What determines consumption of nutritious foods by the urban poor in Africa?

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Abstract:

Purpose: Malnutrition remains a big public health issue especially in developing countries. The purpose of this study is to analyze factors that influence consumption of nutrient-rich foods among children aged 6-59 months and women of reproductive age (15-49 years) in the urban informal settlements of Nairobi, Kenya and Kampala, Uganda. We use multi-composite soft porridge as an example of a nutritious product.

Design/methodology/approach: A cross sectional survey was conducted with 574 households from urban informal settlements in Kampala and Nairobi. A systematic random sampling approach was used to select respondents and interviews were conducted on their socio demographics, porridge consumption and purchase behavior. Probit regression models were used for the analysis.

Findings: Results indicate that households with access to nutrition information are more likely to consume porridge with diversified ingredients, compared to households without nutrition information. Additionally, consumption of fortified porridge flour has a lower probability of consuming porridge flour with diversified ingredients.

Practical implications: The evidence echoes the need for increased dissemination of nutrition information, which will trigger willingness to pay and consumption of nutritious foods. Further, it underpins the need for processor level interventions to avail these foods at affordable prices for the benefit of low-income consumers.

Originality/value: This is among the first papers assessing factors that influence consumption of nutritious and diversified soft porridge by children 6-59 months and women aged 15-49 in the informal settlements of East Africa.

Keywords: Nutritious diversified porridge, consumption determinants, informal settlements, children under five, women, East Africa

Article classification: Research paper

1. Introduction

Despite progress made towards achieving the sustainable development goals globally, prevalence of micronutrient malnutrition remains a major public health issue in most developing countries. More than two billion people still suffer from micronutrient deficiencies mostly due to inadequate intake of essential micronutrients such as iron, zinc, and vitamins (Development Initiatives, 2017). The deficiencies are particularly high among poor households whose diets are dominated by energy dense staples and low consumption of nutrient rich foods (Wanyama *et al*., 2019b; Bouis and Saltzman, 2017). The urban poor households are the most affected due to high dependence on markets for their food needs as well as increases in food prices (Ruel *et al.*, 2010). Undernutrition including fetal growth restriction, sub optimal breast-feeding, stunting, wasting and deficiencies of vitamin A, iron and zinc cause 5.4 million deaths of children below five years (UNICEF, 2018).

There are various interventions and attempts to reduce micronutrient deficiencies in developing countries. These include fortification of staples and oils with micronutrients such as iron, vitamins and zinc; biofortification (e.g. breeding high iron/zinc beans); supplementation; behavior change interventions; and dietary diversity (Bouis and Saltzman, 2017). Biofortification, although cited as a cost-effective way of sustainably improving diets of households, it is more feasible in rural areas where consumer rely on own farm produce for their consumption and there is less reliance on markets (Bouis et al., 2011). Urban consumers would only benefit from bifortification when there is excess production that goes to the market and the consumers have economic capacity to purchase the commodities or products. Food fortification is an option for enhancing cereal-based foods, especially flours with micronutrients such as iron, zinc and vitamin A, and it is effective where food processing is centralized (Horton, 2006). At times, the fortified food are expensive and inaccessible to consumers especially the resource poor. Many countries use mixed approaches to fight malnutrition. For example in East Africa, nutritional supplements are provided to children at risk of malnutrition, and at the same time nutritional information campaigns and broader access to maternal and child health care approaches are used (UNDP, 2010). Mandatory food fortification has been adopted in a number of East African countries including Kenya, Uganda and Tanzania. In Uganda, the Ministry of Health (MoH) established a multi-sectoral National Working Group on Food Fortification (NWGFF) in 2002 to lead the drive to reduce micronutrient deficiency. In Kenya, legislation on mandatory fortification was implemented in 2018 (MoH, 2019). Biofortified commodities such as organge-fleshed sweet potato, high iron/zinc beans and vitamin A rich maize are also widely made available to producers and consumers in many of the East African countries. When assessing all the options for reducing malnutrition, food basket approaches that promote dietary diversity are considered more favoured compared to dealing with a micronutrient-by-micronutrient approach (ISPC, 2014). Dietary diversity is a reliable source of micronutrients such as iron, zinc, and vitamin A that can potentially reduce deficiency diseases and help improve nutritional status and growth of infants (FAO & FHI, 2016). In the case of feeding infants and young children, composite porridge flour made up of cereals, legumes and other nutritious ingredients has been recommended as a sustainable and low cost supplementary food to help improve diets of children (Candace Jackson et al. 2013).

