Report

Fortification Assessment Coverage Tool (FACT) Survey in Uganda, 2015

February 2017

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1. SUMMARY

In Uganda, national fortification of salt with iodine began in 1994, and fortification of wheat and maize flour with multiple micronutrients and oil with vitamin A has been mandated by law since 2012. Currently, there is a lack of information available on how well these programs are performing, household coverage and intake of fortified foods, and if vulnerable populations are being reached. The Fortification Assessment Coverage Tool (FACT) is a survey instrument developed by the Global Alliance for Improved Nutrition (GAIN) for carrying out coverage assessments of large-scale food fortification programs. In 2015 the Ugandan Ministry of Health and GAIN, with technical support from the United States Centers for Disease Control and Prevention (CDC) and Makerere University, Department of Food Technology and Nutrition, School of Food Technology, Nutrition and Bio-engineering (SFNB), conducted a cross-sectional, two-stage, cluster household FACT survey in Uganda from September to October. The purpose of the survey was to assess the coverage and potential contribution of fortified foods to the micronutrient intake of the population.

The survey was designed to be nationally representative and also representative by rural and urban areas of the country. The study population consisted of households and women of reproductive age (15-49 years). Based on sample size calculations and anticipated non-response, 1,101 households were invited to participate nationally (575 households in rural areas and 526 households in urban areas). The survey instrument collected data on household and individual level factors, including: household demographics and socioeconomic status; education levels within the household; housing conditions; recent infant and child mortality; water, sanitation, and hygiene (WASH) practices; food security; women's dietary diversity; and coverage and consumption of fortified oil, wheat flour, maize flour, salt, and unfortified cooking fat and bouillon cubes. Cooking fat is mandated for fortification, but was not able to be tested using the methods available; however, the household coverage of fortifiable cooking fat is included because it is important to know for monitoring. Bouillon cubes are not currently mandated for fortification, but they could play an important role as a fortified staple food product if household coverage is high. Food samples of oil, wheat flour, maize flour, and salt were collected from participating households and analyzed quantitatively to determine fortification levels of select nutrients.

Three measures of coverage were assessed and are expressed as the proportion of sampled households covered. The measures are: consumption of a food (i.e. households report preparing the food at home); consumption of a fortifiable food (i.e. consumption of a food vehicle that was not made at home and is assumed to be industrially processed); and consumption of a fortified food (i.e. consumption of a food vehicle that is confirmed to be fortified). Three indicators of risk were used to assess the relationship between coverage and risk, which included: poverty (defined by the multi-dimensional poverty index (MPI)), rural residence, and lower women's dietary diversity (defined as less than the population median in each stratum (i.e. rural and urban) based on a score out of 10 food groups).

Two methods were used to estimate the amount of fortifiable foods consumed daily. For wheat flour only, an individual assessment of all women of reproductive age was conducted, which asked about frequency of consumption and portion size of wheat flour containing foods over the past seven days using a photo grid to assist with portion size determination. For all vehicles, a household assessment method was used, which asked household respondents about the last time they purchased the food vehicle, how much they purchased, and the length of time that amount typically lasts in the household. The Adult Male Equivalent (AME) method was used to apportion what amount women (among households that reported to consume the vehicle) apparently consumed of fortifiable foods. For both methods, the corresponding daily nutrient intake was determined by multiplying the amount of food consumed per day by a fortification level based on the quantitative food sample analyses. The daily nutrient intake was then translated into a percentage of the daily reference nutrient intake (RNI) for the women based on World Health Organization (WHO) and Food and Agricultural Organization of the United Nations (FAO) (2004) guidelines.

A total of 957 households responded nationwide with a survey response rate of 86.9% nationally (89.2% in rural areas, and 84.4% in urban areas). Nationally and in rural and urban areas, household consumption of oil, salt, and maize flour was high (over 85%) while household consumption of wheat flour, cooking fat, and bouillon cubes was lower (11.2%, 32.2%, and 34.7% respectively). The pattern of consumption of fortifiable oil, salt and wheat flour was very similar while consumption of fortifiable maize flour was significantly lower (42.4% nationally) due to the fact that much of the maize flour consumed is not industrially produced. The proportion of households consuming a fortified product was lower for all foods. The fortification of cooking fats and bouillon cubes was not assessed. Nationally, the proportion of households consuming a fortified food was 54.4% for oil, 8.5% for wheat flour, 6.5% for maize flour, and 93.3% for salt. In rural and urban areas the patterns were similar.

The fortification quality compared to Uganda national standards varied greatly by food vehicle. Among oil samples, 57.9% nationally, 61.7% in rural areas and 55.0% in urban areas were adequately fortified according to national standards. Among maize flour samples, 3.4% nationally, 2.6% in rural areas and 3.7% in urban areas were adequately fortified. Among salt samples, 80.6% nationally, 78.1% in rural areas and 83.3% in urban areas were adequately fortified according to Uganda National Standards. Classification of salt samples using the WHO recommended international guidelines for household samples found that 67.3% nationally, 70.6% in rural areas and 63.8% in urban areas were adequately fortified. Moreover, 29.9% of salt samples were above the WHO recommendations while less than 1% of salt samples were above the national standard.

Although there was no difference in the consumption of cooking oil or salt among the poor and non-poor households nationwide, significantly fewer poor households consumed wheat flour, maize flour, cooking fat, and bouillon cubes compared to non-poor households. The same was true for consumption of fortifiable and fortified oil, wheat and maize flour, as well as fortifiable salt, cooking fat, and bouillon cubes.

Significantly fewer poor households consumed wheat flour, maize flour, cooking fat, and bouillon cubes compared to non-poor households in rural areas. Moreover, in rural areas, significantly fewer poor households consumed fortifiable wheat flour and fortifiable cooking fat as well as fortified oil, fortified wheat and maize flour compared to non-poor households. In urban areas, there was no difference in the consumption of oil or fortifiable oil, but significantly fewer poor households consumed fortified oil compared to non-poor households. Also, significantly fewer poor households consumed wheat flour, fortifiable wheat flour, and fortified wheat flour compared to non-poor households in urban locations.

At the national level, significantly more WRA with a higher dietary diversity score consumed maize flour, fortifiable salt and fortified salt than WRA with a lower dietary diversity score. Among rural households, significantly more WRA with a higher dietary diversity consumed maize flour, cooking fat, and fortifiable cooking fat compared to WRA with a lower dietary diversity score. In urban areas, significantly more WRA with a higher dietary diversity consumed maize flour and cooking fat, as well as fortifiable maize flour and cooking fat compared to WRA with a lower dietary diversity score. Conversely, there were significantly fewer WRA with a higher dietary diversity score consuming fortified maize flour than WRA with a lower dietary diversity score in urban areas.

Using the individual assessment method for wheat flour products with photo grids, it was estimated that nationally, women consume 24.8 grams of wheat flour per day; in urban areas the intake was higher (47.3 grams/day) compared to rural areas (19.5 grams/day). Moreover, added iron from wheat flour was estimated to contribute to 2.6% of the iron RNI among women of reproductive age nationally. The added iron in wheat flour was estimated to contribute to 2.2% of the iron RNI in rural areas and 4.0% in urban areas. When households were separated by risk factors nationally and in rural and urban areas, women's iron RNI from wheat flour was

lower among those from households at risk of poverty compared to non-poor households, and among those with lower dietary diversity compared to those with higher dietary diversity.

Using the AME household assessment method, nationally, women of reproductive age apparently consumed 5.8 milliliters of fortifiable oil per day, 125.4 grams of wheat flour per day, 127.3 grams of maize flour per day, 8.0 gram of salt per day and 1.4 grams of bouillon cubes per day. Moreover, nationally, oil contributed to 18.1% of the vitamin A RNI, wheat flour and maize flour contributed 16.1% and 0%, respectively, to the iron RNI, and salt contributed 165.4% to the iodine RNI. In rural areas, oil contributed 17.1% of the vitamin A RNI, wheat flour and maize flour contributed 15.3% and 0%, respectively, to the iron RNI, and salt contributed to 169.9% to the iodine RNI. In urban areas, oil contributed to 24.5% of the vitamin A RNI, wheat flour, and maize flour contributed 2.7% and 0%, respectively, to the iron RNI; salt contributed to 140.3% to the iodine RNI. Overall, the nutrient RNI from oil and wheat flour among women of reproductive age (WRA) in non-poor households contributed to a significantly higher percentage of vitamin A RNI and iron RNI than WRA living in poor households. The opposite was true for iodine RNI in salt. WRA living in households with higher dietary diversity had a significantly higher percentage of vitamin A RNI from oil.

Nationally 10.4% of all respondents reported ever seeing the fortification logo. Fortified staple food products were observed by interviewers in each household to determine if the product was labeled as fortified or if it had a fortification logo on the original packaging. A fortification label, a fortification logo, or both were observed on 41.8%, 64.0%, 1.2%, 69.4%, and 58.3% of cooking oil, wheat flour, maize flour, salt, and cooking fat packages respectively.

In Uganda, there is high coverage of fortifiable oil and salt in all areas indicating high potential for impact from fortified foods to contribute significantly to nutrient intakes. Coverage of fortifiable wheat and maize flour is lower than other food vehicles, but there is high potential for impact among urban populations. Fortification adequacy remains a concern for all food vehicles except salt. Further efforts are needed to improve quality and enforcement to better address under and over fortification to maximize impact.

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3. ABBREVIATIONS

CDC	United States Centers for Disease Control and Prevention
EA	Enumeration Area
FACT	Fortification Assessment Coverage Tool
MOH	Ministry of Health
GAIN	Global Alliance for Improved Nutrition
PPS	Probability Proportional to Population Size
PSU	Primary Sampling Unit
RNI	Reference Nutrient Intake
SFNB	School of Food Technology, Nutrition and Bio-engineering
WRA	Women of Reproductive Age

4. BACKGROUND

A. Introduction

The burden of anemia and malnutrition is high in Uganda. Among children less than five years of age, 49% suffer from anemia, 33% are stunted, and 14% are underweight. Among women of reproductive age, 23% have anemia and 12% are too thin, while 19% are overweight or obese according to the Uganda Bureau of Statistics (UBOS) and ICF International (UBOS & ICF International 2012a). Vitamin A deficiency among children and women assessed using retinol binding protein enzyme immunoassay (RPB-EIA) on filter paper showed 38% of children 6-59 months and 36% of women of reproductive age had vitamin A deficiency (UBOS & ICF International 2012b). No nationally representative data are available for other deficiencies, but multiple micronutrient deficiencies often co-occur in low-income and-middle-income countries (LMICs) (Ruel & Alderman 2013) due to similar risk factors (Hendricks, Kruger & Puoane 2016). The available data suggest the risk is high for other vitamin and mineral deficiencies among vulnerable populations in Uganda.

The Uganda Food Consumption Survey was carried out in 2008 (Harvey, Rambeloson, & Dary 2010). The objective was to provide information about dietary intake patterns among women of reproductive age and young children so that policymakers could make evidence based decisions to address vitamin and mineral deficiencies in the country. Further, the survey examined intake of fortifiable food vehicles and modeled the potential effects of mass fortification of various vehicles. The survey identified important micronutrient intake gaps in Uganda, particularly for vitamin A, vitamin B12, iron, zinc, and calcium. Although vegetable oil was widely consumed all over the country, the survey found that wheat flour and products made from wheat flour were rarely consumed in rural parts of the country. Maize flour is processed in many small mills all over the country, and is only available seasonally; as such, there was low availability when the survey data were collected between May and September (Harvey, Rambeloson, & Dary 2010). The findings of that survey have informed the development of micronutrient policies in the country.

Currently there are several mandatory fortification policies in place to address micronutrient malnutrition in Uganda. Since 1994, national regulations require mass fortification of salt with iodine. Virtually all salt is imported into the country from Kenya and 99% of households have access to fortified salt (>15 ppm) as reported by the 2011 Uganda Demographic Health Survey (DHS) (UBOS & ICF International 2012a). The 2011 DHS measured iodine in salt using the rapid test kit, which is a qualitative assessment and does not provide quantitative information to determine if the salt is adequately iodized or contains excessive levels of iodine.

