in alphabetical order; code numbers used for nutrient density tests were randomly assigned.

To test the actual nutrient densities of these products, we extracted samples weighing about 100 grammes from each package, randomly numbered and submitted them with no indication of their origin to a commercial food quality testing service, Midwest Laboratories in Omaha, Nebraska. The testing we requested was a standard proximate analysis for macronutrients, plus iron and zinc as indicators of desirable micronutrients, and phosphorus as an indicator of phytic acid that limits digestibility.

These tests are in no way intended to determine whether a given food could meet all of child's solid-food needs, or even whether the food is safe to eat. We requested no tests for bacteria, aflatoxins or other contaminants; did not test for vitamins or minerals other than iron and zinc; and tested for digestibility only using the rudimentary approach of measuring phosphorus content. What our tests offer is just an X-Ray of the most basic attributes of each food, driven principally by the ratios between major ingredients used in each recipe. A producer wishing to cut costs can readily reduce fat and protein content, which the buyer cannot detect but is revealed by our tests.

A complete set of results are presented in Table 7 below, showing each sample's density in terms of energy, moisture, the major macronutrients, three key minerals and ash. It turns out that sample number 11 was Nestle's Cerelac, and we have labeled that row accordingly in the table. We have kept the tested densities of the other samples anonymous to avoid singling out any particular manufacturer other than the benchmark international brand.

Table 7: Nutrient density in fourteen samples of infant foods

Sample	Calories (kCal/ 100g)	Moisture (%)	Macronutrients (g/100 g)			Minerals (mg/100g)			Ash (%)
			Protein	Fat	Carb.	Iron	Zinc	Phos.	
1	416	6.15	15.43	9.24	67.72	4.5	2.3	232.6	1.46
2	415	6.83	14.94	9.36	67.79	5.0	2.0	188.4	1.08
3	391	9.32	6.51	6.22	77.35	5.2	1.4	152.5	0.60
4	409	4.85	18.61	7.33	67.14	9.8	2.5	332.5	2.07
5	448	2.61	17.22	13.34	64.71	8.1	2.7	337.2	2.12
6	417	6.29	15.16	9.39	67.92	5.3	2.3	236.2	1.24
7	431	4.73	23.11	12.06	57.43	12.8	2.9	354.1	2.67
8	436	4.83	18.28	12.79	62.05	7.9	3.0	339.9	2.05
9	419	5.86	11.31	9.61	71.79	4.3	2.8	293.3	1.43
10	382	10.43	12.27	5.62	70.71	2.2	2.0	222.3	0.97
Cerelac	440	3.75	14.33	12.57	67.30	8.4	4.3	301.9	2.05
12	425	4.17	10.90	9.47	74.03	2.2	2.2	267.3	1.43
13	376	11.00	10.18	4.37	74.00	0.8	1.7	135.8	0.45
14	401	7.97	25.45	9.74	52.96	10.4	2.2	295.7	3.88

Source: Authors' test results commissioned from Midwest Laboratories, Omaha, Nebraska.

The most important result from our data is that nutrient densities vary widely. The degree of variation is more fully characterized in Table 8. For example, calorie density is 415 ± 72 kcal/100 g., with a standard deviation that is about 5% of the mean (a coefficient of variation of 5.16%), but the most severe variability is in the individual nutrients. Both protein and fats have standard deviations around 30% of the mean (CVs of 33% and 29% respectively), while zinc and phosphorus variability is only slightly lower. The highest level of variability is for iron, whose coefficient of variability is 56%.

Table 8: Variability of nutrient density across 14 samples of infant foods

Nutrient	N	Mean	Range	Minimum	Maximum	Std. Dev.	CV (%)
Calories	14	414.71	72.00	376.00	448.00	21.39	5.16
Moisture	14	6.34	8.39	2.61	11.00	2.53	39.82
Macronutrients							
Protein	14	15.26	18.94	6.51	25.45	5.09	33.33
Fat	14	9.37	8.97	4.37	13.34	2.75	29.36
Carbohydrate	14	67.35	24.39	52.96	77.35	6.57	9.75
Minerals							
Iron	14	6.21	12.00	.80	12.80	3.47	55.88
Zinc	14	2.45	2.90	1.40	4.30	.70	28.54
Phosphorous	14	263.55	218.30	135.80	354.10	70.88	26.90

Source: Authors' calculations from test results shown in Table 5.

In this review we compare products only to each other, not to WHO recommendations or other external benchmarks. An interesting aspect of that comparison concerns the nutrient claims made by the manufacturers themselves. In this case, only two of our manufacturers have nutrient labels printed on their packaging: one was Nestle, and the other had two different products in our sample. We can therefore compare these two claims relative to each other, and relative to the match between Cerelac's claim and our test results, as shown in Table 9.

The data for Cerelac show most test results slightly above the label claims. Moisture content is 50% higher than their label claim, but that moisture could have been introduced after the package was opened. Protein content for Cerelac was measured at only 96% of the labeled claim, but products A and B have measured protein levels that are even lower at only 89% and 82% of their labeled claims. Iron levels for product B were only 40% of the labeled claim. Interestingly, total calories were 106% of the labeled claim for product A, and 82% of the labeled claim for product B. In sum, the nutrient labels for Brand X bore little relationship to the actual content of its two products. Product A exceeded its labeled values in several dimensions, while product B fell short, even though they both came from the same manufacturer.

Table 9. Comparison of test results and label claims for three samples of infant foods

	Calories	Macronutrients (g/100 g)				Minerals (mg/100g)		
Source		**Moist.**	**Prot.**	**Fat**	**Carb.**	**Iron**	**Zinc**	**Phos.**
Brand X – product A								
Label claim	369	5.3	7.3	5.0	73.9	na	na	na
Test result	391	9.3	6.5	6.2	77.4	5.2	1.4	152.5
Test (% of label)	*106%*	*176%*	*89%*	*126%*	*105%*			
Brand X – product B								
Label claim	512	na	13.8	na	80.4	10.8	na	na
Test result	419	5.9	11.3	9.6	71.8	4.3	2.8	293.3
Test (% of label)	*82%*		*82%*		*89%*	*40%*		
Nestle Ghana – Cerelac (wheat)								
Label claim	430	2.5	15.0	12.0	66.5	7.5	4.0	na
Test result	440	3.8	14.3	12.6	67.3	8.4	4.3	301.9
Test (% of label)	*102%*	*150%*	*96%*	*105%*	*101%*	*113%*	*108%*	

Source: Authors' calculations from test results shown in Table 5.

This lack of correspondence between label claims and actual content found in Table 9, together with the variability across samples in Table 8, suggests that consumers would be well justified in mistrusting the quality of locally produced infant foods. Some of these products turn out to be of very high nutrient density – in one case even higher than their own labels claim – but variability in their nutrient density would make it difficult for any care giver to use them in meeting an infant's needs.

Our final analysis of the nutrient-test data compares each sample to Cerelac. All of these products are mixed with water before serving, and the degree of dilution is ultimately chosen by the child's care giver. What the manufacturer controls is density of nutrients in the dry matter, determined by their choice of ingredients and production methods. Infants have many other needs, of course, but the simple availability of sufficiently dense and digestible nutrients can be a limiting factor on child growth and development. Our laboratory-based comparison is shown in Table 10, presenting the same data as Table 7 as a proportion of the nutrient densities of Cerelac as the benchmark international brand.