Complementary feeding can contribute to improved growth, health and development of young children especially when foods are introduced at six months of life as recommended by World Health Organization (UNICEF, 2005). As a complementary food, soft porridge is mainly composed of cereals such as maize, millet, sorghum, and finger millet (Wanjala, *et al.*, 2016;

De Groote & Kimenju, 2012). The composite porridges supply high levels of protein and can address the evident protein gap among children 6 – 23 months of age (KNBS, 2015). They are also an important source of most B vitamins, especially thiamin, riboflavin and niacin since they are largely cereal based (Kulp & Ponte, 2000), and contain appreciable amounts of vitamin E (McKevith, 2004). A composite porridge flour may include leguminous components such as beans, which are rich in proteins, iron, calcium, magnesium, potassium and folate (Messina, 2014) as well as vegetables rich in iron, zinc and vitamin A, all of which are important for child growth and development (WHO, 2013).
Diverse studies have been conducted on soft porridge consumption in East Africa. However, most studies focus on the diversity of soft porridge in terms of ingredients and consistency (Wanjala, *et al.* 2016), consumer preferences for single cereal porridge made from maize (De Groote & Kimenju, 2012), and the effect of consumption of a fortified maize porridge on iron deficiency anaemia (Macharia-Mutie e*t al*, 2012). De Groote & Kimenju, (2012) argue that socio-economic status plays a major role in the choice of flour products. While low-income households prefer whole maize meal flour from hammer mills, the middle income households go for more refined industrial products. Price, nutrients and hygiene were identified as the major determinants of choice of porridge flour products and outlets.

Despite its popularity and importance as a low cost supplementary food, the consumption of composite porridge in East Africa, has not been adequately analysed.
No studies were found assessing consumption patterns of porridge products with multiple ingredients, especially among infants and young children aged 6 to 59 months and women of reproductive age (15 to 49 years) in the urban informal settlements of Africa. This study seeks to fill this gap by answering the question: What factors influence consumption of multi-composite porridge by children of age 6 and 59 months, and women of reproductive age in the informal settlements of Nairobi, Kenya and Kampala, Uganda? The findings will contribute to knowledge and information for businesses as well as inform policy to address malnutrition challenges in the urban informal settlements of East Africa.

2. Material and methods

2.1.Sample selection and data collection

This study uses primary data collected from resource-poor consumers (base of the pyramid-BoP) in the urban informal settlements of Kampala, Uganda and Nairobi, Kenya. Kampala and Nairobi were selected as they are the most urbanized cities in the two countries with slum dwellers representing more than 50% of the urban population (Syagga, *et al.*, 2001; World Bank, 2017).

Multi-stage sampling strategy was used to select respondents for this study. First, four BoP study sites with lowest poverty levels were selected in each country based on the national statistics (KNBS, 2015; UBOS, 2014). In Kenya, *Kibera, Mathare, Kawangware, and Mukuru-kwa-Njenga* slums were selected while in Uganda *Bwaise, Kawempe, Kawaala and Kamwokya* slums were selected. The slums were further stratified into low base of pyramid and upper base of pyramid based on the indicated poverty levels. Within each BoP site, the village or zone, which is the smallest administrative unit in Kenya and Uganda respectively, were used as the primary sampling unit. Finally, households to be interviewed were selected using a systematic random sampling procedure. In total, 574 households were interviewed, 291 from Kenya and 283 from Uganda. The target respondent at the household level was the main decision maker on household food consumption, especially soft porridge. Prior to the start of the survey, the

enumerators sought oral consent for the survey from each respondent. The enumerators explained the research to the respondent including how the data was to be used and by who and finally they were informed that their individual identifying variables would not be exposed in any way. The respondents were then given a chance to ask any questions prior to indicating whether they consented to undertaking the study or not.

For a household to be include in the survey it had to be within the study sites and had to have at least one child 6-59 months. On the other hand, exclusion criteria into the survey included household with no child 6-59 months, single individual households, household outside the selected study sites and household that refused to participate in the study.

Data were collected through surveys using structured questionnaires. A 24-hour recall dietary diversity questionnaire was used to collect food consumption data for children 6-59 months and women of reproductive age (15-49 years). The two age groups (children 6-59 months and women of reproductive age-15-49 years) were targeted because they are among the most vulnerable in terms of malnutrition. In Kenya, 26% of children below 5 years are stunted, while 61.8% are vitamin A deficient (KNBS et al, 2015). On the side of women, 82% of women of reproductive age are zinc deficient, 27% of pregnant women are vitamin A deficient and 68.3% are zinc deficient. Uganda has similar trends. Nearly a third (29%) of the Ugandan children under five are stunted, 11% underweight and 53% are anemic, and indication of insufficient intake of iron (UBOS and ICF, 2018). On the side of women, 32% of women of reproductive age (15-49 years) in Uganda are anemic.

The questionnaires ware programmed in Computer Aided Personal Interviewing (CAPI) technology and used in the study sites in Kenya and Uganda. The questionnaires from both countries were well tested prior to the actual survey. In addition, the data collection assistants were well trained to ensure they understood the questionnaires hence eliminating unnecessary data errors. Various types of data were collected including household demographics, household porridge consumption and decision-making, porridge flour choice and purchase behavior.

2.2.Empirical analysis

Data were analyzed using descriptive and econometric models. We use Levene's test to check if our data fulfills the homogeneity of variance assumption and apply t-test and chi-square tests to make intercountry comparisons in descriptive analysis. Levene test results presented in Appendix 1 and 2, show non-significance (α=0.05) on key variables such as flour prices and slum residency, indicating equality of variance.