In 2011, with support from the Global Alliance for Improved Nutrition (GAIN), the Ministry of Health mandated fortification of wheat and maize flours with multiple micronutrients, and oils and fats with vitamin A (Table 1) (Uganda Gazette 2011; USAID et al. 2013). The industries mandated to fortify were those that produced at least twenty metric tons of product per 24 hour period for wheat and maize flour, and 10 metric tons per 24 hour period of edible oil and/or fat. In a July 2013 assessment, among the industries that met these criteria, eight of the 10 wheat millers were fortifying, and five were fortifying using the micronutrients in the Uganda National Bureau of Standards (UNBS); three of three maize millers were fortifying and two were following the UNBS standard; and lastly, five of the five oil producers were fortifying following the standard, and all had been doing so on a voluntary basis before the mandatory law was in place (USAID et al. 2013).

In addition to mandatory fortification of staple food vehicles, potential fortification intervention strategies at the sector level may also include distribution of fortified processed complementary foods and bio-fortified beans and sweet potatoes (Ministry of Health, 2016). Home fortification with micronutrient powders is also under development in eight districts for children 6 to 23 months of age.

Table 1. Micronutrients included in food fortification by item in Uganda (Ministry of Health, 2016)

Mandatory or voluntary	Food item	Micronutrients
Mandatory	Salt	Iodine
Mandatory	Cereal flour, such as wheat and maize	Vitamins A, B_{12}, B_1, B_2, B_6, niacin, zinc, iron, and folic acid
Mandatory	Vegetable oil and cooking fats	Vitamin A
Voluntary	Processed complementary foods, such as Corn-Soy Blends (CSB)	Multi-mix of vitamins and minerals
Voluntary	Bio-fortified beans and sweet potato	Iron (beans), provitamin A (sweet potato)

B. The Project

In 2015 the Ugandan Ministry of Health and GAIN, with technical support from the United States Centers for Disease Control and Prevention (CDC) and Makerere University, Department of Food Technology and Nutrition, School of Food Technology, Nutrition and Bio-engineering (SFNB) conducted a national large-scale fortification assessment survey in Uganda. The survey focused on assessing program coverage of fortified staple foods and potential contribution of fortified foods to the micronutrient intake of the population. The survey used the Fortification Assessment Coverage Tool (FACT) survey instrument that was developed by GAIN for carrying out coverage assessments of both population-based (large-scale food fortification) and targeted (e.g., point-of-use fortificants or supplements) programs (Aaron, 2014). The tool was developed to help stakeholders achieve greater program impact by assessing coverage.

5. RATIONALE

Mandatory large scale fortification policies have been in place for several years. The data from the Uganda Food Consumption Survey were collected more than seven years ago in 2008 and the Ugandan context and the mandatory fortification policies have changed dramatically since then. The lack of current information about household coverage (other than salt) or intakes of fortified foods or products made with fortified foods in the country are important information gaps. It is unknown how large scale fortification programs are performing, who benefits from fortification programs, and whether the most vulnerable populations are reached. A nationally representative household survey was proposed to help fill these information gaps and provide information for decision making by policy makers and program managers.

6. OBJECTIVES

A. General objective

The general objective of this cross-sectional survey was to determine the household coverage and potential contribution of fortified foods to the micronutrient intake among urban and rural households in Uganda and women of reproductive age (15 to 49 years).

B. Specific objectives

The specific objectives of the project were:

- To estimate the consumption of cooking oils, salt, wheat flour, maize flour and cooking fats among households and women of reproductive age (15 to 49 years).
- To assess the coverage of fortified cooking oil, wheat flour, maize flour, and salt among households.
- To measure levels of select nutrients in samples of cooking oil (vitamin A), wheat flour (iron), maize flour (iron), and salt (iodine) gathered at the household[1].
- To assess the contribution of fortified salt, wheat flour, maize flour, and vegetable oils to the intake of select nutrients in the diet of women of reproductive age (15 to 49 years).
- To evaluate indicators for other health and nutrition conditions to determine their association with the consumption of fortified foods. Such indicators may include:
    - Multi-dimensional poverty index
    - Women's dietary diversity

7. METHODOLOGY

A. Study design

The survey design was a cross-sectional, two stage, stratified cluster survey. It provided nationally representative estimates, as well representative estimates for urban and rural areas of Uganda.

B. Study population

The target survey populations included households and women of reproductive age (15 to 49 years). A person $\geq$15 years of age familiar with foods purchased for and prepared in the household was asked to complete the household questionnaire. All women of reproductive age (WRA) 15-49 years living in a selected household (including pregnant or lactating women) were asked to complete the female questionnaire. If no eligible woman was living in a selected household, only the household questionnaire was completed.

C. Sampling

The 2014 Uganda Population and Housing Census was used as the sampling frame. As defined by the Uganda Bureau of Statistics (UBOS) (2014), enumeration areas (EA) were used as the primary sampling units (PSU), stratified by rural and urban location. UBOS carried out the first stage of sampling and a total of 35 EAs from urban areas and 35 EAs from rural

[1] Fortification of cooking fat (oil in solid or semi-solid form that is obtained from plants or animals and used in cooking) and palm oil was not assessed.

areas (70 overall) were selected using population proportional to size (PPS) sampling. The 70 EAs were spread out in 51 districts across all regions of Uganda with an average of 1.4 EAs per district.

In each selected EA, survey teams updated maps obtained from UBOS to demarcate the survey boundaries. For the second stage of sampling, the total number of households in each EA was divided by 16 (rural) or 15 (urban) to generate the sampling interval for the rural or urban EA, respectively. Using a random start, the first household was selected and invited to participate in the survey. Subsequently, the remaining households were selected using the sampling interval and invited to participate. No replacement of EAs, households, or women of reproductive age was made. Ultimately, field teams collected data from 35 urban EAs and 34 rural EAs, as one rural EA was inaccessible due to hostility.

The sample size was based on the following assumptions per stratum: 95% confidence interval, 50% prevalence rate, precision of ± 6.5%, a design effect of 2.0, and 95% household response rate and individual response rate, yielding a target sample size of 489 women of reproductive age 15 to 49 years per stratum. Based on the 2011 Demographic and Health Survey (DHS), the average household size and proportion of the population of women of reproductive age varies by urban and rural setting. In urban areas, the average household size is 3.8 and 28% of the population are women of reproductive age 15-49 years. In rural areas, the average household size is 5.1 and 20% of the population are women of reproductive age. The average number of eligible participants per household was 1.064 in urban areas and 1.0047 in rural areas. Because of these differences, in urban areas, 15 households were to be visited per EA, and in rural areas 16 households were to be visited in order to achieve the target sample size of 489 women of reproductive age per stratum. However, after the first week of data collection, the sample size in urban areas was deemed inadequate due to a lower than expected response rate and the decision was made to select 16 households in the remaining urban EAs.

D. Data collection summary

Data collection involved two components. First, there was a household listing in all selected EAs in order to identify the number of households in order to complete the random selection of households (described above), which took place in July 2015. While in the districts for the household listing, there were also social mobilization activities at the district, sub-county, and community levels to ensure access to the communities. In addition, there was qualitative data collection in all EAs to identify food and recipe lists for foods made with fortified wheat and maize flour. Two focus group discussions were conducted in each District; one urban and one rural. The information from these focus group discussions were summarized across all EAs in survey districts to generate a final list of wheat and maize food products to include in the WRA questionnaire and develop photo grids of foods eaten and portion sizes. Essentially, the food products were similar across the survey districts with minor or no differences in preparation methods. The final list of foods made from wheat and maize flour are shown in the questionnaire in **Annex A**.

Second, the main FACT survey data collection took place in September to October 2015 and involved the collection of administered questionnaires for the household and all WRA, as well as the collection of food samples for laboratory analysis. Each questionnaire was administered after obtaining and documenting oral informed consent from the respondent(s) (**Annex a & B**). Participants were asked to provide a small sample of salt, wheat flour, maize flour, vegetable oil, available. A sample was not collected if 1) no sample was available or 2) the respondent reported they did not consume a food that would be produced through large scale fortification (e.g., food was grown and processed at home).

E. Questionnaires and supporting tools

<u>Questionnaires</u>

GAIN and CDC initially revised questionnaires developed from previous GAIN FACT surveys for this survey, and then SFNB further revised and adapted them to the Ugandan context.

Modifications were reviewed by GAIN and CDC prior to survey implementation. The final English copies of these questionnaires [Household questionnaire1 (HH1); Household questionnaire2 (HH2); and Women of reproductive age questionnaire (WRA)] are provided in **Annex A**.

Data collection for the household listing and FACT survey was conducted using paper questionnaires administered by interviewers from the respondents' own homes, in their own language. The questionnaires were translated into 11 major local languages: Ateso, Luganda, Lugbara, Lugisu, Luo, Lusoga, Ngakaramojong, Rukiga, Runyankole, Ruyoro, and Rutoro. Translation was done in two stages. Initially, translation was carried out by identified professionals with a background education in nutrition and health sciences who were also well grounded in their respective local languages. Further translation and translation revisions were carried out during the training of field teams after understanding the proper context of each question.

Food lists and photo grids

The FACT survey instrument included a food frequency questionnaire for WRA over a seven day recall period. Based on a protocol developed by GAIN, portion size photo grids were developed for foods made with wheat flour consumed in Uganda (**Annex C**). Maize flour food products were also planned to be included in the food lists and photo grids, but it was found that the only two main food products that were cooked with maize flour consisted primarily of maize and water. Briefly, food lists (**Annex D**) compiled during the household listing exercise were consolidated and harmonized for the entire country and used to develop the photo grids. Portions of the foods made with wheat flour that are typically consumed by WRA were re-created from the largest (e.g. one big serving of spaghetti or 10 samosas) to the smallest (e.g. a very small serving of spaghetti or half a samosa). Each typical portion was measured and recorded as a proportion of the largest portion (e.g. fourth of a slice of bread). Color photographs of each portion size were used to create one-page grids per food item. In order to facilitate the representation of the actual size, a spoon was used as a reference object and included in each photo (e.g. a spoon next to a slice of bread). Bound booklets of the food grids were color printed for each of the survey enumerators. A standard portion based on common sizes for sale in the local markets for each food was weighed and recorded in grams after the photo was taken for each food. In addition to the portion size photo grids, food type photo grids were generated to provide ease to the respondent to point out a particular type of food for the food products that had more than one variety; for example, a 1kg loaf of bread, a 500g loaf of bread, donuts, and buns. To make these grids, varieties of the same food were lined up and a spoon used to represent actual size of these foods. Photos were taken and a one-page photo grid of all types of a particular food item was created.

List of instruments and tools

A series of instruments and supporting tools were developed to facilitate field work and to ensure high quality field work. All tools were printed and bound in one booklet as a reference tool and visual aid for the enumerator:

- Household questionnaire 1 (HH1): asked questions on household demographics, asset ownership and housing characteristics;
- Household questionnaire 2 (HH2): asked questions on the use of fortified foods at household level;
- WRA questionnaire: asked questions on dietary diversity and consumption of fortified foods by WRA;
- Food lists: provided a list of commonly consumed foods containing wheat flour was created to help WRA assess food consumed in previous 7 days;
- Photo grid: showed pictures of foods to help WRA estimate consumption of foods frequently eaten in previous 7 days;
- Pricelist of fortified foods: prices for each fortified food (cooking oil, wheat flour, maize flour, salt, and cooking fat) were compiled based on quantity of product to help calculate standard metric measurements **(Annex E)**

- Training manual, project introduction and listing guides: provided field staff detailed steps in data collection;
- Checklists for team leaders and enumerators: provided detailed daily checklists to follow in the field;
- Field travel and data collection calendar: provided an overview of the travel schedule and work timeline;
- Cluster control form: listed the households selected for data collection in each EA that was updated by the team leader based on field results from each household;
- Household control form: provided an inventory and quick check tool for the team leader to ensure all questionnaires and samples were collected and forwarded to the survey coordinator. This form also served as a valuable resource during data cleaning.