Table 10. Comparison of nutrient densities to Cerelac, dry matter only

Sample	Calories (kCal/100g)	Macronutrients (g/100 g)			Minerals (mg/100g)			Ash (g/100 g)
		Protein	Fat	Carb.	Iron	Zinc	Phos.	
5	101%	119%	105%	95%	95%	62%	110%	102%
8	100%	129%	103%	93%	95%	70%	114%	101%
Cerelac	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
7	99%	163%	97%	86%	153%	68%	118%	132%
2	97%	108%	77%	104%	61%	48%	64%	54%
9	97%	81%	78%	109%	53%	65%	99%	71%
6	97%	109%	77%	104%	65%	55%	80%	62%
12	97%	76%	76%	110%	27%	52%	89%	70%
1	97%	110%	75%	103%	55%	54%	79%	73%
14	95%	186%	81%	82%	129%	54%	102%	198%
3	94%	48%	53%	122%	66%	34%	54%	31%
4	94%	131%	59%	101%	117%	60%	111%	102%
10	93%	92%	48%	113%	28%	51%	79%	51%
13	92%	77%	38%	119%	11%	43%	49%	24%

Source: Authors' calculations from test results shown in Table 5.

Our lab test results reveal that in Table 10 show that, of the 13 samples we can compare to Cerelac, three are of comparable density in terms of macronutrients and some minerals. Samples numbered 5, 8 and 7 offer 97 per cent or more of proteins and fats than Cerelac, and 95 per cent or more of the iron in Cerelac. This finding demonstrates that it is possible for local producers to market high-density foods. Their composition is hardly ideal, of course: none of the three have more than 70 per cent of Cerelac's density in zinc and they have 110 per cent or more of Cerelac's level of undesirable phosphorus, which is included here as an indicator of the anti-nutrient phytic acid. Those and other limitations could be remedied with appropriate ingredients and processing.

Although some products are of high density, many are seriously deficient in key nutrients. More than three-quarters of our sample (ten out of the thirteen products) were short on fats, offering only 81 per cent or less of Cerelac's density, and three of them were *extremely* low in fat content, offering 53 per cent or less of Cerelac's density. Protein is less often deficient, as only four of the products were similarly short at 81 per cent or less of Cerelac's protein density, and only one was extremely short at only 48 per cent of the Cerelac standard. One product (sample #3) was extremely short on both proteins and fats, offering about half of the Cerelac standard. This product is close to being just a cereal grain without the fortification needed for infant growth.

In terms of micronutrients, eight products were short on iron at 66 per cent or less of Cerelac's level, and two had extremely low iron levels at 28 per cent or less. All thirteen products were low in zinc at 70 per cent or less of Cerelac's level, and seven were extremely low at 54 per cent or less. In the antinutrient area, four products had high phophorus at more than 110 per cent or Cerelac's level, but most actually had lower and hence perhaps more desirable levels of phosphorus than Cerelac.

4.4 Summary of findings

To conclude our assessment of the infant-food market as it now exists, we draw four observations that inform the design of our proposed intervention:

First, the Accra region has numerous small-scale local manufacturers of cereal-based infant foods that are capable of meeting children's nutritional needs using local ingredients at low potential cost, but very little of these products are being sold – these products are often entirely unavailable in Accra markets, where availability and sales are dominated by Nestle's Cerelac.

Second, an important possible explanation for this situation is that small local manufacturers are unable to signal high quality to potential consumers, as each one lacks the scale of operations needed to justify advertising and investment in a brand identity – and looking forward, a collective brand signaling nutritional quality could be established, if products from competing manufacturers were subject to testing and held to a common nutritional standard.

Third, Ghana does have an infrastructure for product registration and certification through the Food and Drugs Board and Ghana Standards Board, but those services do not extend to guaranteeing the most nutritionally important distinctive features of infant foods as opposed to adult cereals – namely the high nutrient density that comes from using relatively high proportion of expensive ingredients, eg, soyabeans, groundnuts, powdered milk and potentially also micronutrient fortificants, as opposed to low-cost cereal grains.

Fourth, we find that the underlying nutritional content of the locally-produced infant foods that are actually sold turns out to be highly variable. In the absence of an enforceable and recognized product standard for nutrient density, manufacturers who *could* achieve consistently high nutrient densities do not always do so, thereby justifying a potential consumer's hesitancy to use these products for infant feeding.

5. Design of the proposed intervention and randomized trial

Historically, most food quality certification programs have arisen in response to scandals about toxicity, adulteration or other hazards associated with widely-used products. Such certifications are introduced to protect consumers from harm, in the context of strong demand for public action by politically influential victims and existing retailers and manufacturers, who seek ways to avoid the recurrence of past scandals. Safety analysts may study the cost-effectiveness of these programs, but the programs themselves are typically introduced and operated independently of their research.

In contrast to politically-driven certification systems, our proposal calls for the proactive introduction of quality assurance to expand a market that is now stunted by the lack of it. Wealthier consumers now meet their children's needs using Cerelac or other products whose quality is assured by a brand name, so they are not calling for certification. Those who would benefit are the low-income families whose infants go hungry in part because of the unavailability of inexpensive but high density foods, and the local manufacturers who could meet their needs using local ingredients. These potential beneficiaries have little reason to know that quality certification would help them, so introducing certification to improve child nutrition is a step that would be driven by research rather than politics.

Our research predicts that introducing a successful certification program would have two predictable outcomes: greater sales of the high-quality certified infant foods from local manufacturers, and healthier bodyweights among the children whose families have purchased those foods. The degree of success in achieving these goals depends on how well a certification system is implemented, and also on what constraints other than asymmetric information may limit market development and child growth. The design of our proposed intervention aims to implement certification in a cost-effective manner that allows measurement of its impact, so as to inform the continued expansion and scaling-up of certification over time in Ghana and to other countries. Identification of long-term impacts relies on the timing of exposure, as each surveyed child may or may not have benefited from certification services in their market area when they passed through the relevant age range.

5.1 What qualities are to be certified?

The purpose of certification is to give consumers a visible marker of qualities that they want to obtain but are unable to observe for themselves. This can be done cost-effectively only if there is a way for the certifier to verify those qualities for less money than what consumers are willing to pay for the information. Our scoping study suggests that an appropriate quality guarantee would address macronutrient density, a few indicator micronutrients, and whatever contaminants can be monitored at low cost. These qualities would be monitored through a combination of random sampling of products from the market, and monitoring of production processes mainly through Hazard Analysis & Critical Control Points (HACCP) inspections.

To determine exactly what would be tested and by what protocols, we would begin implementation by assembling a new Infant Nutrition Quality Assurance Panel (INQAP). Among nutritionists, using the INQAP acronym for this project would echo the famous work of INCAP, the Instituto de Nutrición de Centroamérica y Panamá, which in the late 1950s introduced a product known as INCAPARINA that pioneered the treatment of protein-energy malnutrition in Latin America (Scrimshaw 1980).

5.2 Who would provide the certification?

The sponsor of the certification could be INQAP itself, as an independent body affiliated with various institutions in the public and private sectors. For example, the members of INQAP might include representatives of the Food and Drugs Board (FDB), the Ghana Standard Board (GSB), the Crop Research Institute and the Ghana Health Service as well as the University of Ghana and international or local NGOs. Each of these institutions might nominate a person to participate in the panel, thereby creating a shared governance structure that promotes both independence and credibility. In our scoping study we interviewed top officials and researchers in each of these organization who expressed keen interest in being invited to join such a panel if funding for a certification project were obtained.

The implementation of INQAP's certification system would be implemented by a secretariat located at the Accra offices of an independent scientific research organization such as the University of Ghana – Legon, or an international NGO such as the International Growth Center (IGC) or International Food Policy Research Institute (IFPRI) which could manage the project's finances. The initial introduction and research phase of the certification under INQAP might run for 3-4 years, with limited personnel consisting of a project director, a quality control officer and a research officer, assisted by a communications manager and a business manager. If the donor-funded research phase of INQAP's work proved successful, then a new entity could be registered under Ghanaian law to collect user fees and operate a self-sustaining commercial certification service. A model for this type of transition from research to commercial operation would be the Ethiopia Commodity Exchange (ECX), which was initiated as a donor-funded research project housed at IFPRI's offices in Addis Ababa and then became an independent commercial entity (Alemu and Meijerink 2010).