We conduct women and children analysis separately, using Probit models to assess determinants of consumption of multi-composite (diversified) porridge among children aged 6 to 59 months and women of reproductive age (15 to 49 years). The Probit model is presented as follows:

$$PD = f\ (X_1, X_2, - - - X_{n,}\ e)$$

where PD is a binary dependent variable taking on a value of 1 if the target child or woman consumed porridge composed of two or more food groups and zero if they consumed porridges from one food group only. We use the 12 food group classification to determine the number

of food groups in a given porridge type that had been consumed by the household. The 12 food groups are: cereals; white roots and tubers, and plantains; vegetables; fruits; meat; eggs; fish and other sea food; legumes, nuts, and seeds; milk and milk products; oils and fats; sweets and sugars; and spices, condiments, and beverages (FAO, 2011). The more the groups of foods consumed, the higher is the level of food security and dietary diversity.

The porridge flour ingredients were categorized into food groups to determine the flour's level of diversification. Households that consumed porridge made up of ingredients from two or more food groups were considered to be consuming a diversified porridge compared to those who consumed porridge made of ingredients from only one food group.

X_1 to X_n are variables that influence the probability of consuming diversified porridge and they include demographic characteristics such as age of household head, gender of the decision maker on the type of porridge consumed in the household, access to nutrition information, and location dummies, among others. *e* is the random error term.

The list of determinants of consumption of diversified porridge flour in the women and children models are grouped into seven factors. The first category of variables is related to age of children in months, which is captured as dummy variables presented in four age groups: presence of children in a household aged 6 to 11 months, 12 to 23 months, 24 to 35 months, 36 to 47 months and 48 to 59 months. Existing evidence in Africa shows that consumption of diversified diet increases with age. Younger children are less likely to consume diverse diets compared to the older ones (Mitchodigni *et al.,* 2017; Gewa and Leslie, 2015). Even though the diversified porridge flour is not synonymous to diversified diet because porridge is used as complementary food, we hypothesize that children in the older categories are more likely to consume porridge with diversified ingredients compared to the younger ones.

The second category of variables relate to physical access of the porridge flour. Here we capture information on source of porridge flour. Past studies show that physical access to diverse types of food in a given food environment influences what consumers can purchase and subsequently consume (HLPE, 2017). In the analysis, we include a variable on the sources of porridge flour consumed by the target consumers. The variable is captured as a categorical variable with three categories: own processing, informal sources (Mom& Pop shops, kiosks, street vendors or hawkers, open-air markets) and supermarkets.

The third set of variables are related to economic access factors, which captures affordability of the food consumed. HLPE (2017) highlight the need for increasing affordability of nutritious food for them to play an important role in improving diets of vulnerable consumers especially the resource poor consumers. In this study, accessibility was captured using purchase price of the porridge flour and the category of household consumers by age, consuming porridge. We hypothesize that diversified porridge flour are highly priced and therefore BoP consumers may not afford them. In addition, we hypothesize that when several household members consume porridge, the household may not purchase diversified porridge flour due to the amount of flour required to prepare porridge for the large of consumers and the consequent cost. However, when the porridge is consumed only by children or only by women, the household may purchase more diversified flour for that specific consumer group since the amount of flour required and consequently the cost will not be as high as when purchasing for the entire household.

The fourth factor relates to location differences, which captures the differences in consumption behavior across the two countries and the location variability. We use the country dummies and the two categories of the informal settlement (low and upper BoP areas) to capture the location differences. Previous studies have shown that Kenya and Uganda are different in terms

of their social economic characteristics and culture, hence important to control for the country differences (Chege *et al.,* 2019; Wanyama *et al.,* 2019a, 2019b).

The fifth factor captures variables related to household characteristics. We use household demographics variables such as age and education level of the child's caretaker, age of household head and age and education level of the reference woman of reproductive age in the household.

Finally, we use a sixth factor which captures access to nutrition information. Nutrition information access is captured by the variables access to nutrition information and whether the porridge consumed is fortified. Data on access to nutrition information were collected at household level and we hypothesize that households with access to nutrition information are more likely to consume diversified porridge compared to those without access to such information. Previous studies have shown that consumers who have access to nutrition information are likely to consume more diversified food. In addition, a recent study showed that when BoP consumers have nutrition information about multi-composite nutritious porridge flour, they are even willing to pay a premium for that flour compared to other cereal based non-diversified porridge flour (Chege *et. al.,* 2019).

For ease of interpretation, we present the marginal effects of the predicted probabilities. The marginal effects from Probit models represent discrete change (how predicted probabilities change as the dependent variable changes from 0 to 1) in binary factor variables and instantaneous rate of change in continuous variables. Marginal effects for continuous variables can be difficult to interpret depending on how the data is scaled but in our case the continuous variables in the model are all expressed in single units in which case the instantaneous rate of change is similar to the change in P(Y=1) as Xn increases by one.