F. Field staff recruitment, field team structure, and management

To ensure adequate capacity to select the most qualified final field team, applicants were required to have a university degree as a minimum qualification with preference for those with background in nutrition and health sciences. Resumes were received from over 150 applicants and 80 were invited for oral interviews. Interviews took place 19-20 June, 2015 at SFNB by a panel of the FACT survey technical team. Each candidate was scored separately by three people based on previous experience, local language ability, comprehension and analytical ability and previous survey experience. Scores were averaged and the best 60 candidates selected.

Training for the household listing occurred 1-7July 2015 and fieldwork for the household listing and sample selection took place from 8-18 July 2015. Thirteen field teams completed the listing within two weeks; each team consisted of three enumerators and one supervisor (total 56 people plus four additional substitutes).

The training for the main FACT survey was conducted from 28-31 July 2015 at Makerere University. All 56 people (supervisors and enumerators) who had participated in the household listing were invited for the main survey training. However, four people did not rejoin the team. Training was conducted by the core SFNB team and CDC Atlanta.

Compared to the household listing, the number of field teams for the main FACT survey was reduced to 11 teams to improve logistical efficiency, data quality supervision, and tracking. Each team consisted of three enumerators with one supervisor (total of 44 people).

For both the household listing and the main FACT survey data collection, the country was divided into four operational regions and a field coordinator was assigned to each region to oversee the activities of 2-3 field teams. All field staff had checklists to guide daily activities and ensure high quality data collection. Overall supervision was conducted by the four members of the FACT survey core research team.

A field travel calendar was developed to guide the data collection process and team movement. To ensure adequate supervision during the critical first days of data collection, team deployment in each sub-region was staggered by 2-3 days to allow the field coordinator to stay and shadow the team leaders and assist them in collecting data according to protocol guidelines.

Monitoring and supervision of the field work was done in real-time using a discussion and sharing forum set up on the WhatsApp mobile messaging application. All field supervisors and enumerators were connected to the forum and were encouraged to share their observations, challenges, and questions in the field. Feedback could be provided by all members of the technical team and field teams. This tool provided a real-time communication channel and it generated team work and motivation in the field.

G. Training and data collection procedures

Household listing training

The training for the household listing included three days of classroom work followed by field pre-testing, pilot-testing and a post-pilot review before survey implementation. During training, the team was taken through the FACT survey background, objectives and the specific purpose of the household listing and sample selection exercise. The core of the training involved explaining the listing tools and the listing guide. Teams were taken through systematic random sampling techniques and introduced to mapping using the actual maps for the target EAs obtained from UBOS. The two teams for Kampala (urban strata) conducted their pilot from two EAs in the urban Makindye Division. The rest of the teams carried out the field pre-test from Bombo, Luwero district, about 30 kilometres from Kampala, which offered a rural and semi-rural setting.

Household listing procedures in each district

A project introduction and field listing guide was given to each team to assist in carrying out their duties. Briefly, each team was tasked to take two days to complete the introduction of the survey at district, sub-county and village levels; conduct focus group to generate food and recipe lists of fortifiable food, and map out and visit all the households from within each EA boundary to create a list of all households.

On the first day, at the district level the field team leader and another field team member explained the survey and secured permissions from the District Chief Administration Officer (CAO) and the Resident District Commissioner (RDC). Each team then proceeded to the sub-county offices to introduce and sensitize these officials using letters endorsed from the district officials. Simultaneously, while the team leader and another team member went to introduce the survey at the district and sub-county offices, the remaining two team members collected information and compiled lists of foods made with wheat and maize flour in each district using focus group discussions with 5-7 people in each district... These two team members also visited local shops and markets to observe and document available food preparations and recipes.

On the second day, the field team proceeded to each selected EA village selected for the survey. Initially, they held a meeting with the village leader to explain the mapping and listing procedures. Using the EA map, they marked the boundaries of the EA and noted key features to confirm boundaries. The team systematically visited each household and listed it by head of household name. After listing all households in the village, the team randomly selected the initial household and then systematically selected the required households according to the sampling interval and protocol for urban and rural areas. The selected households were then revisited to establish additional basic information and complete a listing of all women of reproductive age in the household. Telephone contact details were collected for leaders and guides as well as selected households in each EA.

FACT survey training

A training program and schedule were developed to guide the training and a training manual was used to clarify the meaning of questions and field procedures. Training methods included power point presentations, discussions, demonstrations and role playing in English and local languages. After six days of classroom training, on the 5th of August 2015, the first pilot survey was carried out in Kinawataka zone, Nakawa Division of Kampala, a multi-ethnic community. After debriefing feedback and additional training, a second pilot survey was conducted on 11 August 2015 with teams divided between rural villages of Bombo, Luwero district and urban areas of Kyebando and Butabika parish in Kampala. Logistical and funding issues delayed the survey start date by two weeks.

FACT survey procedures in each district

Field data collection activities were conducted from 1-18 September 2015. Team leaders called the local leaders ahead of the field visit to share their field plans and to request their presence and assistance on the appointed days. Where possible, local leaders were

requested to alert the selected households about the field teams' arrival and intentions. Team leaders also called respondents directly by phone to arrange for interviews. At least two days were provided for each EA to allow for call back interviews for any households missed on the first day. Households were revisited up to two times before leaving the cluster. The main respondent for the survey (HH1 and HH2) had also been identified. Field teams had: 1) a sample list identifying the households by household number, 2) name of the household head, 3) name of the potential respondent, and 4) the expected number of WRA in the households.

The female responsible for food preparation in the household was identified as the respondent for HH1 and HH2. If the female head of the household was not present, another household member most knowledgeable about food preparation in the household was interviewed. The WRA questionnaire was administered to all available women between 15-49 years.

After each interview, available samples of the main type of salt, wheat and maize flours most commonly used in the household were collected in small plastic bags. Each specimen was labeled with the designated household food specimen label. In addition, if available in the household, one specimen of the most commonly used oil and fat was collected and stored in a plastic container with a secure lid.

Immediately upon completing data collection in each EA, the data were summarized on a master cluster control form which was sent electronically to the field supervision team. Information on the cluster control forms was then entered into a field monitoring sheet which showed the cumulative, consolidated data collection totals for the entire survey.

H. Data entry and management

Data entry and cleaning

Data for the Uganda FACT survey was entered using version 6.1 of CsPro (Census and Survey Processing System) a public domain software package from the US Census Bureau. The data were double entered and validated to reduce data entry errors. After five days of training, a team of eight people entered data from 17 to 28 September 2015. Data were re-entered from 21 September to 6 October 2015 for validation. The two datasets were then compared and verified. The data were then exported to the SPSS software (version 18.0) for further cleaning. Final datasets were submitted to GAIN in October 2015.

Data Quality

Multiple levels of data quality checks were conducted. Each team had a team leader whose main task was editing questionnaires for errors and inconsistencies. The team leader also accompanied each enumerator to observe them during interviews and remedy any errors in interviewing skills and food sample collection either immediately or later during a general re-training activity. Team leaders were also tasked to vigilantly retrieve questionnaires from enumerators immediately upon completion of each interview and review them (edit) for errors and immediate corrections. Team leaders were also asked to back-check 10% of all household interviews (about 2 households) for each enumeration area. In addition, the field coordinators were asked to carry out 100% review and editing of questionnaires for the first EA of each team and generate an error log for each enumerator and the whole team. They were then expected to summarize any errors into systematic and random errors for field re-training of teams as necessary. The cluster control form was used to summarize data collection for each EA and provided a full account of any household or WRA interviews that were not completed to ensure that all interviews that could be done would be completed. All data quality control measures and checks were outlined in the various field checklists for enumerators, team leaders, and field coordinators. As part of data quality monitoring and assurance, field teams were visited by a GAIN technical specialist during the first week of data collection. Routine visits were also conducted by the technical team on several occasions throughout the data collection period to review performance and adherence to protocol.

Storage and shipment of food samples

Food samples were collected from the field in two batches (after 1 week of data collection and at the end of data collection) and were kept in black plastic bags out of the light. This was to ensure that samples did not deteriorate under field conditions or get misplaced. They were transported to Makerere University and stored in a cool room in black plastic bags at the SFNB until final preparation and shipment. After a courier was solicited and the required certification was obtained, the samples were systematically sorted and packaged cording to guidelines provided by GAIN. In addition to food samples collected from survey households, 100 gram samples of unfortified maize (n=4) and wheat flours (n=4) from eight separate local manufacturers in Kampala were collected and shipped to enable testing of natural/intrinsic micronutrient content. These manufacturers were a convenience sample of unfortified flour from shops and manufacturers able to provide unfortified samples in Kampala. All samples were shipped out to BioAnalyt Lab in Germany using DHL Courier services on the 7 October 2015.

I. Data analyses

Data analyses were completed using SAS version 9.4 (SAS Institute, Cary, NC USA) statistical analysis software with statistical significance set at $p < 0.05$. Descriptive statistics were applied to assess the structure of the variables and indicators within each stratum and the entire country and are presented as mean (95% Confidence Interval (CI)), median (25th percentile, 75th percentile), or percentage (95% CI). For categorical variables, the statistical significance of associations between categorical variables and coverage of fortified foods was assessed using adjusted chi-square. For continuous variables, adjusted student's t-test was used to compare between two groups. The Wilcoxon rank sum test was used to compare median differences across categories. Sampling weights for national level data were applied to account for unequal rural-to-urban population composition using the 2014 national census data as the auxiliary population. Calculations for key variables are in **Annex F**, including for household dependency ratio, dietary diversity score, multidimensional poverty index, household food insecurity, and fortifiable food consumed, fortified food consumed, unfortified food sample, reported positive attributes to logo, percent recommended nutrient intake, and apparent food consumption.

Survey design effects and weighting

The PSUs were selected as enumeration areas (EAs). As defined by the Uganda Bureau of Statistics (UBOS) in the census sampling frame, a total of 70 EAs were selected (35 EA urban and 35 EA rural areas) were selected using population proportional to size (PPS) sampling. Strata specific response rates for the household survey #2 (regarding fortification coverage) were very high, thus no weighting was needed when calculating strata-specific estimates, as per protocol. For national analyses however, rural to urban composition ratio was uneven (4.4 rural households for every urban household), thus specialized weighting was needed in order to generate nationally representative estimates when analyses were done using pooled rural and urban data. This was achieved by post-stratification weighting using the Uganda 2014 census data as the auxiliary population (UBOS, 2014). The following notation was used:

$$\boldsymbol{National\ Sampling\ Weight} = \frac{\textbf{Census Population}_{\boldsymbol{strata\_i}}}{\boldsymbol{NFACT}_{\boldsymbol{strata\_i}}}$$

where strata_i denotes rural or urban census area, and NFACTstrata_i represents the realized final sample size for the said strata. Subsequent national estimates were weighted with Taylor expansion series variance estimation (Korn & Graubard 1991). Complex survey design effects were accounted for by nesting EA within strata (i.e. rural or urban residence), in addition to the weighting, where appropriate. Clustering of effects of multiple women from a household was not statistically accounted for (via random intercepts or estimation equations) as dietary diversity score of one woman was randomly selected and assigned to the household.

Definition of key variables

Key outcome variables were fortification coverage followed by nutrient intakes from fortified food. Nutrient intakes were estimated for women of reproductive age (WRA) using two different methods: 1) an individual assessment using a photo grid method for wheat flour-containing foods consumed over the past seven days, and 2) a household assessment using the adult male equivalent method (AME) for all food vehicles based on reported amounts purchased and duration they lasted in the household. Additionally, two stratifying variables were constructed: poverty risk and women's dietary diversity score.