5.3 What certification services would be provided?

The certification services provided by the INQAP Secretariat would be:

(a) outreach and technical advice to local infant-food manufacturers, to recruit them into the certification trial and then manage their participation through the steps listed below;

(b) implementing plant and marketplace inspections, and contracting with one or more analytical laboratories for the quality testing of samples so obtained;

(c) issuance of time-limited *"INQAP OK"* stickers to each enrolled manufacturer, to be placed on the packaging of their products for the approved time period. Each batch of stickers will have a clearly printed expiration date, to show that the certification is earned only for a given period.

(d) implementing randomized *"INQAP OK"* publicity campaigns at various marketplaces, consisting of fixed billboards and other signage, plus mobile demonstration teams providing targeted information about what the *"INQAP OK"* sticker means, and other marketing tools such as promotional coupons and discount vouchers.

Initially, these services would be provided at no charge to the manufacturer, other than the manufacturer's willingness to submit to product testing and HACCP inspections. The manufacturer's decisions about how to respond to the introduction of certification services would be an important determinant of program impact, along with consumers' behavioral responses and growth outcomes. Our central hypothesis is that multiple local manufacturers would sharply increase their competing production and marketing efforts to take advantage of product certification and the marketing of the collective *INQAP OK* brand, and that consumers would respond with increased purchases, improved child nutrition and growth outcomes around the intervention sites.

At the end of the donor-funded experiment, if manufacturer and consumer willingness-to-pay for the *INQAP OK* label does prove to be greater than the cost of certification and marketing services, then the INQAP Secretariat could convert the trial into a sustainable commercial certification service. At that point, all producers who wished to obtain *INQAP OK* stickers would be able to do so for a fee, subject to periodic random testing and inspections. The certification service could in principle operate on an entirely commercial basis, although donors might want to supplement its fee-for-service revenues with additional support to expand coverage and further reduce infant feeding costs.

5.4 How would the impact of certification services be measured?

Alongside the INQAP Secretariat, we propose the formation of an INQAP Study Team which could be contracted and funded separately to conduct an independent impact assessment. The secretariat and the study team would need to coordinate their work, as the Study Team would randomly draw locations at which the Secretariat would then provide its certification services, while the Study Team continued its surveys at both the treatment and control sites. A key feature of the study design, however, is randomized rollout by which no one would know ahead of time which of the candidate locations would received each successive round of certification services, and which would other locations would serve as controls during that time period.

A possible initial list of candidate locations includes markets at Takoradi, Cape Coast, Kumasi, Tamale, Navrongo, Wa, Bolgatanga, Koforidua, Techiman and Sunyani, as well as various sites around Accra. These locations are quite diverse in many dimensions, including conditions that are directly related to infant feeding. For example at Techiman there is a Catholic hospital that has been active in promoting cereal blends for infant foods, and Sunyani is where the largest local manufacturer (Yedent) is located.

Having established the list of candidate locations, the Study Team would collect three types of data: (a) household survey responses regarding quantities of infant foods purchased and infant feeding practices; (b) child growth-monitoring cards and illness records from the weigh-in days at local health clinics, and (c) manufacturers' and retailers' records of sales by product type and location. Part (b) of this data collection strategy is made feasible by Ghana's very high participation in growth monitoring through the Ministry of Health. Exact figures on monthly compliance are not available, is thought to have achieved about 80 per cent participation which implies that we could use children's growth cards for anthropometric evidence on efficacy, rather than conducting our own weight and height measurements. The growth-card data could be collected anonymously, since we do not need to match children with households – we need to know only the health clinic at which they were measured, the date of measurement and the child's age on that date. Our study design is at the market level, with treatment-to-control comparison occurring for an entire age-specific cohort of children in a given area. Unlike most nutrition interventions, this market-based project is designed to operate at the population scale and would be evaluated accordingly. For the randomized trial the populations in question are successive cohorts of infants growing up in towns and villages served by particular marketplaces, with gradual expansion of the program to serve all children growing up around an increasing number of markets around the country.

6. Conclusions

In this research, we ask whether child nutrition in developing countries could be improved by a program to test and certify the nutrient density of infant foods produced by local entrepreneurs. Currently, the infant-food market is dominated by a single global brand, Nestle's Cerelac, which is sold for several times the cost of nutritionally-similar alternatives developed by NGOs, nutrition research institutions and local manufacturers. To facilitate the marketing of these locally-produced infant foods we propose to introduce a quality certification program, aimed at assuring consumers that their otherwise-unobservable nutrient density is similar to that of Cerelac. The certification program would be rolled out in a stepwise manner in randomized locations, with market surveillance and child growth monitoring to measure the impact of various certification services on total sales and child development.

As part of our scoping study, we interviewed numerous local manufacturers, researchers, government officials and other stakeholders concerned with child health and nutrition, food marketing and quality assurance. These colleagues are uniformly familiar with the broad lines of what certification can do, and they showed a high degree of interest and support for the possibility of participating in a new project in this area.

The introduction of infant-food certification in Ghana would be a bold new step towards transforming the landscape of child nutrition at population scale. Rolling out certification services in a randomized fashion would allow the impact of those services to be rigorously measured under a wide range of conditions, so as to adjust implementation procedures over time in Ghana, and then guide the possible replication of the most successful approach in other countries.

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Annex D. Photographs of tested samples, alphabetical by maker

Anonymous (light color)

Anonymous (dark color)

Blessed Child (Weanimix)

Blessed Child (Rice Mix)

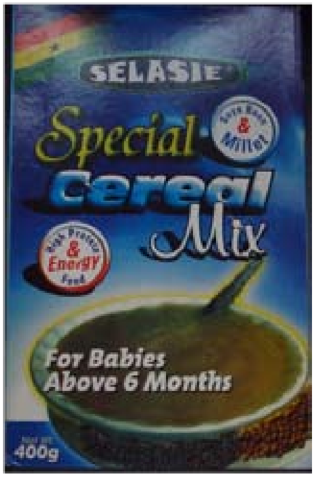
Finer Foods (Ceresoya)

RAWC-MEC (Tom Brown)

Mrs. Romartey (Annointing Whinimix)

Mrs. Romartey (illegible label)

Selassie (Weanimix)



Selassie (Special Cereal Mix)

TIMS (Weannimix)

TIMS (Wheat Mix)

TIMS (Ricemix)

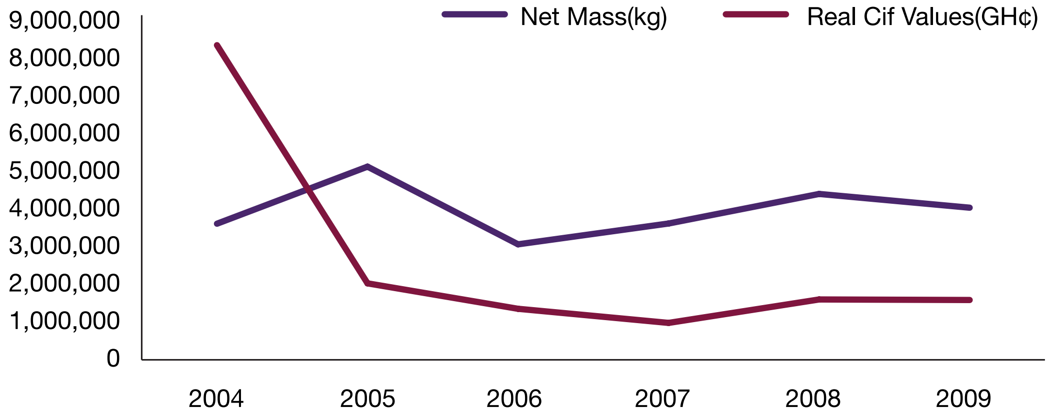
Nestle (Cerelac)

Annex B. Customs and excise data on imports of complementary infant foods, 2004-2009

Our study focuses on the emergence of locally-produced complementary infant foods, in contrast with comparable products made by multinational firms. By far the largest market share is held by Nestle's Cerelac, which in Ghana is produced in a large domestic production facility. Nestle does not publish quantity data for individual products, but Ghana's Customs Excise and Preventive Service offers a detailed set of data on the quantities and prices of other imported infant foods, for each year over the period, 2004-2009.