3. Results

3.1.Descriptive Statistics

Table 1 presents socioeconomic and demographic characteristics of the study households in Kenya and Uganda, and for the pooled sample. We find significant differences between the study households in Kenya and Uganda for most of the demographic and social economic variables for example the household head characteristics, household income, and access to nutrition information. This is not surprising given that we expect the two countries to be different in terms of socioeconomic status. Furthermore, previous studies conducted in similar urban BoP area of Nairobi, Kenya and Kampala, Uganda found these differences (Chege *et al.,* 2019; Wanyama *et al.,* 2019a, 2019b).

(Table 1 about here)

The descriptive analysis also show some gender differences between the two countries in terms of household decision on the type of porridge consumed in the households; mostly females make the decision in both countries, although the percentage is significantly higher in Kenya (68%) than in Uganda (55%). The percentage of males who make the decision on porridge consumption is significantly higher in Uganda (40%) than in Kenya (28%). Only 5% of the household in both countries decide jointly on the kind of porridge to be consumed in the household.

Table 2 presents analysis on the demographic characteristics of the target children and their porridge consumption behavior. The caretakers of the reference child in Kenya are relatively younger than those from Uganda. Their education level also significantly differs between the two countries.

(Table 2 about here)

Our results further show that porridge consumed by target children across the two countries were made of ingredients from one to four food groups. However, most of the porridge flour consumed was composed of ingredient(s) from one food group (67% in Uganda and 35% in Kenya). Overall only 33% of households in the two countries indicated that their children consumed porridge made of ingredients from two food groups, and a much smaller proportion of households had children's porridge ingredients from three or four food groups (14% and 4% respectively).

We also find that porridge flour consumed by children in the two countries is mostly non-fortified. Overall, only 32% of households reported their children to be consuming porridge fortified with important micronutrients such as iron, zinc, and calcium, and the percentage was slightly higher in Kenya (35%) than in Uganda (27%).

In addition, households purchase porridge flour from different sources. Overall, 67% of the households in Kenya and Uganda obtain their porridge flour from informal sources such as kiosks, mom and pop shops, cereal shops, street vendors or open air market, 23% buy their porridge flour from supermarkets while 10% buy ingredients and process the flour themselves at the local hammer mills.

Having found that overall about half of the children aged 6 to 59 months mostly consume porridge made of just one food group, we conduct further descriptive analysis to assess what kind of ingredients these are. Are they energy dense or more nutrient dense ingredients? Figure 1 provides results of this analysis.

(Figure 1 about here)

Our results show that in Kenya, the 35% of children who consume porridge made of one food group (as shown in Table 2), the ingredients are only cereals (maize, millet, sorghum, and wheat). In Uganda, out of the 67% of the children who consume porridge made of ingredients from one food group only (Table 2), 96% of them use cereals only (maize, millet, sorghum, wheat and rice), while 4% use pulses only (soybeans).

Table 3 presents descriptive analysis of data on women of reproductive age and other variables related to porridge consumption by this consumer group. Our results show that the average age of the sampled women in both countries was 27 years. The Kenyan women have a significantly higher level of formal education (10 years) compared to their Ugandan counterparts (9 years).

The trend of diversity of porridge consumed by target women in both countries is similar to what we found in the children's analysis. The highest percent of women consume porridge made of ingredient(s) from one food group (52%), and a smaller percent of women consume porridge made of ingredients from two food groups (33%). Only a 12 percent have their porridge made of ingredients from three food groups and 3% form four food groups. We also find that most of these women consume porridge, which is not fortified. Only 16% of the women overall indicated that the porridge they consumed was fortified, and the percentage was higher in Kenya (22%) than in Uganda (9%). Similar to the case of children porridge flour, the porridge flour consumed by the target women was mostly purchased from informal sources

such as kiosks, and mom and pop shops (74% on average), while only 10% of the women consumed porridge flour that they processed in the local flour mills.

(Table 3 about here)

In terms of distance to porridge flour sources, the households source the flour from shops that are on average 4 kilometers away from their homes. Ugandan households get their flour from a further distance (6 kilometers) compared to the Kenyan households (2 kilometers). In terms of pricing, the porridge consumed by women from Kenya are more expensive (US$ 0.9/kg) compared to those consumed by women in Uganda (US$ 0.7/kg).

In Figure 2, we conduct some additional analysis to understand the kind of ingredients used in the porridge types consumed by the target women. We conduct an analysis on the 37% of women that consume porridge flour made of ingredients from one food group only (Table 2). As shown in Figure 2, all the women in Kenya who consume porridge made of ingredients from one food group only (52% of the women), the porridge is made of cereals only, and these are maize, millet, sorghum, and wheat. In Uganda, out of the 69% of women who consume this kind of porridge, 97% of them use cereals only (maize, millet, sorghum, wheat and rice) while 3% use legumes only (soybeans and groundnuts).

(Figure 2 about here)

3.2.Empirical model

The descriptive results presented in the previous section sheds some light on the kind of porridge consumed by the target women and children, and provide some preliminary indications of what factors may be influencing consumption of various types of porridge flour. However, the analysis may not provide a conclusive understanding of the factors driving consumption of the diversified porridge because we do not control for other factors. In this section, we present an in-depth econometric analysis of factors influencing consumption of diversified porridge using Probit models. We present analysis for porridge consumption by target children and women separately under Table 4.