Fortification coverage

Three variables were crafted to assess fortification coverage. They were as follows:

a) **Consumes food**: Household reports preparing the food at home, regardless of whether or not it is fortified.
b) **Consumes fortifiable food:** Household reports consumption of a food vehicle that was not made at home and is assumed to be industrially processed
c) **Consumes fortified food:** Household reports consumption of a food vehicle that is known to be fortified and is confirmed by quantitative laboratory testing of the household sample or if no sample was available, analyses of sample from the reported brand. Refers to analyzed foods confirmed to contain nutrients above the fortification threshold (i.e. at the level of under fortified or higher) as follows:
    - In households where a food sample was taken and laboratory-analyzed, if the sample was above the intrinsic/naturally occurring level for iron (i.e. wheat flour ≥35.0 mg/kg iron and maize flour ≥15.0 mg/kg) the household was classified as "yes" for consumes fortified foods. If the sample did not meet the criteria, then the household was classified as "not fortified" for consumes fortified food for each of the food types assessed. For example, intrinsic iron values were estimated from unfortified wheat/maize flour samples (obtained from the mills). The mean of iron content of these unfortified flour was then calculated by the laboratory as the intrinsic/or naturally occurring iron. Four samples for unfortified wheat flour and four samples from unfortified maize flour were lab tested for intrinsic iron.
    - In households where a food sample was not taken and the brand name was available, the median nutrient value in the branded samples analyzed from other households in the same stratum was used. If the value met the fortified criteria then the household was classified as "yes" for consumes fortified food. If it did not meet the criteria, then the household was classified as "not fortified" for consumes fortified food.
    - In households where a food sample was not taken and the brand name was not available, the household was classified as "don't know" for consumes fortified food.

Daily wheat flour consumption (Photo-Grid Method) and micronutrient contribution to Reference Nutrient Intake (RNI)

The individual assessment (using the photo-grid method) was used to determine the RNI contribution from wheat flour only. This method targeted only women who completed the WRA questionnaire and included wheat flour foods that could be consumed at home and also outside of the house. Women were asked to report whether they consumed any of the 12 wheat flour containing foods on the list in the last seven days (see female questionnaire in **Annex A**). For foods they consumed, the frequency (number of times) was asked and the portion size was estimated using photo grids for each food (see photo grid example in **Annex C**). The grams of flour in each portion size were multiplied by the frequency consumed to estimate the amount of flour consumed by women per week, and then divided by seven to

calculate intake per day. A cumulative total of wheat flour consumed in grams per day was obtained by summing all food items containing flour for women per day. For any of the 12 foods a woman did not consume or for missing (i.e. frequency or portion size), the grams consumed for that food item were assigned a 0.

Because the analyses of iron content in wheat flour does not allow for differentiation of added and natural (intrinsic) iron, intrinsic iron amounts were deducted before analyses. The intrinsic iron content of unfortified wheat flour was first determined to be <35 mg/kg and this was deducted from the total iron for wheat flour to obtain added iron content. This amount was then subsequently used in calculating %RNI contribution using both the AME and individual assessment/photo methodology.

To quantify %RNI contributed by the fortified wheat flour foods consumed by WRA *per day, (via photo grid method)*, the grand median of the added iron content of all wheat flour samples (both branded and unbranded) per stratum was multiplied with the amount of flour each woman consumed daily to estimate the daily amount of iron consumed. The grand median added iron was estimated as the population median iron (mg/kg) in all laboratory analyzed wheat flour and was calculated for separately for urban and rural specimens. This approach was adopted as wheat flour foods consumed by the WRAs comprised of those prepared at home (may be branded or unbranded, or unfortified), and those purchased/eaten outside of the home (also branded or unbranded, or unfortified). Median iron content was considered a more robust estimate (as opposed to the mean) as it less influenced by outlying/extreme values. It is thought to be a good estimate as it could account for large variations in iron content across flour mills; or from the same mill but with different iron premix sedimentations in a single wheat flour bag.

The % RNI met was then calculated as follows: amount of nutrient consumed from each food/RNI x 100%. For iron, the RNI for women assumed a 12% bioavailability and was based on World Health Organization (WHO) and FAO thresholds as follows): 25.8 mg/day (15-18 years), 24.5 mg/day (19-50 years), 24.5 mg/day (pregnant women), 12.5 mg/day (lactating women), (WHO/FAO 2004).

<u>Daily apparent food consumption (using the AME method) and micronutrient contribution to RNI</u>

The daily apparent food consumption (using the AME approach) was used to calculate the RNI from fortified foods among women in the household that consumed any of the four food vehicles (oil, salt, wheat, and maize flour) at home. The reported amount of food purchased and the duration it lasted for each household were used to calculate daily apparent consumption of each food per household. Local measurements for each food were converted into metric units and duration into days as needed, to derive the apparent daily consumption (i.e. grams/day). The AME food amount apparently consumed/day for WRA was estimated as the product of the amount of household food apparently consumed/day and the household AME fraction for WRA (i.e. household consumption g/day x WRA individual AME).

Outlier values:

AME amount of foods consumed per day per woman were explored using Tukey's outlier criteria (Tukey, 1977) and based on the interquartile (IQR) range of the empirical distributions per strata for each food vehicle. Values outside ± 1.5*IQR of the lower, and upper quartiles were considered outliers. AME values above 324.7g/day for wheat, 357.9 g/day of maize meal, 29.4ml/day of oil, and 19.4 g/day of salt for a woman in urban areas were considered outliers and excluded from subsequent descriptive analyses. Similarly, for rural areas, 489.1 g/day of wheat flour, 436.1 g/day of maize meal, 19.7 ml/day of oil and 21.6 g/day of salt were also considered outliers and excluded from subsequent descriptive analyses.

The WRA individual AME fraction was estimated as the woman's AME divided by the sum of AME values of all household members. Each member on the household roster was assigned a different AME fraction based on their age and sex, with males 18-30 years assigned a value of 1.0. Box 3 lists the AME fraction for all age and sex groups. The individual AME fraction

for each WRA in the household was multiplied with the daily amount of the food apparently consumed by the household to estimate apparent food consumed for each WRA. For example, in a family composed of one male 25 years of age, one woman 20 years of age, and one baby less than 1 year, their AME values are 1.0, 0.786885246, and 0.216721311, respectively. When summed up, this results in a household AME of 2.003606557. The WRA AME fraction in this household is 0.392734413 (i.e. 0.786885246/2.003606557). If the reported household wheat flour consumption was 100 grams/day, the apparent WRA flour consumed is 39.27 grams/day (i.e. 100 grams/day flour x 0.392734413). Thus, the AME food amount apparently consumed/day for WRA was estimated as the product of the amount of household food apparently consumed/day and the household AME fraction for WRA (i.e. household consumption g/day x WRA individual AME).

Box 3. The adult male equivalent (AME) fractions assigned to household members based on their sex and age (Sununtnasuk, 2013).

ADULT MALE EQUIVALENT		
MALE	AGE (y)	FEMALE
0.216721311	0-1	0.216721311
0.311475410	1-2	0.278688525
0.368852459	2-3	0.344262295
0.409836066	3-4	0.377049180
0.442622951	4-5	0.409836066
0.483606557	5-6	0.434426230
0.516393443	6-7	0.467213115
0.557377049	7-8	0.508196721
0.598360656	8-9	0.557377049
0.647540984	9-10	0.606557377
0.704918033	10-11	0.655737705
0.770491803	11-12	0.704918033
0.836065574	12-13	0.745901639
0.909836066	13-14	0.778688525
0.983606557	14-15	0.803278689
1.040983607	15-16	0.819672131
1.090163934	16-17	0.819672131
1.114754098	17-18	0.819672131
1	18-30	0.786885246
0.967213115	30-60	0.770491803
0.803278689	60-150	0.688524590

The next step was to estimate the nutrients contributed by the fortified food apparently consumed by WRA. The nutrients assigned to each household's food were as follows:

a) If a food sample was taken from the home and analyzed, the nutrient value measured in the food sample was assigned to the household (e.g. 25 mg/kg iron in wheat flour).
b) In households where a food sample was not taken and the brand name was available, the median nutrient value out of all the samples analyzed from that brand that were collected from other households was used in that strata.
c) In households where a food sample was not taken and the brand name was not available (fortification unknown), the median nutrient value in the unbranded samples analyzed from other households in that strata was used.

The nutrients consumed from these foods were then expressed as a percentage of the nutrient RNI as noted by WHO/FAO (2004). The iron RNI for women, assuming 12% bioavailability, was as follows: 25.8 mg/day (15-18 years), 24.5 mg/day (19-50 years), 24.5 mg/day (pregnant women), 12.5 mg/day (lactating women). The vitamin A RNI for women is as follows: 600

micrograms retinol equivalents (mcg RE)/day (15-18 years), 500 mcg RE/day (19-50 years), 800 mcg RE/day (pregnant women), and 850 mcg RE/day (lactating women). The iodine RNI for women was as follows: 150 µg/day (15-18 years), 150 µg/day (19-50 years), 200 µg/day (pregnant women), and 200 µg/day (lactating women). For women who were both pregnant and lactating, the pregnancy RNI was used for all nutrients. The percent of RNI met was calculated as follows: amount of nutrient consumed from food / nutrient RNI x 100%. The pregnancy and lactation status of all women in the household was not known, as not all women in the household were necessarily available to participate in the survey. This information was only known for the subset of women who answered the WRA questionnaire. Thus, all non-surveyed women (who were listed on the household roster) were assumed to be non-pregnant and non-lactating.

Multidimensional Poverty Index (MPI)

The MPI is adapted from Alkire and Santos (2013) and is derived from three domains: living standards (mpiS), household education (mpiED), and health and nutrition (mpiHN). The household living standard score was based on six variables: no electricity, inadequate flooring, inadequate cooking fuel, < 2 key assets owned, unsafe drinking water, and inadequate toilet sanitation). If affirmative, each living standard variable got a score of 1/18. The household education dimension was based on two variables: household head had less than five years of education and any school age child was not attending school. If affirmative, each education variable was scored 1/6. For households without a school age child the household was assigned a non-affirmative score 0/6. For health and nutrition, the domain was based on three variables: hunger (calculated using the household hunger index), recently born child died, and poor access to preventative services. All affirmative responses were given a score of 1/9. Next the scores from each domain were summed (i.e. mpiLS + mpiED + mpiHN) to obtain a maximum score of 1. Households with an MPI score greater than or equal to 0.33 were defined as at "at-risk of acute poverty" (poor) while households with an MPI less than 0.33 were classified as "non-poor".

The household hunger index instruments and scoring were adapted from Deitchler et al. (2010), Ballard et al. (2011), and Deitchler et al. (2011). The hunger score was calculated as a household cumulative sum of responses to 3 questions on "lack of food", "insufficient food over the past month", and "insufficient food (day and night)".

Women's dietary diversity score

The dietary diversity instrument and scoring were based on the 10 point score (FAO and FHI 360, 2016). Women were asked about their consumption of 18 food groups over the previous 24 hours. These responses were then scaled into a 10 point scoring system based on the following 10 food groups: 1) all starchy staple foods; 2) beans and peas; 3) nuts and seeds; 4) dairy; 5) flesh foods; 6) eggs; 7) vitamin-A rich, dark, green, leafy vegetables; 8) other vitamin-A rich vegetables and fruits; 9) other vegetables; 10) other fruits

If a woman consumed a food from a food group, she received a score of 1 for the food group and a maximum of 10 if she consumed foods from all of the food groups. This summary score (0-10) was the woman's dietary diversity score. A woman's score less than the population median in each stratum (i.e. rural or urban residence) was classified as "lower dietary diversity (below the median)", otherwise it was termed "higher dietary diversity (at or above the median)".