In this section we report the Ghana Customs and Excise data on all known types of imported complementary foods for infants, which they categorize as: (a) Cereal grains, rolled or flakes of other cereal; (b) Cereal grain, worked but not rolled or flaked of oats; (c) Cereal grain, worked but not rolled or flaked of maize; (d) Cereal grain, worked but not rolled or flaked of other cereal; (e) Cereal germ, whole, rolled, flaked or ground; (f) Prepared food obtained by the swelling or roasting of cereal; (g) Prepared food obtained from unroasted cereal flakes; and (h) Prepared cereal in grain form. We discuss the imports of these foods into Ghana, starting with the totals and then by the sub-groups.

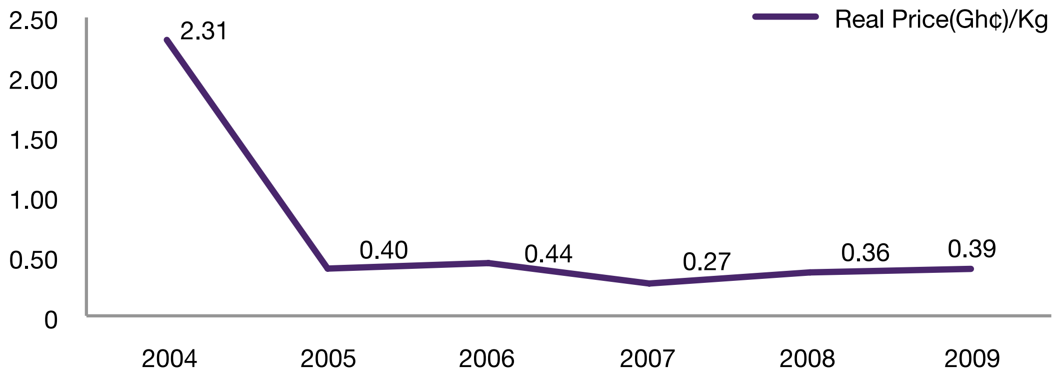
Figure B1: Total imports of complementary infant foods



Source: Customs Excise and Preventive Service

Figure B1 shows the total volume and value of imports of cereal based complementary foods. The figure indicates that volume of imports increased between 2004 and 2005. It thereafter decreased between 2005 and 2006, and then increased from 2006 to 2008, before assuming a relatively slight decrease in 2009. The reasons for these trends in imports may be due to price fluctuations in the world market. The real Cif value of imports (in domestic currency units) decreased sharply from 2004 to 2005, then gently to 2007 before rising slightly to 2008 and then stabilized between 2008 and 2009.

Figure B2: The real price per kilogram of the total imports of complementary infant foods

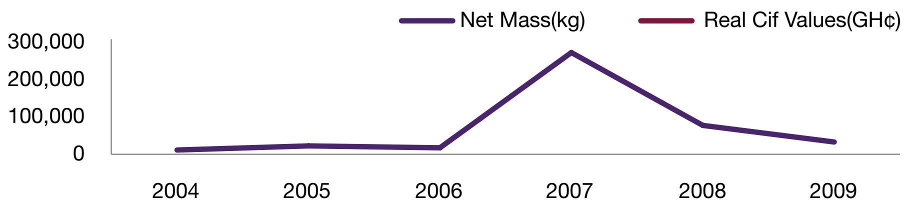


Source: Customs Excise and Preventive Service

Figure B2 depicts trends in the real Ghana cedi per kilogram of cereal-based infant food imports. The trend in the real price per kilogram of all imported complementary infant foods declined very sharply between 2004 and 2005 resulting in the sudden increase in the volumes imported. Thereafter, it rose gently until 2006 before declining gently to 2007. It then assumed a gentle rising pattern from 2007 through to 2009.

The graphs of the different types of Cereal-based complementary foods indicated are shown in figures B3- below.

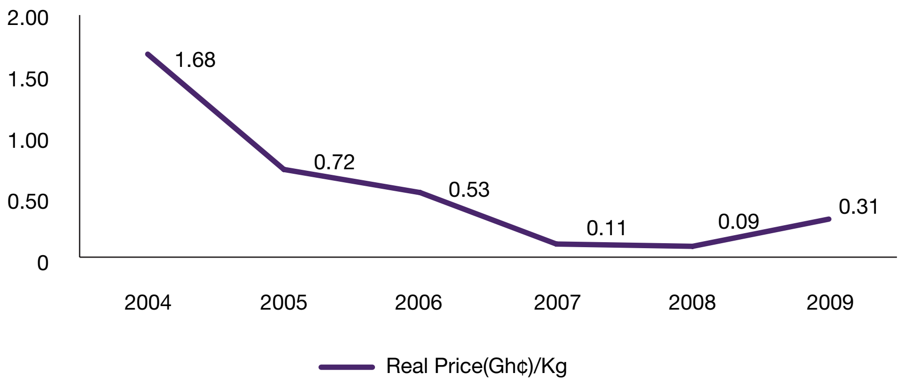
Figure B3: Imports of complementary infant foods - Cereal grains, rolled or flaked of other cereal



Source: Customs Excise and Preventive Service

Figure B3 shows that the net volume imports of Cereal grains, rolled or flaked of other cereal had a fairly constant volume from 2004 to 2006. It then increased very sharply in 2007 and decreased sharply in 2008 before declining slightly in 2009. The Cif value decreased from 2004 to 2006 and then increased slightly in 2007, before decreasing in 2008 and slightly increased in 2009.

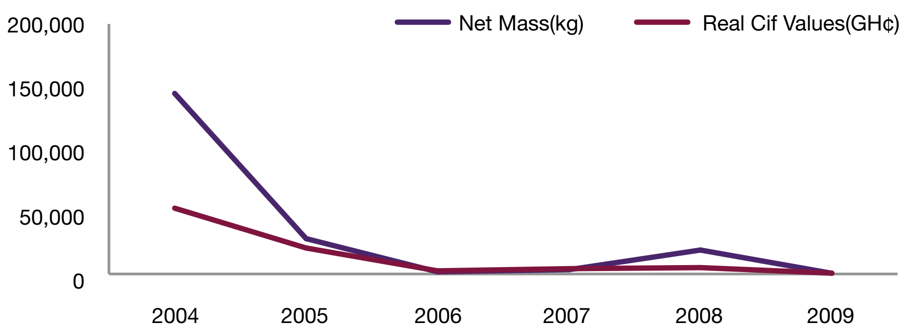
igure B4: The real price per kilogram of the imports of complementary infant foods - Cereal grains, rolled or flaked of other cereal



Source: Customs Excise and Preventive Service

The was a drastic decline in the real price per kilogram of the cereal grains, rolled or flaked of other cereals from 2004 to 2005 (see figure 8), before decreasing fairly constantly to 2007 then stabilizing in 2008. It then rose slightly again in 2009.