Both the children and women's models show several factors that influence consumption of diversified porridge. Children who have older caretakers are less likely to consume diversified porridge compared to those who have younger caretakers, with a one-year increase in the age of the caretaker reducing the likelihood of consuming diversified porridge by 0.8 percent. In the contrary, we find that children that belong to households with older household heads are more likely to consume diversified porridge compared to those that belong to households with younger household heads.

(Table 4 about here)

Both the children and women models show that children and women who consume diversified porridge flour pay a higher price, an indication that diversified porridge flour are priced higher than the non-diversified ones. In addition, we find that access to nutrition information is associated with an increased probability of consuming diversified porridge by 18 percent in the

children models and 19% in the women's model. On the contrary, children and women who consume fortified porridge flour are less likely to consume porridge made of diversified flour-with more than one ingredient.

Our results further show that children of different age groups consume diversified porridge, but the younger ones (6 to 11 months) are more likely to consume diversified porridge at 25% compared to the others.

Finally, our results show that both children and women from Kenyan households are 23% more likely to consume diversified porridge compared to those from Uganda.

4. Discussion and conclusion

Malnutrition in all its form (undernourishment, micronutrient deficiency, and overweight/obesity) is still a public health concern in most developing countries. Dietary diversity could assist in addressing these nutrition problems. Consumption of diversified diets by children under five is vital in improving their nutrition status (Dewey, 2013). However, most times resource-poor urban consumers do not have access to or cannot afford diversified diet hence they rely on cereal based-energy dense foods. Soft porridge is widely used for complementary feeding and consumption by adults in most informal settlements of Africa. Besides being utilized as a complementary food, most of the base of the pyramid (BoP) children in Kenya and Uganda wholly depend on soft porridge as their only meal for several days and weeks in their first 2 years of life. Unfortunately, the porridge consumed in those households are often cereal based, mostly made of maize alone or maize and millet. Given that the cereal based flour mixes are already available from the market, its' critical to upgrade the quality of the porridge and make them more nutritious (Mitchodigni, et al., 2017). Processor level interventions could therefore contribute in availing nutritious and affordable dry porridge flours which have been produced using locally available nutritious ingredients to contribute in addressing nutrition problem among consumers (Hotz, et al., 2015).

This study seeks to identify factors that influence consumption of diversified and nutritious soft porridge, among the urban BoP consumers using quantitative data collected from urban BoP sites in Nairobi, Kenya and Kampala, Uganda. Results from the children model show that demographics characteristics of the child's caretaker and the household head are important determinants for the type of porridge consumed by the target children. Children that belonged to households with older household heads were more likely to consume diversified porridge. This could be because household heads who are mostly the bread winner in the household, are likely to have accumulated wealth with time hence have more resources to purchase diversified porridge flour, which is more expensive than the non-diversified one. On the contrally, we find that children that belong to households with older care takers are less likely to consume diversified porridges. The younger care takers may have access to more nutrition information than the older care takers due to their exposer to social media and regular viewing of television and listening to radio and consequently, they are in position to translate this into better nutrition. Bilal *et al.,* (2016) found that improved nutrition awareness of the caretakers (either father or mother) improves knowledge toward childcare and feeding practices and their nutrition situation.

The women model shows that women who are in households that have a child aged 6 to 59 months are more likely to consume diversified porridge. This could be because such a household may be more nutrition conscious and therefore may prepare porridge that is more diversified hence nutritious, compared to households without children under five.

Our analysis on the economic access of diversified flour shows that porridge flour purchased at higher prices are more likely to be the diversified flour compared to those priced at lower prices. These results are true for both the children and women models.This could be probably due to the belief that these are nutritious and they have several ingredients, hence they are priced higher than the non-diversified ones. Strikingly, consumers at the base of the pyramid are still purchasing diversified porridge flour, even at a higher price than the less diversified. This however is not surprising since a recent publication found that the BoP consumers in the slums of Nairobi and Kampala are willing to pay a premium for nutritious porridge flour and the willingness to pay is even higher for the consumers who have nutrition information about the porridge flour (Chege, *et al.,* 2019; Wanyama et. al., 2019a). In a similar direction, we find that access to nutrition information increases probability of consuming diversified porridge for both children and women. Previous studies have attributed nutrition awareness to improved knowledge on nutritious foods and benefits of eating healthy, therefore influencing what consumers eat (Palwala, et al., 2009). Our findings are in line with those of Hirvonen and Hoddinott (2017) who found that access to better nutrition knowledge leads to considerable improvements in children's dietary diversity.