To obtain the proportion of women that consumed plant sources of vitamin A, a woman had to have consumed in the last 24 hours a food from either food groups 7,or 8; for animal sources of vitamin A groups 4, 5 or 6; and for iron rich foods and for zinc rich foods groups 5.

Fortification quality

Foods were analyzed by BioAnalyt in Germany to determine fortification levels (see methodology in **Annex G**). The testing method to determine iron levels in wheat and maize flour measures only total iron content and does not provide specific iron levels for intrinsic

(natural) iron and added sodium iron EDTA (NaFeEDTA) when determining the amount of iron in fortified wheat or maize flour. Analyses determined that the intrinsic iron level for samples of non-fortified wheat flour was <35.0 mg/kg iron and non-fortified maize flour <15.0 mg/kg iron based on measuring four samples of non-fortified wheat flour and four samples of non-fortified maize flour.

Fortification quality for oil was determined by analyzing the vitamin A levels in samples collected from households complying with the 2012 Uganda Standard (UNBS 2012). "Unfortified" had <3.0 mg RE/kg vitamin A, "inadequately fortified" had 3.0 to <20.0 mg RE/kg vitamin A, "adequately fortified" had 20.0 to <40.0 mg RE/kg vitamin A and "above standard" had ≥40.0 mg RE/kg vitamin A. Red palm oil was not included in these analyses because it is not required to be fortified in Uganda and was considered not fortifiable.

Fortification quality of wheat flour, maize flour and salt were assessed by laboratory analysis of nutrients in food specimens collected from the households using cut-offs based on the 2006 Uganda National Standards (UNBS 2006a; UNBS 2006b; UNBS 2006c). This survey was conducted during the grace period before industry was mandated to implement the 2012 standards in January 2016.

Fortification quality for wheat flour was determined by analyzing the iron levels in samples collected from households complying with the 2006 Uganda Standard (UNBS 2006a). "Unfortified" had <35.0 mg/kg iron, "inadequately fortified (below standard)" had 35.0 to <50.0 mg/kg iron, "adequately fortified (at standard)" had 50.0 to <80.0 mg/kg iron and "above standard" had ≥80.0 mg/kg iron. If the sample was above the intrinsic level for iron (i.e. wheat flour ≥35.0 mg/kg iron) the household was classified as "yes" for consumes fortified foods. If the sample did not meet the criteria, then the household was classified as "not fortified" for consumes fortified food.

Fortification quality for maize flour was determined by analyzing the iron levels in samples collected from households complying with the 2006 Uganda Standard (UNBS 2006b). "Unfortified" had <15.0 mg/kg iron, "inadequately fortified (below standard)" had 15.0 to <30.0 mg/kg iron, "adequately fortified (at standard)" had 30.0 to <45.0 mg/kg iron and "above standard" had ≥45.0 mg/kg iron. If the sample was above the intrinsic level for iron (i.e. maize flour ≥15.0 mg/kg) the household was classified as "yes" for consumes fortified foods. If the sample did not meet the criteria, then the household was classified as "not fortified" for consumes fortified food.

Fortification quality for salt according to national standards was determined by analyzing the iodine levels in samples taken from households complying with the 2006 Uganda Standard (UNBS 2006c). "Unfortified" had <7.6 ppm iodine, "inadequately fortified (below standard)" had 7.6 to <30.0 ppm iodine, "adequately fortified (at standard)" had 30.0 to <80.0 ppm iodine, and "above standard" had ≥80.0 ppm iodine.

Additionally, fortification quality for salt according to international (WHO) guidelines was determined by analyzing the iodine levels in samples taken from households complying with WHO, UNICEF, ICCIDD, 2008. "Unfortified" had <7.6 ppm iodine, "inadequately fortified (below standard)" had 7.6 to <15 ppm iodine, "adequately fortified (at standard)" had 15 to <40 ppm iodine, and "above standard" had ≥40 ppm iodine.

Some oil and salt samples were missing rural/urban labels and were only analyzed at the national level; aggregating the number of rural and urban samples that were missing labels will not add up to the total number of national samples analyzed.

J. Ethical considerations

Ethical approval for the FACT survey was granted by the Higher Degrees, Research, and Ethics Committee of the School of Public Health, College of Health Sciences, Makerere University. The research permits and apex approvals were granted by the Uganda National Council for Science and Technology (UNCST). Enumerators read the informed consent verbatim to all survey respondents. All respondents gave voluntary oral informed consent before participating in any data collection **(Annex B)**.

K. Limitations

There were several limitations of the project that are outlined below:

a) The fortification program in Uganda includes fortificants other than iron in wheat and maize flour (e.g. they are both also fortified with folic acid and vitamin B12). In this survey, only iron was assessed in wheat and maize flour and served as a "marker" to reflect likely fortification of other micronutrients and folic acid. Laboratory testing was conducted on all food samples collected in the households except for cooking fat.

b) The two methods used to assess dietary intake of iron-fortified foods use self-report and have limitations that could affect the estimated contribution of fortified foods to nutrient intakes. Self-reporting can introduce recall bias, as people were asked to recall the amount of foods they purchased and consumed. The use of the adult male equivalent (AME) methodology to estimate apparent consumption of foods and nutrients has recognized limitations, due to the extrapolations of household purchases to consumption, and of assuming that intra-household food distribution is the same in all households based on the person's age, sex and physiological status (Imhoff-Kunsch, Flores, Dary, & Martorell 2012). The photo grid methodology uses a short food frequency questionnaire and is subject to the limitations including systematic error and interviewer bias (Thompson et al., 2015). It should be noted that the FACT survey tool has not been compared with other methods of dietary intake. The photo grids and recipes used to estimate the intake of wheat flour-based foods were not validated.

c) When more than one woman of reproductive age answered the dietary diversity information per household, the dietary diversity score of one woman was randomly selected and applied to the household. The method did not take into account intra–household clustering of dietary habits of women within the same household. One randomly selected woman's dietary diversity may not reflect the pattern of multiple family members within a household.

d) Using the grand median added iron levels from household wheat flour samples when calculating the RNI contribution in the individual assessment is a limitation as household samples do not necessarily capture the variety of wheat flour types used in wheat flour products purchased and consumed away from the home. Moreover, due to the small number of wheat flour samples collected and analyzed (i.e. 47) for many brands, the reliability of brand specific information per household was limited. As a result, the grand median level was used for all women as an estimate of what consumers on average are likely to consume. Analysis of wheat flour samples collected at market level may have been more representative of fortification levels in wheat flour however that was beyond the scope of this survey. Also, while the use of the median maybe robust statistical estimate (relative to the mean), it does not capture disproportionate distribution of flour mills, and their market share in relation to fortification standards.

e) The definition of 'fortified' food for a household was based on the median nutrient of the brand the household reported to consume when food samples were not collected. This is subject to recall bias as more popular brands are more likely dominate responses.

f) The term ‘fortified’ for wheat and maize flour was based on the nutrient content above the ‘intrinsic value’ for both these foods. Unfortunately, only a small number of unfortified samples were used to determine this intrinsic value, four samples for wheat flour and four samples for maize. These were not representatively collected samples and were all collected in the Capital City of Kampala. The intrinsic iron identified during this survey may vary from the intrinsic content measured at another time or with more samples. It is also possible that with more than 15 different varieties of maize in Uganda (African Seed Trade Association, 2013), the iron content also differs with each flour variety.

g) For some foods, the amount purchased was reported in non-metric units (e.g. milk tin) and the estimate of the grams or milliliters in that unit was not reliable.

h) The womens’ questionnaire for women 15-49 years of age did not ask each woman’s specific age, and although there were some 15 to 17 year olds in the survey, the RNI was based on women 18-49 years of age.

i) Labelling of the collected food samples followed a systematic process but unfortunately several of the food samples were unlabeled, so it was not possible to link the food sample to the household or determine if the food sample came from the urban or rural stratum. The results from the two unlabeled oil specimens and two unlabeled salt specimens contributed only to the national fortification standards estimates. The AME method did not screen out those households that were storing staple food items in their house for multiple households or storing staple foods to be later sold at a local shop. If the household consumption levels were within the acceptable range for family members to consume the product, it was assumed that the household members were consuming the quantity of food within the time period reported in the interview. An attempt to prevent this bias was made through exclusion of consumption values >1.5*IQR the upper quartiles.

j) Using the icheck instrument for measuring vitamin A in oil has a lower precision and accuracy than using the high-performance liquid chromatography (HPLC) (Renaud, Berger, Laillou, & Avallone 2013). The iCheck instrument has been validated only using fine salt and the performance may be lowered if coarse salt is used (as is common in Uganda). Foreign substances could also influence the performance of the icheck for salt (Rohner et al. 2012). While the icheck has been validated for testing iron content in flour by industry, there are currently no publications validating this method.

8. RESULTS

Response rates

The response rate for Household Questionnaire 1 and 2 was 86.9% and 86.2% (**Table 2**). The respondent for Household Questionnaires 1 and 2 occasionally varied as the respondent for Household Questionnaire 1 required knowledge related to household characteristics while the respondent for Household Questionnaire 2 required content knowledge related to household food preparation and use.

Table 2. Response rate for different components of the survey.

Questionnaire	Sample size		Reasons for non-response
	Planned[1] N	Interviewed N (%)	
Household questionnaire 1[2]	1,101	957 (86.9%)	Refused, n=12; No eligible respondent at home, n=68; Person incapacitated or intoxicated, n=3; Dwelling vacant for an extended period, n=12; Household has permanently moved, been destroyed, or is not a dwelling, n=29; Other, n=20.
Household questionnaire 2[3]	1,101	949 (86.2%)	Refused, n=2; No eligible respondent at home, n=5; Other, n=3.
WRA	1,135	965 (85.0%)	Refused, n=4; No eligible respondent at home, n=161; respondent incapacitated or moved, n=4; Other, n=1

[1] These are the number that were planned to be visited, based on sample size calculations.
[2] Household questionnaire 1 asked about the household roster; birth history of women in household; household characteristics; water, sanitation and hygiene; and health services access.
[3] Household questionnaire 2 asked about household hunger; coverage of several fortified foods; and fortification logo knowledge and influence.

Household characteristics

The median household size was 4.7 nationally and 5.0 for both rural and urban households (**Table 3**). The household dependency ratio was 1.0 both nationally and in rural households indicating an equal proportion in the number of dependent household members (those below 15 years and above 64 years) and independent household members (those 15-64 years). The dependency ratio was significantly lower among urban households (0.8), indicating fewer dependents per independents in urban households. Less than 25% of all households were female-headed nationwide, and in rural and urban areas. The nationwide average age of the household head was 42.5 years; average age was significantly higher in rural settings.

Table 3. Summary of household characteristics.[1]

Characteristic	National N=949	Rural N=509	Urban N=440	p-value[6]
	Median (25%, 75%), % (95% CI), or mean (95% CI)	Median (25%, 75%), % (95% CI), or mean (95% CI)	Median (25%, 75%), % (95% CI), or mean (95% CI)	
Household size[2]	4.7 (3.1, 6.6)	5.0 (4.0, 7.0)	5.0 (3.0, 6.0)	0.680
Household dependency ratio[2,3]	1.0 (0.5, 1.7)	1.0 (0.5, 2.0)	0.8 (0.3, 1.3)	<0.0001
Female-headed household[4] (%)	19.4 (16.3, 22.5)	18.5 (15.1, 21.8)	24.1 (20.1, 28.1)	0.6454
Age in years of head of household[5]	42.5 (41.5, 43.5)	44.3 (42.9, 45.7)	40.5 (39.2, 41.8)	0.0009

Abbreviation: CI= confidence interval

[1] All values are median, percent or mean as indicated and adjusted for probability of selection by PPS. National values are weighted.

[2] Median (25%, 75%).

[3] Household dependency ratio = Number of household members below 15 years of age and above 64 years of age / Number of household members between 15 and 64 years of age.

[4] Percent (95% CI).