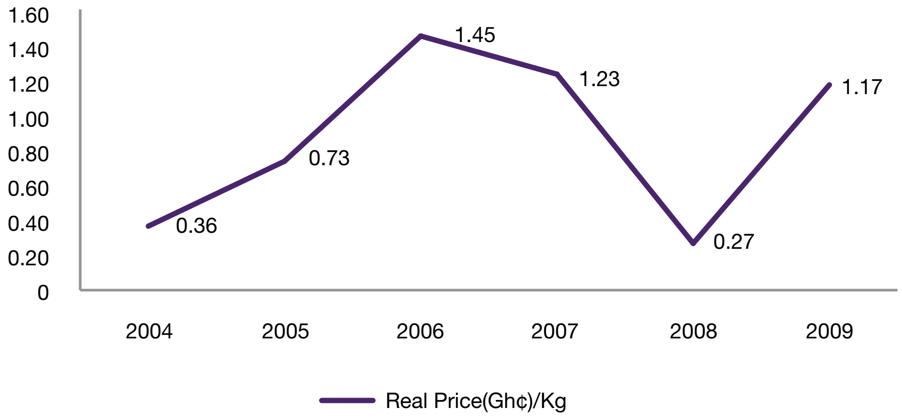
Figure B5: Imports of complementary infant foods - Cereal grains, worked but not rolled or flaked of other cereal



Source: Customs Excise and Preventive Service

In figure B5, both the net mass and value of the import of cereal grain worked but not rolled or flaked of oats decreased sharply from 2004 to 2006. Again both were quite constant in 2007 before the net mass of the imports rose steadily from 2007 to 2008 then declined again in 2009. The real Cif value however remained fairly stable over the period, 2006 to 2009.

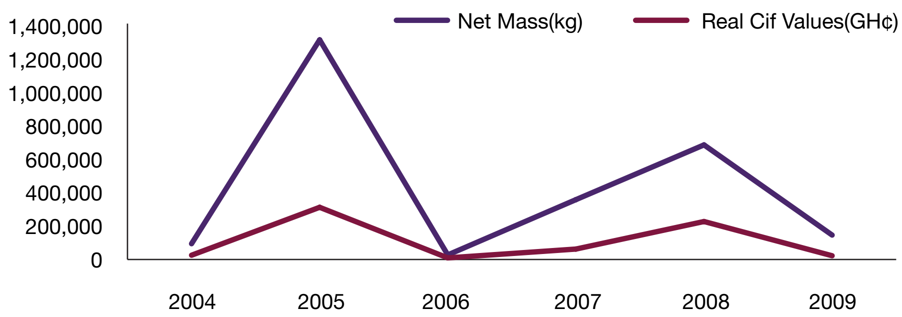
Figure B6: The real price per kilogram of the imports of complementary infant foods - Cereal grains, rolled or flaked of other cereal



Source: Customs Excise and Preventive Service

There was a steep rise in the real price per kilogram for the imports of cereal grains, rolled or flaked of other cereal from 2004 to 2006 (see figure 10). It then declined in 2007 and 2008. It then increased very sharply from GH¢0.27 to GH¢1.17 in 2009.

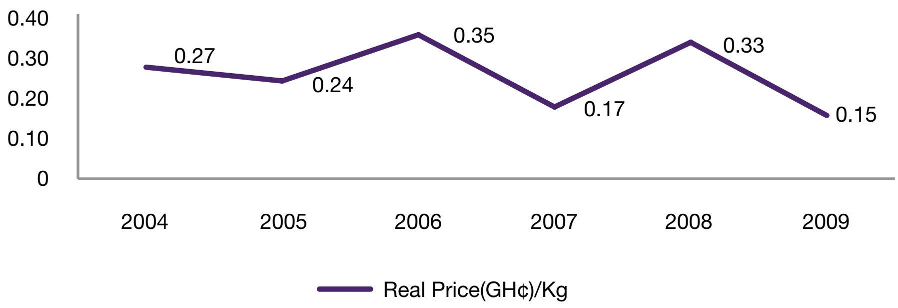
Figure B7: Imports of complementary infant foods - Cereal grains, worked but not rolled or flaked of other cereal



Source: Customs Excise and Preventive Service

The figure B7 shows that although both net mass and the Cif value sharply increased in 2004, the magnitude of increase was greater in the net mass than that of the value. Conversely although there was a decrease in both net mass and Cif value, the magnitude of decrease was greater in mass than that of the Cif value in 2005. From 2006 to 2008 both the net mass and Cif value increased again but that of net value depicted a constant increase whereas Cif value increased gradually. Finally in 2009 they both decreased.

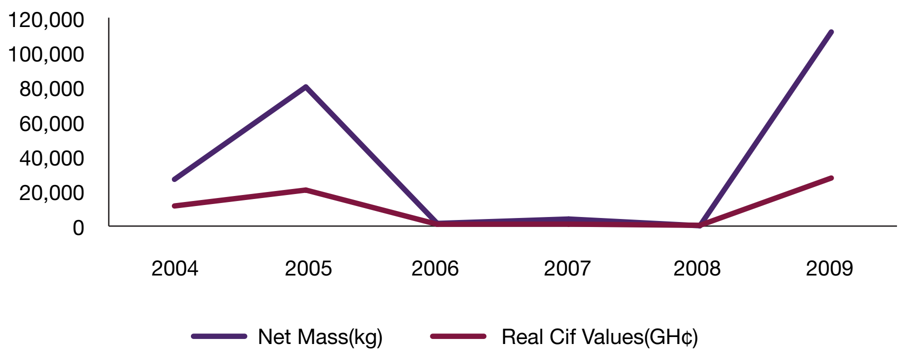
Figure B8: The real price per kilogram of the imports of complementary infant foods - Cereal grains, worked but not rolled or flaked of other cereal



Source: Customs Excise and Preventive Service

Figure B8 shows that there was a sharp decline in the real price per kilogram of import of cereal grain worked but not rolled or flaked of other cereal which fluctuated from GH¢0.27 in 2004 to GH¢0.15 in 2009.

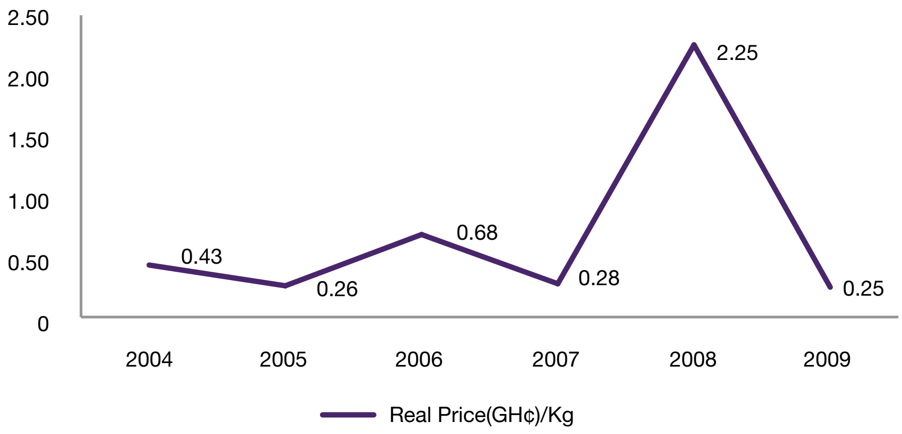
Figure B9: Imports of complementary infant foods -Cereal germ whole, rolled, flaked or ground



Source: Customs Excise and Preventive Service

Figure B9 shows for imports of cereal germ whole imports that although both net mass and real Cif value increased sharply from 2004 to 2005, the magnitude of increase was greater in the net mass than the Cif value. Conversely, although there was a decrease in both net mass and value, the magnitude of decrease was greater in mass than that of the Cif value in 2006. These mass and Cif values were fairly constant between 2006 and 2008, and then increased sharply again in 2009.