The study findings additionally show that fortified porridge flour consumed by children is less likely to be diversified. This implies that when children consume fortified porridge, it is mostly made of just one ingredient or ingredients from one food group and the flour is additionally fortified with other nutrients. This finding is not surprising because there has been little effort to aggressively market diversified fortified porridge flours in low economic settlements due to their high cost which render these products unaffordable. Deliberate fortification efforts for flours for instance in Kenya have focused on maize and wheat (GoK, 1964). Therefore improving on access and use of fortified maize flour for child feeding (Leyvraz et al., 2018), with little focus on diversified flours. Given the trade-off between fortification and multi-composite ingredient four, it is important that if the flours are being fortified, they should be fortified with important micronutrient especially those deficient among women and children like iron, zinc, and vitamin A.

Finally, our results indicate that both women of reproductive age and young children under 5 years from Kenya are more likely to consume diversified porridge flour compared to their Ugandan counterparts. This is probably due to the cultural and ethnic differences that exist among these countries that inherently influence consumers' food eating patterns. Ethnic groups have been shown to differ in dietary quality and nutrient intake and this may be due to the sociodemographic or cultural differences in the types of foods served and the methods of preparation (Patrick & Nicklas, 2005). The findings of our study reinforce that of Gewa and Leslie (2015) who found that children from Kenya had the highest dietary diversity scores when compared from those in Uganda and Tanzania.

Our results have several implications for policy makers and private sector actors in the food system. First, importance of nutrition information in improving diets of the urban poor consumers in Kenya and Uganda is reinforced. Policy makers should play a role in ensuring nutrition awareness is increased among consumers in the informal settlements but also among other consumers as this will contribute to reducing malnutrition. In addition, business entities should consider dissemination of nutrition information as part of their business operations when introducing nutritious commodities in the market.

Second, private sector processors should play a role in producing affordable nutritious convenient foods such as multi-composite porridge flour and other products and make them

accessible to consumers including those in the urban informal settlements. Affordability of the products to all consumer categories can be achieved through direct sourcing of raw materials from farmer groups to bring down transaction costs.

Third, we find a trade-off between multi-composite flours and fortification. Both policy makers and private sector companies involved in product development should ensure that the non-diversified flours are fortified with important micronutrients such as iron, zinc, and vitamin A as these are identified as critical micronutrients lacking in most diets of children and women and contributing to high micronutrient deficiencies in developing countries. Both Kenya and Uganda have mandatory fortification policies which are meant to increase intake of micronutrients by consumers. In Kenya, the policy requires fortification of wheat and maize flour, vegetable oils and fats by food processors and there are set standards for food processors to follow (MoH, 2018). Poor consumers may not always purchase the fortified commodities due to cost and in such times dietary diversity or consumption of multi-composite flours shouls be advocated.

Finally, the private company processors should choose appropriate marketing channels and outlets to disseminate nutritious products. As our descriptive results study shows, the urban BoP consumers mostly buy their porridge flour from informal market outlets. There is therefore a need for the processors to identify the exact informal market outlets during dissemination of such products to ensure they are placed in the most appropriate outlet. Further research is required to identify most suitable marketing channels for nutritious porridge flour and other nutritious products specifically for the BoP consumers in the urban informal settlements.

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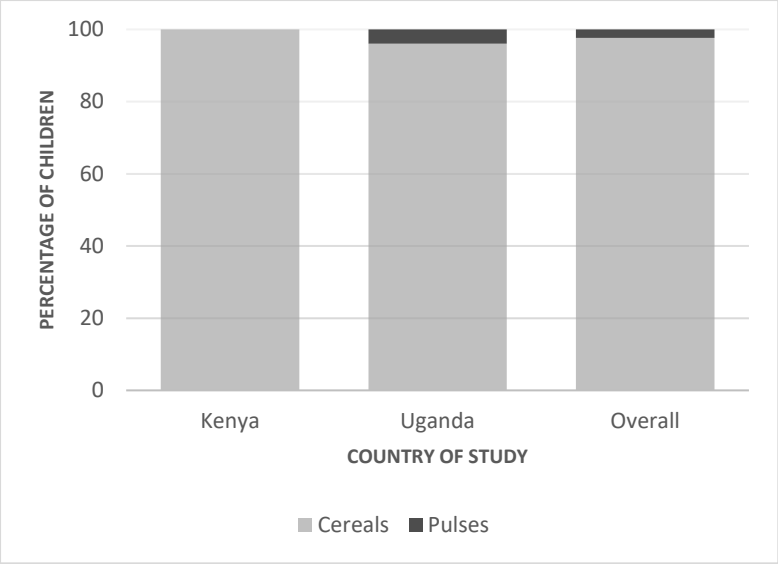
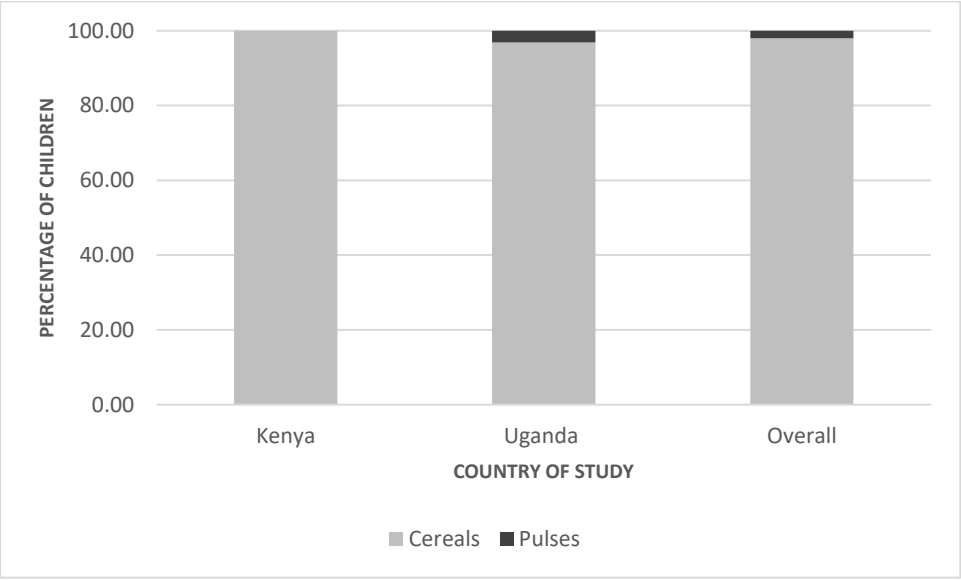