[5] Mean (95% CI).

[6] Wilcoxon rank sum test was used to compare median values for continuous variables. *P-values based on rural vs. urban differences with adjustment for complex survey design effects.*

Characteristics of women of reproductive age

Women who participated in the WRA questionnaire were, on average, approximately 30 years old (**Table 4**). In rural areas, 12.1% were pregnant while 9.0% were pregnant in urban settings. Approximately one quarter of the female population surveyed was lactating with a significantly higher percentage breastfeeding in rural settings (29.2%) than in urban areas (20.1%).

Table 4. Summary characteristics of women of reproductive age who participated in the WRA questionnaire.[1]

Characteristic	National N=965	Rural N=517	Urban N=448	p-value[4]
	Mean (95% CI), or % (95% CI)	Mean (95% CI), or % (95% CI)	Mean (95% CI), or % (95% CI)	
Age in years[2]	30.1 (29.5, 30.7)	30.4 (29.5, 31.2)	29.8 (29.0, 30.6)	0.6454
Pregnant[3]	11.6 (9.1, 14.0)	12.1 (9.3, 14.9)	9.0 (6.4, 11.7)	0.1269
Lactating[3]	27.7 (23.4, 32.0)	29.2 (25.3, 33.1)	20.1 (16.4, 23.8)	0.0011

Abbreviation: CI, confidence interval

[1] All values are mean or percent as indicated and adjusted for probability of selection by PPS. National values are weighted.

[2] Mean (95% CI).

[3] Percent (95% CI).

[4] P-values based on rural vs. urban differences with adjustment for complex survey design effects.

Households at risk of poverty

An estimated 63.4% of Ugandan households at the national level were classified at risk of acute poverty based on the MPI (**Table 5**). MPI is constructed from indicators categorized into three domains: living standards, household education, and health and nutrition. The findings were significantly worse in rural settings compared to urban settings for almost all indicators in each of the three domains. The results showed that 69.4% of households in rural settings were classified at risk of acute poverty compared to 33.4% of urban households.

Households living in rural communities fared significantly poorer than urban households on almost every indicator of poverty. There were insignificant rural and urban differences for only two indicators; these included "any household member 5-14 years not currently attending school," which is a component of the education domain, and "moderate to severe household food insecurity", which is part of the health and nutrition domain.

Table 5. Multidimensional Poverty Index (MPI) and the variables that compose it.[1]

MPI and components	National N=949	Rural N=509	Urban N=440	p-value[6]
	% (95%CI)	% (95%CI)	% (95%CI)	
At risk of acute poverty (MPI >0.33)	63.4 (57.3, 69.6)	69.4 (65.3, 73.4)	33.4 (29.0, 37.8)	<0.0001
Living standards component				
No electricity	78.0 (73.9, 82.1)	84.7 (81.5, 87.8)	44.1 (39.4, 48.7)	<0.0001
Use solid cooking fuel[2]	99.2 (98.6, 99.8)	99.6 (99.1, 100.0)	97.0 (95.5, 98.6)	0.0016
Floor made with earth, sand, mud, or dung	68.4 (62.2, 74.5)	77.0 (73.3, 80.7)	24.5 (20.5, 28.6)	<0.0001
No safe drinking water, or safe water source >30 min walk round trip	85.9 (81.5, 90.3)	94.1 (92.1, 96.2)	44.3 (39.7, 49.0)	<0.0001
Toilet not improved[3], or is improved but shared with another family	66.4 (61.3,71.5)	68.6 (64.5,72.6)	55.7 (51,60.3)	<0.0001
< 2 household assets[4]	7.9 (3.4. 12.4)	8.8 (6.4, 11.3)	3.2 (1.5, 4.8)	0.0003
Education component				
Household head < 5 y education	17.8 (13.1, 22.5)	19.8 (16.4, 23.3)	7.5 (5.0, 10.0)	<0.0001
Any household member 5-14 years NOT currently attending school	34.6 (30.4, 38.7)	33.8 (29.7, 37.9)	38.4 (33.8, 43.0)	0.1393
Health and nutrition component				
Moderate to severe household food insecurity	13.9 (9.9, 17.8)	14.1 (11.1, 17.2)	12.5 (9.4, 15.6)	0.4578
A child ≤5 years died in past 5 years	5.7 (3.8, 7.6)	6.3 (4.2, 8.4)	2.7 (1.2, 4.3)	0.0093
Poor access to health services[5]	41.9 (33.6, 50.2)	47.7 (43.4, 52.1)	12.5 (9.4, 15.6)	<0.0001

Abbreviations: CI, confidence interval; MPI, multidimensional poverty index

[1] All values are percent and adjusted for probability of selection by PPS. National values are weighted.

[2] Solid cooking fuel sources include charcoal, wood, straw, shrubs, grass, agricultural crops, and animal dung.

[3]Toilet is considered improved if it is a flush or pour toilet unless it is a flush/pour toilet that is shared with another family.

[4] From an asset list with 15 items/groups (Television, mobile phone, fixed phone, refrigerator, table, chair, sofa set, bed, cupboard, clock, watch, bicycle, motorcycle/scooter, animal drawn cart, car or truck, boat with motor, boat without motor).

[5] Defined as the travel duration to the nearest health facility exceeds 60 minutes.

[6] P-values based on rural vs. urban differences with adjustment for complex survey design effects,

Dietary diversity among women of reproductive age

The median dietary diversity score for women of reproductive age was significantly lower in rural areas (4.0) than urban areas (5.0) (**Table 6**). Correspondingly, 66.9% and 57.1% of rural and urban women, respectively, were classified as having a higher dietary diversity score. Almost two-thirds of women in both rural and urban areas consumed vitamin-A rich sources of plant origin while almost all women reported consuming animal source foods of vitamin A in the previous 24 hours. Women in urban areas consumed significantly more iron-rich and zinc-rich foods than women in rural areas.

Table 6. Dietary diversity score and its components for women of reproductive age.[1*]

Dietary diversity score and components*	National N=965	Rural N=517	Urban N=448	p-value[6]
	Median (25%, 75%), % (95% CI)	Median (25%, 75%), % (95% CI)	Median (25%, 75%), % (95% CI)	
Dietary diversity score[2**]	3.8 (2.7, 4.9)	4.0 (3.0, 5.0)	5.0 (4.0, 6.0)	<0.0001
Higher dietary diversity score[3,4]	65.3 (59.4, 71.2)	66.9 (62.9, 71.0)	57.1 (52.5, 61.7)	0.0018
Consumed plant sources of vitamin A[3,5]	62.5 (56.7, 68.3)	62.5 (58.3, 66.7)	62.5 (58.0, 67.0)	0.9938
Consumed animal sources of vitamin A[3,5]	98.5 (97.5, 99.5)	98.5 (97.4, 99.5)	98.7 (97.6, 99.7)	0.7874
Consumed iron-rich or zinc- rich foods[3,5]	46.6 (39.4, 53.8)	44.3 (40.0, 48.6)	58.5 (53.9, 63.1)	<0.0001

Abbreviation: CI, confidence interval

[1] All values are median or percent and adjusted for probability of selection by population proportional to size (PPS) sampling. National values are weighted.

[2] Median (25%, 75%).

[3] Percent (95% CI).

[4] Higher dietary diversity is defined as dietary diversity score greater than or equal to the population median in each stratum (rural and urban).

[5] Women consumed at least one food item from this food group.

[6] Comparing rural vs. urban. Wilcoxon rank sum test was used to compare median values for continuous variables. *Complex survey chi-square test was used to compare percentages.*

** When more than one woman of reproductive age answered the dietary diversity information per household, the dietary diversity score of one woman was randomly selected and applied to the household.*

*** The national median is weighted but the rural/urban are not weighted. As the nationally sampling weights were weighed 'towards' the rural, one would expect national estimates to be to be closer to the rural estimate as currently observed with dietary diversity.*

When stratified by household poverty risk (based on the MPI), the percentage of women meeting with a higher dietary diversity score was significantly lower among poor households compared to non-poor households in both rural and urban settings, but not nationally (**Table 7**).

Comparing the women in poor and non-poor households nationally and in both rural and urban settings, there were no significant differences in the frequency of consuming plants that are rich sources of vitamin A; similarly, there were no differences in the consumption of rich animal sources of vitamin A between women in poor and non-poor households either. Nationally, and in urban settings, there was a significantly lower percentage of women in poor households compared to non-poor households consuming iron-rich and zinc-rich foods, but there were no significant differences among poor and non-poor women in rural settings.

Table 7. Dietary diversity score and its components for women of reproductive age by poverty risk.[1*]

Dietary diversity score and components*	Poor % (95% CI)[2]	Non-poor % (95% CI)[2]	p-value[3]
National	**N=462**	**N=503**	
Higher dietary diversity score (at or above the median)[4]	62.4 (53.7, 71.0)	69.9 (65.1,74.6)	0.0911
Consumed plant sources of vitamin A[5]	62.8 (55.7, 69.8)	62.0 (54.6,69.5)	0.8667
Consumed animal sources of vitamin A[5]	97.8 (96.3, 99.3)	99.6 (98.8,100)	0.0615
Consumed iron-rich or zinc- rich foods[5]	42.1 (32.9, 51.3)	53.6 (45.1,62.1)	0.0369
Rural	**N=346**	**N=171**	
Higher dietary diversity score (at or above the median)[4]	63.6 (58.5, 68.7)	73.7 (67.1,80.3)	0.0216
Consumed plant sources of vitamin A[5]	62.7 (57.6, 67.8)	62.0 (54.7,69.3)	0.8721
Consumed animal sources of vitamin A[5]	98.0 (96.5, 99.5)	99.4 (98.3, 100.0)	0.2125
Consumed iron-rich or zinc- rich foods[5]	41.3 (36.1, 46.5)	50.3 (42.8,57.8)	0.0536
Urban	**N=131**	**N=317**	
Higher dietary diversity score (at or above the median)[4]	48.1 (39.5, 56.7)	60.9 (55.5,66.3)	0.0128
Consumed plant sources of vitamin A[5]	63.4 (55.1, 71.6)	62.1 (56.8,67.5)	0.8093
Consumed animal sources of vitamin A[5]	95.4 (91.8, 99.0)	100.0 (100.0, 100.0)	**
Consumed iron-rich or zinc- rich foods[5]	51.1 (42.6, 59.7)	61.5 (56.1,66.9)	0.0428

Abbreviation: CI, confidence interval

[1] All values are percent and adjusted for probability of selection by population proportional to size (PPS) sampling. National values are weighted.

[2] Multidimensional Poverty Index (MPI) greater than or equal to 0.33 defined as "poor" and MPI less than 0.33 defined as "non-poor".

[3] Comparing poor versus non-poor. Complex survey chi-square test was used to compare percentages.

[4] Lower dietary diversity refers to a dietary diversity score lower than the population median in each stratum (i.e. rural or urban residence). Higher dietary diversity refers to a dietary diversity score greater than or equal to the population median in each stratum (i.e. rural or urban residence). The population median is 4 in rural areas and 5 in urban areas.

[5] Women consumed at least one food item from this food group.

[*] When more than one woman of reproductive age answered the dietary diversity information per household, the dietary diversity score of one woman was randomly selected and applied to the household.

*** P-value not estimable due to 100% prevalence.*

Food samples sent for laboratory analysis

The household food samples analyzed by the laboratory for their nutrient content are summarized in **Table 8**. It should be noted that some food samples were missing labels; these food samples were only analyzed at the national level. Thus, samples without a label stating that they were from either an urban or rural area were not included in the urban or rural level estimates.

A total of 278 oil samples were collected from households nationally and analyzed. Few households had wheat flour, thus only 43 samples were collected for nutrient analysis nationally. A total of 238 households had maize flour for laboratory analysis. Households often had salt and samples were collected from 820 households nationally. Results of the laboratory

analysis of nutrient content from the food samples can be found in **Figures 1-4**, **Annex H.** Cooking fat was not analyzed by laboratory testing for vitamin A fortification.