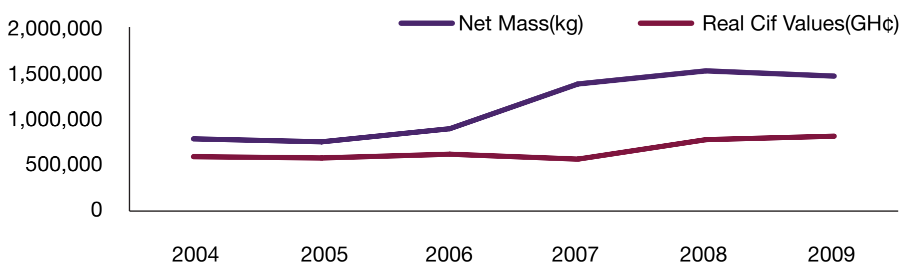
Figure B10: The real price per kilogram of the imports of complementary infant foods - Cereal germ whole, rolled, flaked or ground



Source: Customs Excise and Preventive Service

From figure B10, it can be realized that the real price per kilogram of cereal germ whole, rolled, flaked or ground fell between 2004 and 2005; it then increased suddenly by about 161 per cent in 2006 and then fell again in 2007. The real price per kilogram increased very sharply (about 700 per cent) between 2007 and 2008 and then fell at about the same rate in 2009; the fall of which could be attributed to the sharp increase in import volume within the period.

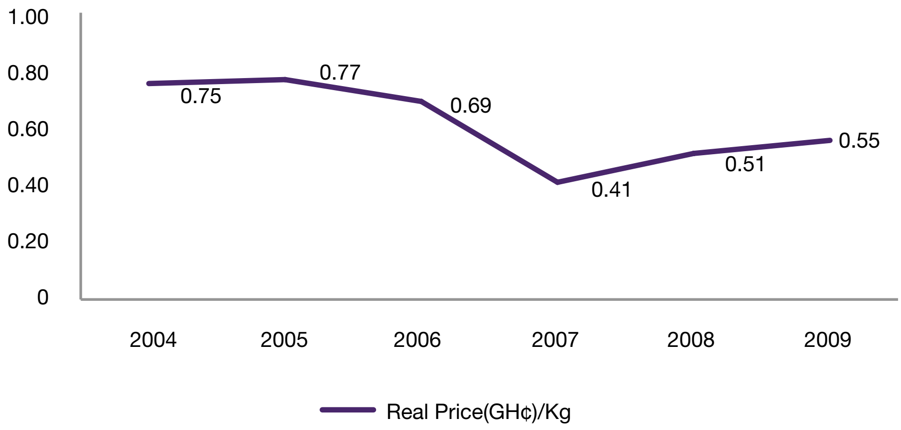
Figure B11: Imports of complementary infant foods -Prepared foods obtained by the swelling or roasting of cereals



Source: Customs Excise and Preventive Service

Figure B11 shows that, both the volume of imports of prepared foods obtained by the swelling or roasting of cereals for infants and their corresponding Cif values were quite stable from 2004 to 2005 before rising gently in 2006. The net mass of imports then assumed an increasing trend to a peak in 2008 thereafter declining just a little in 2009. On the contrary, the real Cif value (figure 16) declined from 2005 to 2007 before taking on a rising trend in 2008 and 2009.

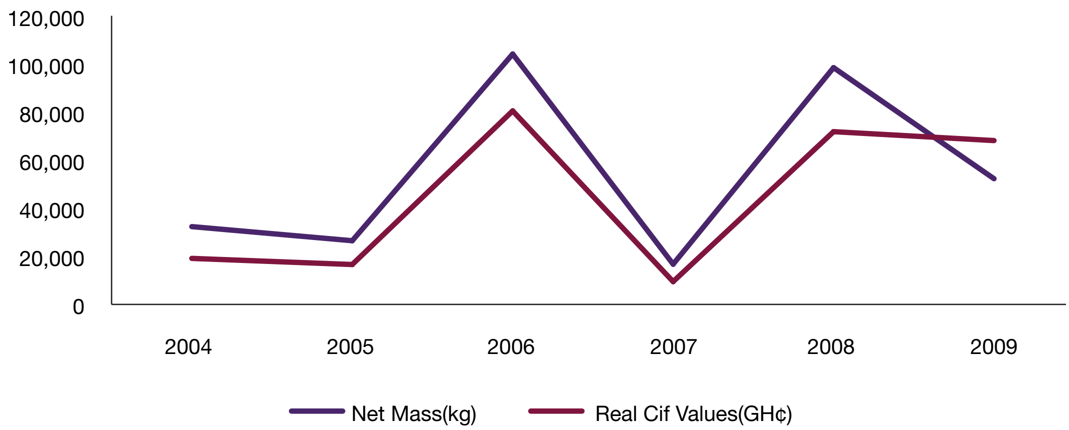
Figure B12: The real price per kilogram of the imports of complementary infant foods - Cereal germ whole, rolled, flaked or ground



Source: Customs Excise and Preventive Service

The real price per kilogram of Cereal germ whole, rolled, flaked or ground decreased from GH¢ 0.75 in 2004 to GH¢ 0.41 in 2007, and thereafter increased to GH¢ 0.55 in 2009.

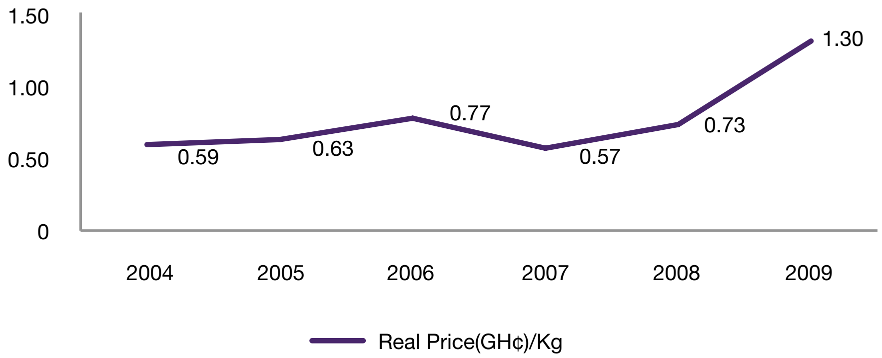
Figure B13: Imports of complementary infant foods - Prepared foods obtained from unroasted cereal flakes



Source: Customs Excise and Preventive Service

Figure B13 shows that, both the net mass of the import of prepared foods obtained from unroasted cereal flakes for infants and their corresponding real Cif values declined slightly in 2005 and rose very sharply in 2006 and then declined also very sharply in 2007. Despite this sharp decline, they both rose sharply again in 2008 and finally declined again in 2009. However, the fall in the net mass was rather very sharp then that in the real Cif value in 2009.

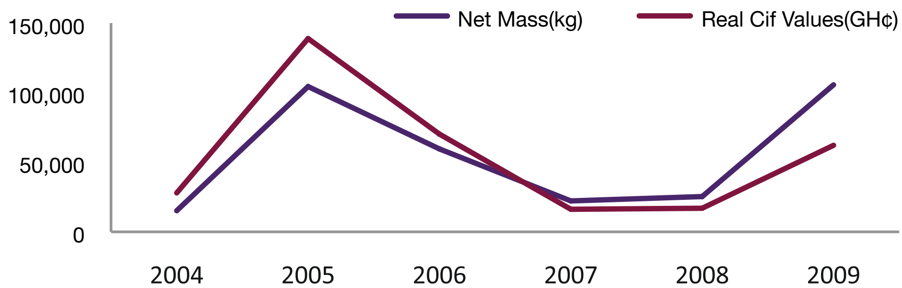
Figure B14: The real price per kilogram of the imports of complementary infant foods - Prepared foods obtained from unroasted cereal flakes



Source: Customs Excise and Preventive Service

In figure B14, the real price per kilogram of the imports of prepared foods obtained from unroasted cereal flakes rose a little from 2004 to 2005 then a little steeper rise occurred in 2006. In 2007 however, the price fell to its minimum, then started to take up the upward trend again; first, gently in 2008 then very sharply in 2009.