Notes: The Cereals in Kenya are maize, millet, sorghum, and wheat; while in Uganda the cereals are maize, millet, sorghum, wheat and rice and the pulses are soybeans only

Figure 1: Percentage of children consuming porridge made of ingredients from one-food group



Notes: In Kenya, the cereals consist of maize, millet, sorghum, and wheat; while in Uganda the cereals are maize, millet, sorghum, wheat and rice and the pulses are soybeans and groundnuts

Figure 2: Percentage of women consuming porridge made of ingredients from one-food group

Results Tables

Table 1: Demographic and socioeconomic characteristics of study households

Variables	Kenya (*n*=291)		Uganda (*n*=283)		Pooled (*n*=574)	
	Mean	SE	Mean	SE	Mean	SE
Male-headed household (dummy)	77.3***	2.5	63.6	2.9	70.6	1.9
Age of Household head (years)	36.6	0.6	38.7**	0.7	37.7	0.5
Education of household head (years)	10.6***	0.2	8.9	0.2	9.8	0.2
Household annual income (USD)	2790***	154.7	1786	100.6	2295	95.1
Decision maker of porridge consumed						
Male	27.5	2.6	39.9***	3.0	33.6	2.0
Female	68.4***	2.7	55.1	3.0	61.9	2.0
Joint decision making	4.1	1.2	4.9	1.3	4.5	0.9
Access to nutrition information (dummy)	86.9***	2.0	53.4	3.0	70.4	1.9
Low BoP informal settlements [a] (dummy)	51.2	2.9	49.8	3.0	50.5	2.1

*Note: *** p<0.01, ** p<0.05, * p<0.1; t-tests are conducted to test for differences between Kenya and Uganda the mean values; at the time of the survey 1 USD was equal to 108 Kenya shillings (KES) and 3400 Uganda shillings (UGX); BoP is base of the pyramid;* [a] BoP settlements are categorized into low and upper

Table 2: Demographic characteristics and porridge consumption of target children (6-59 months)

Variables	**Kenya (n=190)**		**Uganda (n=155)**		**Pooled (n=345)**	
	Mean	SE	Mean	SE	Mean	SE
Reference child caretaker age (years)	29.2	0.5	32.1***	0.9	30.5	0.5
Reference child caretaker education (years)	9.9***	0.2	7.9	0.3	9.0	0.2
Number of children aged 6 to 59 months	1.2*	0.1	1.3	0.1	1.3	0.0
Categories of children ages						
6 to 11 months (dummy)	16.8*	2.7	9.7	2.6	13.6	3.8
12 to 23 months (dummy)	24.2	3.3	17.4	3.2	21.2	2.3
24 to 35 months (dummy)	30.0	3.7	33.6	4.5	31.6	2.9
36 to 47 months (dummy)	25.9	3.4	34.2	4.1	29.6	2.6
48 to 59 months (dummy)	26.8	3.5	38.1**	4.3	31.9	2.7
Diversity of porridge consumed by children 6-59 months (%)						
One food group	34.7	3.5	66.5***	3.8	49.0	2.7
Two food groups	34.7**	3.5	31.0	3.7	33.0	2.5
Three food groups	22.6***	3.0	2.6	1.3	13.6	1.9
Four food groups	7.9	2.0	0.000	-	4.4	1.1
Fortified porridge (dummy)	35.3	3.5	27.1	3.6	31.6	2.5
Sources of porridge flour (%)						
Own processing	15.3	2.6	3.2	1.4	9.9	1.6
Supermarket	31.6	3.4	11.6	2.6	22.6	2.3
Informal sources [a]	53.2	3.6	85.2	2.9	67.5	2.5

*Note: *** p<0.01, ** p<0.05, * p<0.1; t-tests are conducted to test for differences between Kenya and Uganda the mean values; [a]informal sources includes Mom& Pop shops, Kiosks, street vendors or hawkers, local processors, open air markets*