Table 8. Summary of food samples analyzed.

Food samples	Nutrient analyzed	National*	Rural	Urban
Oil	Vitamin A	278	107	169
Wheat flour	Iron	47	7	40
Maize flour	Iron	238	76	162
Salt	Iodine	820	429	389

**Some oil and salt samples were missing labels and were only analyzed at the national level; aggregating the number of rural and urban samples that were missing labels will not add up to the total number of national samples analyzed*

Household coverage of foods

The household coverage of foods is noted in **Figure 1** and the same data are available in table format in **Annex H**. Please note that the household coverage of fortified food refers to households that consumed a food that was confirmed to be fortified by quantitative analyses. "Don't know" refers to households where a food sample was not collected and the brand name was not available.

For cooking oil, 89.9% of Ugandan households reported consuming oil (**Figure 1A**). A slightly lower percentage (89.4%) of rural households compared to 92.7% of urban households reported consuming fortifiable oil. Among all Ugandan households, 54.4% consumed fortified oil, which was found in a significantly higher proportion of urban households (70.0%) than rural households (51.3%).

Among all Ugandan households, 11.2% consumed wheat flour and 10.6% and 8.5% reported consuming fortifiable and fortified wheat flour at the national level **(Figure 1B).** In urban households, 20.0% consumed fortified wheat flour; this was significantly higher than the 6.3% of rural households consuming fortified wheat flour.

Nearly all Ugandan households reported consuming maize flour; however, 42.4% reported they consumed fortifiable maize flour and only 6.5% consumed fortified maize flour nationally (**Figure 1C**). A significantly greater proportion of urban households reported consuming maize flour, fortifiable maize flour, and fortified maize flour than rural households.

Nationally, over 99% of households reported consuming salt and fortifiable salt (**Figure 1D**). In urban areas, 95.9% of households consumed fortified salt, as did 92.7% of rural households.

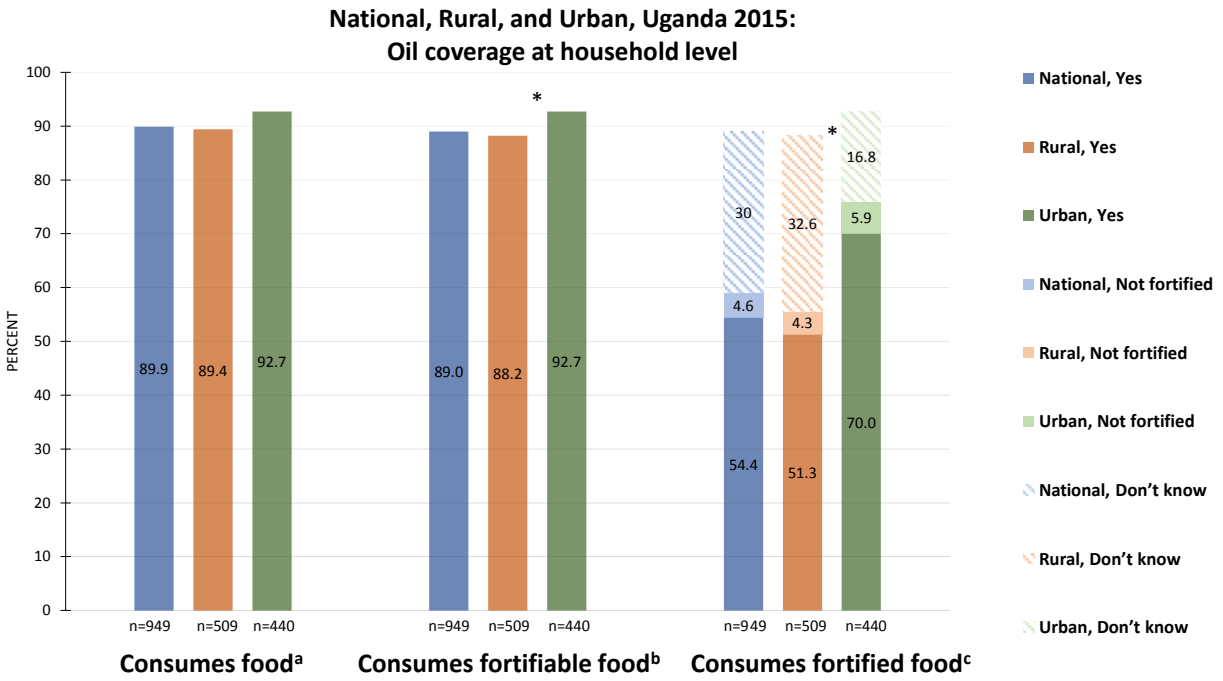
Nationally, nearly a third of households consumed cooking fat and approximately 30% of households consumed fortifiable cooking fat (**Figure 1E**). Consumption of cooking fat and fortifiable cooking fat was significantly higher among urban households compared to rural households. There was no laboratory analysis of fortification of cooking fat from household samples to determine whether the cooking fat was fortified or not.

More than a third of households nationwide consumed bouillon cubes (**Figure 1F)**. In urban households, almost two-thirds (64.1%) consumed bouillon cubes and fortifiable bouillon cubes; this was significantly higher than the 28.9% of rural households consuming bouillon

cubes and fortifiable bouillon cubes. There was no collection or laboratory analysis of bouillon cubes from household to determine whether they were fortified or not.

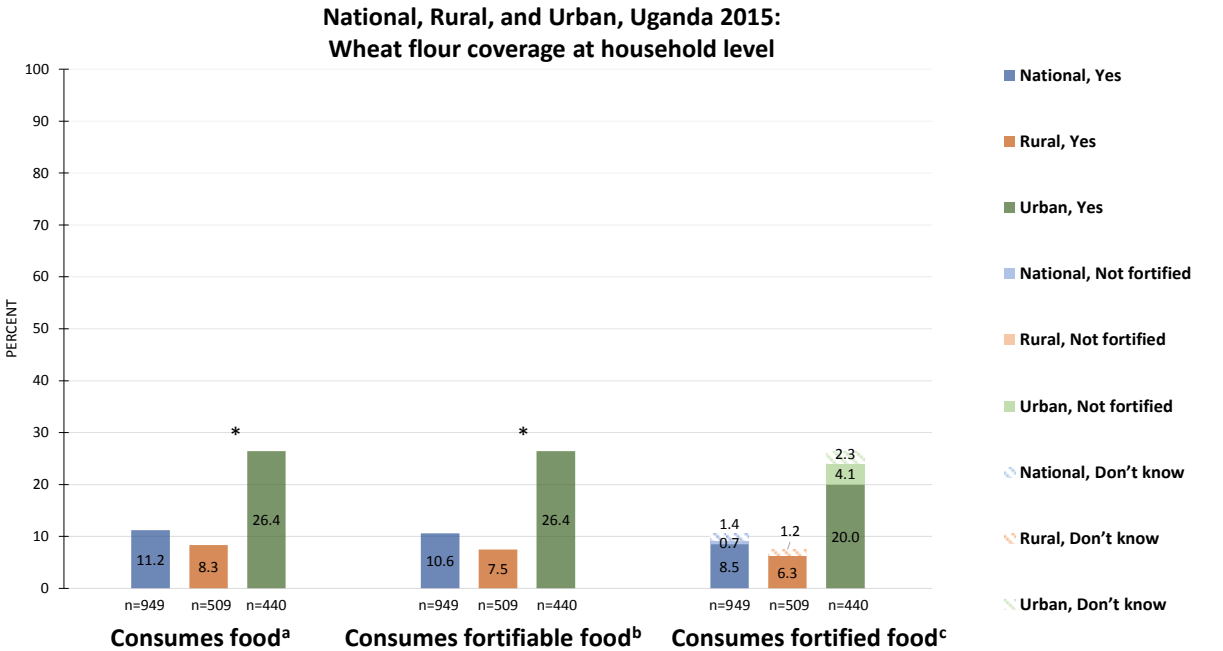
Figure 1. Household coverage of foods.[1,2,3]

A.



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic level; "Not fortified" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses not to contain the nutrient above the intrinsic level; "Don't know" refers to households that could not be classified because no sample or reported brand was available; Households that did not consume a fortifiable food are not shown. * P < 0.05

B.



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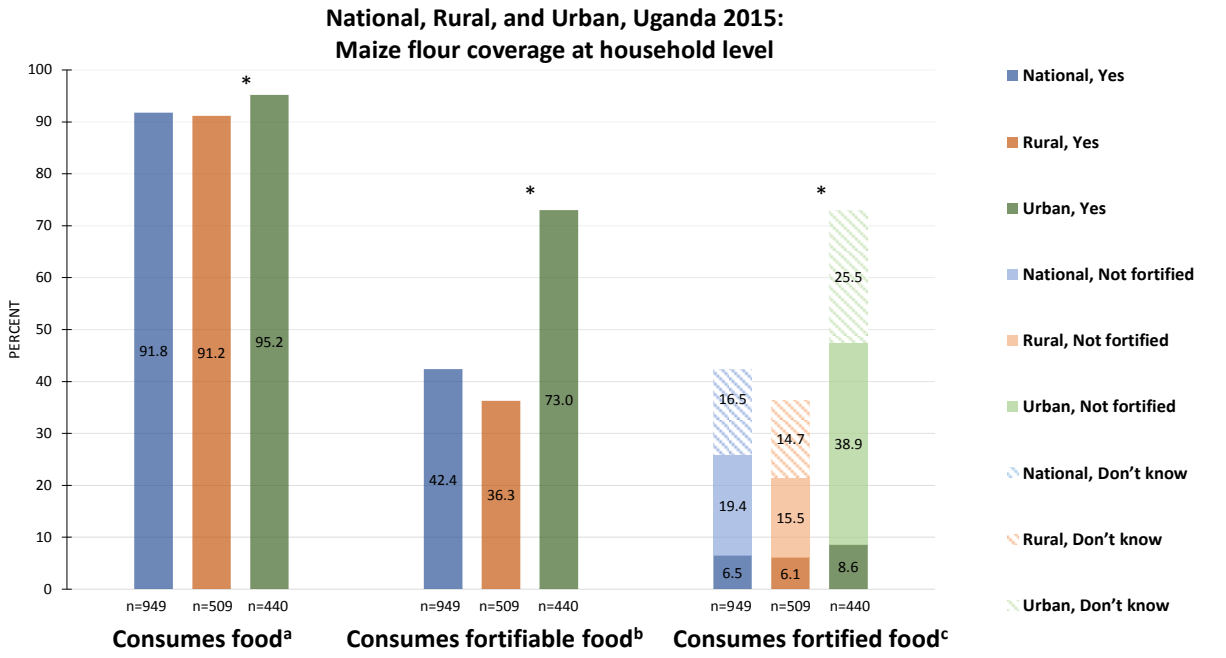
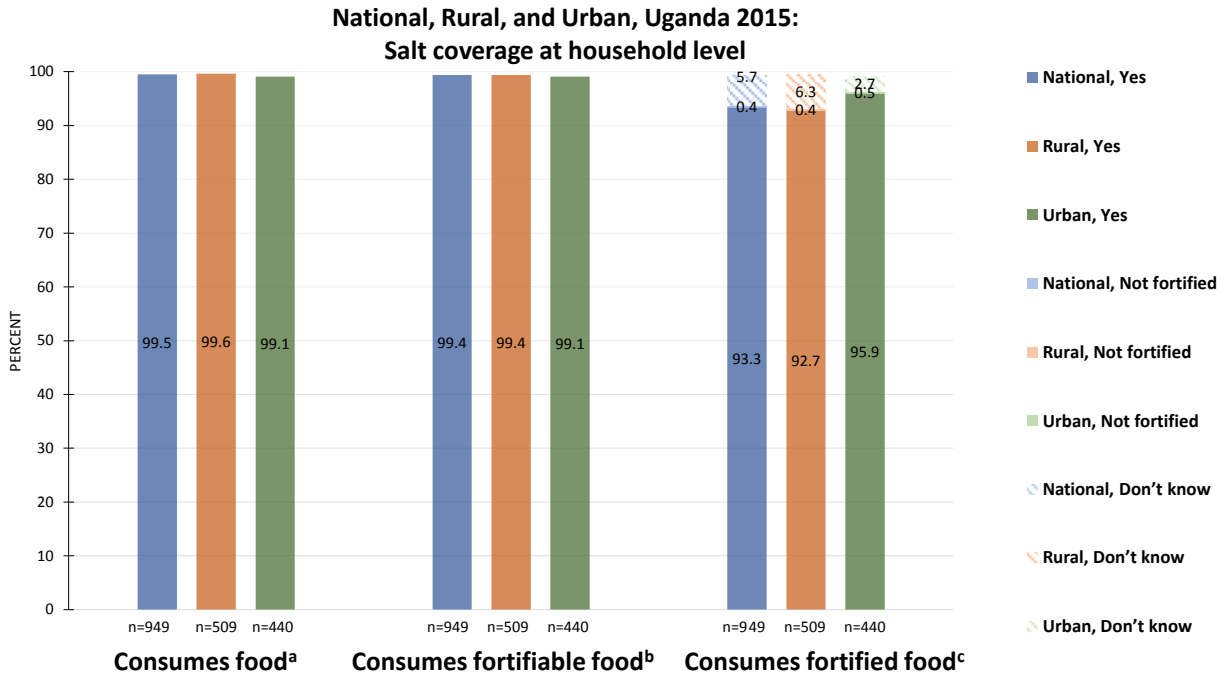
C.