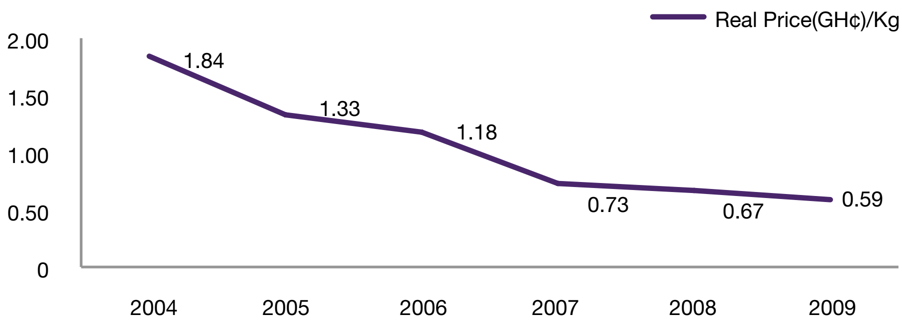
Figure B15: Imports of complementary infant foods - Prepared cereals in grain form (excluding maize)



Source: Customs Excise and Preventive Service

Both the net mass of imports and the real Cif Value of prepared cereals in grain form (excluding maize) increased very sharply from the year 2004 to 2005 (see figure 19), then began to fall very sharply again down to the year 2007. They were both fairly stable between 2007 and 2008 and the increased quite steeply again in 2009.

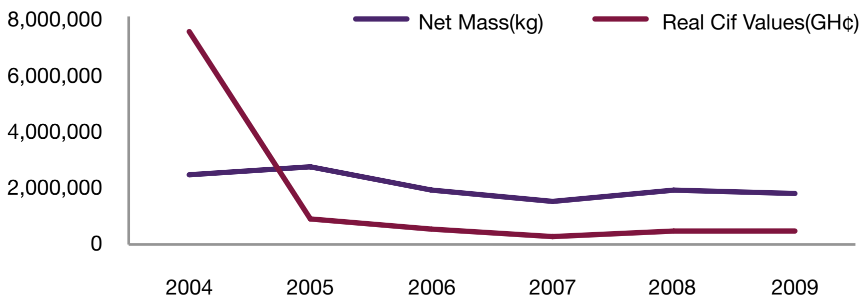
Figure B16: The real price per kilogram of the imports of complementary infant foods - Prepared cereals in grain form (excluding maize)



Source: Customs Excise and Preventive Service

From figure B16, the real price per kilogram trend for the imported prepared cereals in grain form (excluding maize) decreased from the year 2004 to 2009. The rate of decline was sharp between year 2006 and 2007, after which it decreased gently from 2007 to 2009.

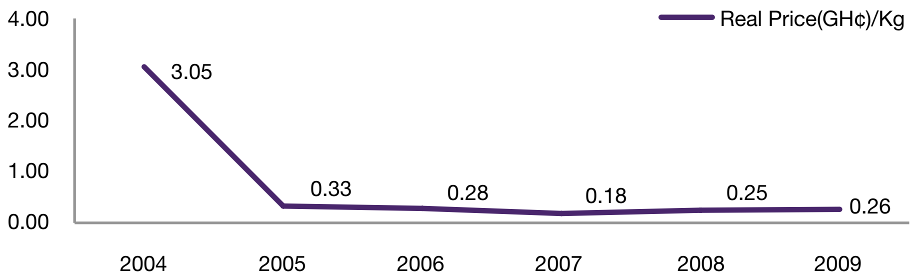
Figure B17: Imports of complementary infant foods - Cereal grains, rolled or flaked of oats



Source: Customs Excise and Preventive Service

Figure B17 shows trends in volume and real value of imports of imported cereal grains, rolled or flaked of oats. It could be seen that the real Cif values of imported cereal grains, rolled or flaked of oats fell very sharply in 2005 then again through to 2007, but this time, quite gently. It then began to rise at a fairly constant rate from 2007 to 2009. The corresponding net masses, rose on the contrary in 2005 before beginning its gentle downwards journey from 2005 to 2007, and then began to rise a little in 2008 and remained fairly constant in 2009.

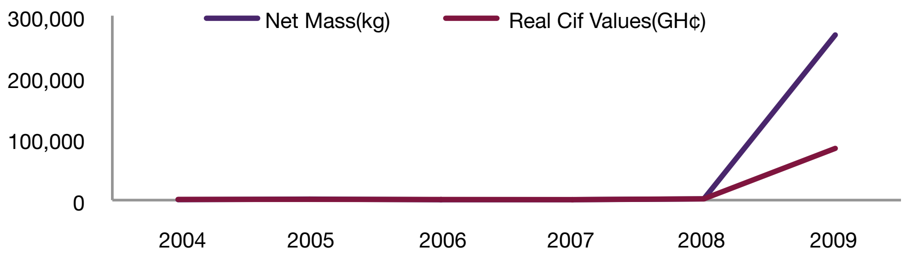
Figure B18: The real price per kilogram of the imports of complementary infant foods - Cereal grains, rolled or flaked of oats



Source: Customs Excise and Preventive Service

The real price per kilogram of cereal grains, rolled or flaked of oats as can be seen from figure 22 decreased greatly in 2005 thereafter assuming a more stable trend from 2005 through to 2009 with the minimum occurring in year 2007.

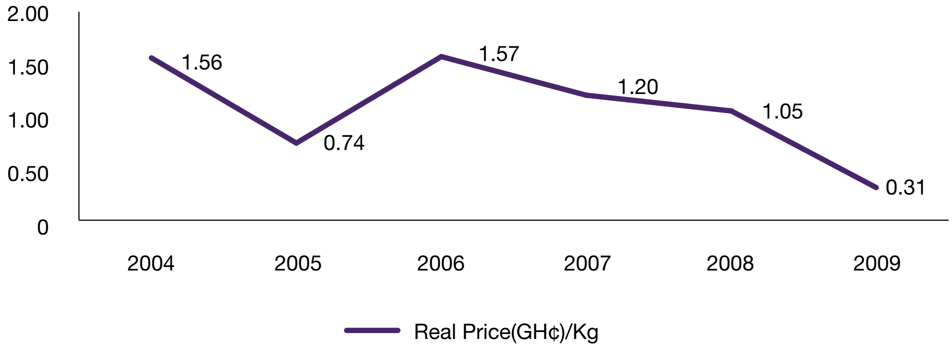
Figure B19: Imports of complementary infant foods - Cereal grains, worked but not rolled or flaked of oats



Source: Customs Excise and Preventive Service

From figure B19, net mass and the real Cif value of cereal grains, worked but not rolled or flaked of oats have both been fairly stable from the year 2004 to 2008. However both quantities shot up very sharply in 2009 with rise in the volume of imports, being more intense than that in the real Cif value.

Figure B20: The real price per kilogram of the imports of complementary infant foods - Cereal grains, worked but not rolled or flaked of oats



Source: Customs Excise and Preventive Service

The real price per kilogram of the cereal grains, worked but not rolled or flaked of oats however has been quite fluctuating throughout the period 2004-2009 (see figure 24). It fell sharply (approximately 50 per cent) in 2005 then rose to its original in 2006, it thereafter assumed a downward trending pattern till 2008 before it fell suddenly and sharply to a minimum in 2009.