Table 3: Porridge consumption by target women of reproductive age (15-49 years)

Variables	Kenya (n=291)		Uganda (n=283)		Pooled (n=574)	
	Mean	SE	Mean	SE	Mean	SE
Age of target women (years)	27.6	0.4	27.1	0.5	27.4	0.3
Education of target women (years)	10.3***	0.2	9.0	0.3	9.7	0.3
Access to nutrition information (dummy)	86.9***	1.98	53.4	2.97	70.4	1.91
Diversity of porridge consumed (%)						
One food group	36.8	2.8	68.6***	2.8	52.4	2.1
Two food groups	35.4***	2.8	29.7	2.7	32.6	2.0
Three food groups	22.0***	2.4	1.8	2.4	12.0	1.4
Four food groups	5.8	1.4	-	-	3.0	0.7
Fortified porridge (dummy)	22.3	2.4	9.2	1.7	15.9	1.5
Sources of porridge flour (%)						
Own processing	17.2	2.2	2.5	0.9	9.9	1.3
Supermarket	26.9	2.9	6.0	1.7	16.6	1.8
Informal sources [a]	55.9	2.6	91.5	1.4	73.5	1.6
Distance to porridge source (km)	5.7	2.5	1.9	1.3	3.9	1.4
Porridge flour purchase price (USD/kg)	0.9***	0.0	0.7	0.0	0.8	0.0
Low BoP informal settlements[a] (dummy)	51.2	2.9	49.8	3.0	50.5	2.09

*Note: *** p<0.01, ** p<0.05, * p<0.1; t-tests are conducted to test for differences between Kenya and Uganda the mean values; at the time of the survey 1 US$ was equal to 101 Kenya shillings (KES) and 3400 Uganda shillings (UGX); [a]Informal sources includes Mom& Pop shops, Kiosks, street vendors or hawkers, processors, open air markets; BoP is base of the pyramid; [a] BoP settlements are categorized into low and upper*

Table 4: Probit model results on factors determining consumption of diversified porridge by children 6-59 months and women aged 15-49 years

Variables	Children model	Women model
Care taker age (years)	-0.009(0.004)**	
Care taker education (years)	-0.010(0.008)	
Women Age (years)		-0.002(0.003)
Women education (years)		0.002(0.006)
Age of household head (years)	0.008(0.003)**	0.003(0.002)
Presence of child aged 6 to 59 months (dummy)		0.078(0.041)*
Porridge purchase price (USD/Kg)	0.175(0.054)***	0.106(0.061)*
Access to nutrition information (dummy)	0.171(0.057)***	0.194(0.044)***
Fortified porridge (dummy)	-0.179(0.057)***	-0.227(0.065)***
Porridge consumers' categories (number)	-0.007(0.008)	0.003(0.006)
Children aged 6 to 11months (dummy)	0.253(0.090)***	
Children aged 12 to 23 months (dummy)	0.065(0.080)	
Children aged 24 to 35 months (dummy)	0.147(0.073)**	
Children aged 36 to 47 months (dummy)	0.157(0.073)**	
Children aged 48 to 59 months (dummy)	0.016(0.065)	
Male decision maker on porridge consumption (dummy)	-0.019(0.082)	-0.024(0.042)
Porridge flour source (Reference =own processing)		
Supermarket	0.052(0.089)	-0.038(0.074)
Informal sources a	-0.003(0.083)	-0.001(0.089)
Upper BoP informal settlement (dummy)	0.040(0.050)	-0.023 (0.039)
Kenya (dummy)	0.226(0.054)***	0.228(0.042)***
Wald chi2(17)	66.17	87.67
Prob> chi2	0.000	0.000
Pseudo R2	0.152	0.123
Log pseudo likelihood	-202.708	-348.272
Number of observations	*345*	*574*

*Notes: *** p<0.01, ** p<0.05, * p<0.1; marginal effects are presented with robust standard errors in parentheses; [a]Informal sources includes Mom& Pop shops, Kiosks, street vendors or hawkers, processors, open air markets*

Appendix:

Table A1: Levene's test on target woman variables

Variable	T	Prob>T
Age of target woman	7.03	0.00820
Education of target woman	23.81	0.00000
Access to nutrition information	327.64	0.00000
Diversity of Porridge consumed	67.95	0.00000
Fortified porridge	85.35	0.00000
Sources of porridge flour	145.11	0.00000
Distance to porridge source (KM)	6.18	0.01320
Porridge flour purchase price	1.93	0.16490
Low BoP informal settlements	0.15	0.69570

Table A2: Levene's test on target child variables

Variable	T	Prob>T
Reference child caretaker age (years)	14.46	0.00020
Reference child caretaker education (years)	10.09	0.00160
Nutrition information	200.99	0.00000
Age of household head	8.72	0.00340
Porridge flour purchase price	1.42	0.23410
Diversity of porridge consumed by children 6-59 months (%)	24.15	0.00000
slum classification	0.33	0.56530
Fortified porridge (dummy)	10.86	0.00110
male decision	3.41	0.06560
Sources of porridge flour (%)	95.41	0.00000