Annex C. Randomization procedure and quadrant locations for the availability survey

Our units of observation are quadrants, defined by the latitude and longitude of their central point, with a span of 0.0025 degrees of latitude and longitude so that each quadrant covers an area of approximately 0.1 square kilometers. Google Maps software allows convenient printing of detailed street map for each quadrant, using the following format for the URL to each map:

http://maps.google.com/maps?&ll=5.558740,-0.253961&spn=0.0025,0.0025&pw=2

Note that the central point's latitude and longitude are specified in decimals, followed by the length of each span. The code "pw=2" indicates that the resulting output is to be printed as a street map. Omitting that code generates a satellite view of the quadrant.

To create our sample of grid cells, we begin by defining a rectangle that constitutes "Accra", which runs somewhat arbitrarily from the following corner cells:

SW corner (lower left)	5.527144	-0.261792	Dansoman High St. & Samanea Rd.	http://maps.google.com/maps?&ll=5.527144,-0.261792&spn=0.0025,0.0025&pw=2
NW corner (upper left)	5.677144	-0.261792	Above Westland Blvd.	http://maps.google.com/maps?&ll=5.677144,-0.261792&spn=0.0025,0.0025&pw=2
NE corner (upper right)	5.677144	-0.151792	Outside Boudary Rd.	http://maps.google.com/maps?&ll=5.677144,-0.151792&spn=0.0025,0.0025&pw=2
SE corner (lower right)	5.527144	-0.151792	In water off Labadie	http://maps.google.com/maps?&ll=5.527144,-0.151792&spn=0.0025,0.0025&pw=2

To sample randomly within the rectangle defined by the furthest corners, we created an Excel spreadsheet in which to randomly generate central points in this region using the formula:

> latitude = "=5.527144+0.15*(RAND())", to draw from a uniform distribution between 5.527144 and 5.677144
>
> longitude = "=-1*(0.151792+0.11*(RAND()))", to draw from a uniform distribution between -0.151792 and -0.261792

The result was a sequence of grid maps, ordered randomly. Our goal was to keep drawing from this sequence until we obtained a sample size of over 200 shops. The actual list of randomly-generated maps follows below. Using the satellite versions of each map obtained by removing the "&pw2" at the end of the URL, we identified those quadrants that had no commercial activity at all, for the reason indicated on the table, so we skipped those sites in the sequential numbering of maps used for the actual survey. During the fieldwork we reached our target of more than 200 shops after surveying the 16th quadrant, so maps #17 and above were not visited.

Table C1. Random sequence of 0.1 square kilometer quadrants used for availability survey

Draw	Latitude	Longitude	Map # (or reason for omission)	URL of map
0	5.55955781	-0.2514287	used as example only	http://maps.google.com/maps?&ll=5.559558,-0.251429&spn=0.0025,0.0025&pw=2
1	5.5287303	-0.1659632	water	http://maps.google.com/maps?&ll=5.528730,-0.165963&spn=0.0025,0.0025&pw=2
2	5.5587400	-0.2539612	1	http://maps.google.com/maps?&ll=5.558740,-0.253961&spn=0.0025,0.0025&pw=2
3	5.6354111	-0.2595801	residential only	http://maps.google.com/maps?&ll=5.635411,-0.259580&spn=0.0025,0.0025&pw=2
4	5.5854626	-0.2004181	2	http://maps.google.com/maps?&ll=5.585463,-0.200418&spn=0.0025,0.0025&pw=2
5	5.5840288	-0.1823189	3	http://maps.google.com/maps?&ll=5.584029,-0.182319&spn=0.0025,0.0025&pw=2
6	5.6572276	-0.1950452	empty	http://maps.google.com/maps?&ll=5.657228,-0.195045&spn=0.0025,0.0025&pw=2
7	5.6495892	-0.2082775	4	http://maps.google.com/maps?&ll=5.649589,-0.208278&spn=0.0025,0.0025&pw=2
8	5.5391548	-0.2203554	water	http://maps.google.com/maps?&ll=5.539155,-0.220355&spn=0.0025,0.0025&pw=2
9	5.5688408	-0.2371970	5	http://maps.google.com/maps?&ll=5.568841,-0.237197&spn=0.0025,0.0025&pw=2
10	5.5615783	-0.2143171	6	http://maps.google.com/maps?&ll=5.561578,-0.214317&spn=0.0025,0.0025&pw=2
11	5.6158654	-0.1798072	7	http://maps.google.com/maps?&ll=5.615865,-0.179807&spn=0.0025,0.0025&pw=2
12	5.5543698	-0.2591154	8	http://maps.google.com/maps?&ll=5.554370,-0.259115&spn=0.0025,0.0025&pw=2
13	5.5695762	-0.1844612	9	http://maps.google.com/maps?&ll=5.569576,-0.184461&spn=0.0025,0.0025&pw=2
14	5.6716589	-0.2504241	empty	http://maps.google.com/maps?&ll=5.671659,-0.250424&spn=0.0025,0.0025&pw=2

Draw	Latitude	Longitude	Map # (or reason for omission)	URL of map
15	5.5999305	-0.1769986	10	http://maps.google.com/maps?&ll=5.599930,-0.176999&spn=0.0025,0.0025&pw=2
16	5.6518493	-0.1526933	11	http://maps.google.com/maps?&ll=5.651849,-0.152693&spn=0.0025,0.0025&pw=2
17	5.6674361	-0.2289158	12	http://maps.google.com/maps?&ll=5.667436,-0.228916&spn=0.0025,0.0025&pw=2
18	5.6053329	-0.1579475	empty	http://maps.google.com/maps?&ll=5.605333,-0.157947&spn=0.0025,0.0025&pw=2
19	5.5545400	-0.1545991	water	http://maps.google.com/maps?&ll=5.554540,-0.154599&spn=0.0025,0.0025&pw=2
20	5.5965152	-0.1921682	13	http://maps.google.com/maps?&ll=5.596515,-0.192168&spn=0.0025,0.0025&pw=2
21	5.6602194	-0.2297549	empty	http://maps.google.com/maps?&ll=5.660219,-0.229755&spn=0.0025,0.0025&pw=2
22	5.6216184	-0.2035431	forest	http://maps.google.com/maps?&ll=5.621618,-0.203543&spn=0.0025,0.0025&pw=2
23	5.6624486	-0.1528400	14	http://maps.google.com/maps?&ll=5.662449,-0.152840&spn=0.0025,0.0025&pw=2
24	5.6344450	-0.1704095	15	http://maps.google.com/maps?&ll=5.634445,-0.170409&spn=0.0025,0.0025&pw=2
25	5.6281116	-0.1593119	Motorway only	http://maps.google.com/maps?&ll=5.628112,-0.159312&spn=0.0025,0.0025&pw=2
26	5.5645853	-0.2442133	16	http://maps.google.com/maps?&ll=5.564585,-0.244213&spn=0.0025,0.0025&pw=2
27	5.6442957	-0.1523950	17	http://maps.google.com/maps?&ll=5.644296,-0.152395&spn=0.0025,0.0025&pw=2
28	5.6083252	-0.2147788	18	http://maps.google.com/maps?&ll=5.608325,-0.214779&spn=0.0025,0.0025&pw=2
29	5.5592977	-0.2399420	19	http://maps.google.com/maps?&ll=5.559298,-0.239942&spn=0.0025,0.0025&pw=2
30	5.6457851	-0.2200813	residential only	http://maps.google.com/maps?&ll=5.645785,-0.220081&spn=0.0025,0.0025&pw=2

About the International Growth Centre

The IGC offers independent advice on economic growth to governments of developing countries. Based at the London School of Economics and in partnership with Oxford University, the IGC is initiated and funded by the UK Department for International Development (DFID).

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