*[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic level; "Not fortified" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses not to contain the nutrient above the intrinsic level; "Don't know" refers to households that could not be classified because no sample or reported brand was available; Households that did not consume a fortifiable food are not shown. * P < 0.05*

D.



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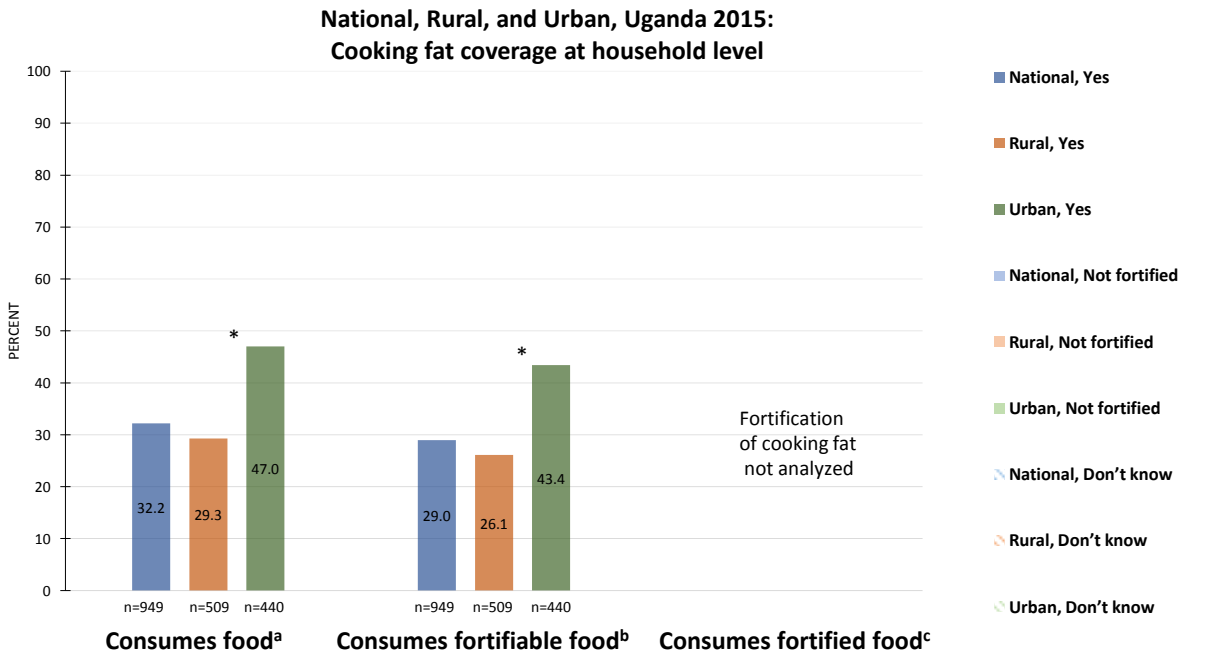
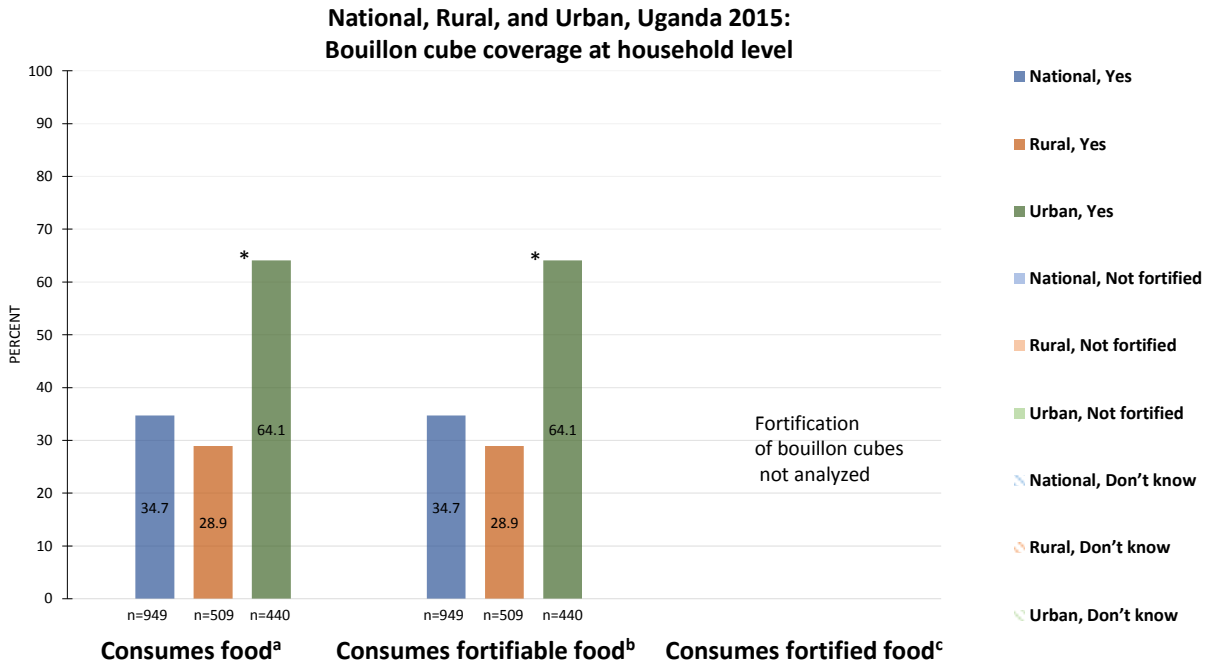
E.



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] Laboratory analyses were not conducted on this food product. * P < 0.05

F.



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Laboratory analyses were not conducted on this food product. * P < 0.05

[1] "Consumes food" refers to households that reported preparing this food at home. "Consumes fortifiable food" refers to households that reported consuming a food that was not made at home and is assumed to be industrially processed. "Consumes fortified food" refers to households that consumed a food that was confirmed to be fortified by quantitative analyses (i.e. if the sample or brand provided met or exceeded the following nutrient content cut-off criteria: oil with ≥3.0 IU/kg vitamin A, wheat flour ≥35.0 mg/kg iron, maize flour ≥15.0 mg/kg iron, salt ≥7.6 mg/kg iodine. "Consumes fortified food" was determined as follows:
(A) In households where a food sample was collected and analyzed, if the sample met the fortified criteria then the household was classified as "yes" for consumes fortified food. If the sample did not meet the fortified criteria, then the household was classified as "not fortified" for consumes fortified food.

(B) In households where a food sample was not taken and the brand name was available, the median nutrient value in the branded samples analyzed from other households was used. If the value met the fortified criteria then the household was classified as "yes: for consumes fortified food. If the value did not meet the fortified criteria then the household was classified as "not fortified" for consumes fortified food.

(C) In households where a food sample was not collected and the brand name was not available, the household was classified as "don't know" for consumes fortified food.

(D) Households that did not consume a fortifiable food are not shown.

[2] The "N" below each bar refers to the total number of households in the denominator.

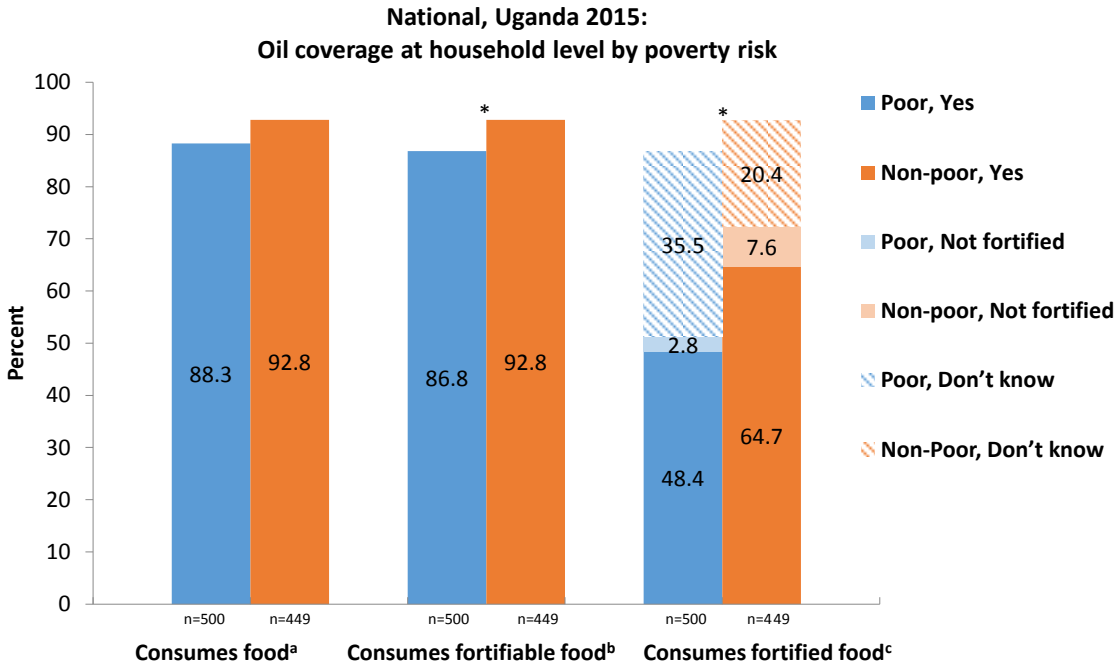
[3] All bouillon cubes are assumed to be fortifiable because they are industrially made outside of the household.

Household coverage of fortifiable and fortified foods by poverty risk

Household coverage of foods was stratified by poverty risk for all households surveyed (**Figure 2** and the same data are available in table format in **Annex H**). Nationwide, there was no difference in the consumption of cooking oil or salt among the poor and non-poor households (**Figures 2A and 2D).** Nationally, significantly fewer poor households consumed wheat flour, maize flour, cooking fat, and bouillon cubes compared to non-poor households (**Figures 2B, 2C, 2E, and 2F respectively**). The same was true for consumption of fortifiable and fortified oil, wheat and maize flour, as well as fortifiable salt, cooking fat, and bouillon cubes (**Figures 2A, 2B, 2C, 2D, 2E, and 2F respectively**). There was no laboratory analysis of fortified cooking fat or bouillon cubes from household samples.

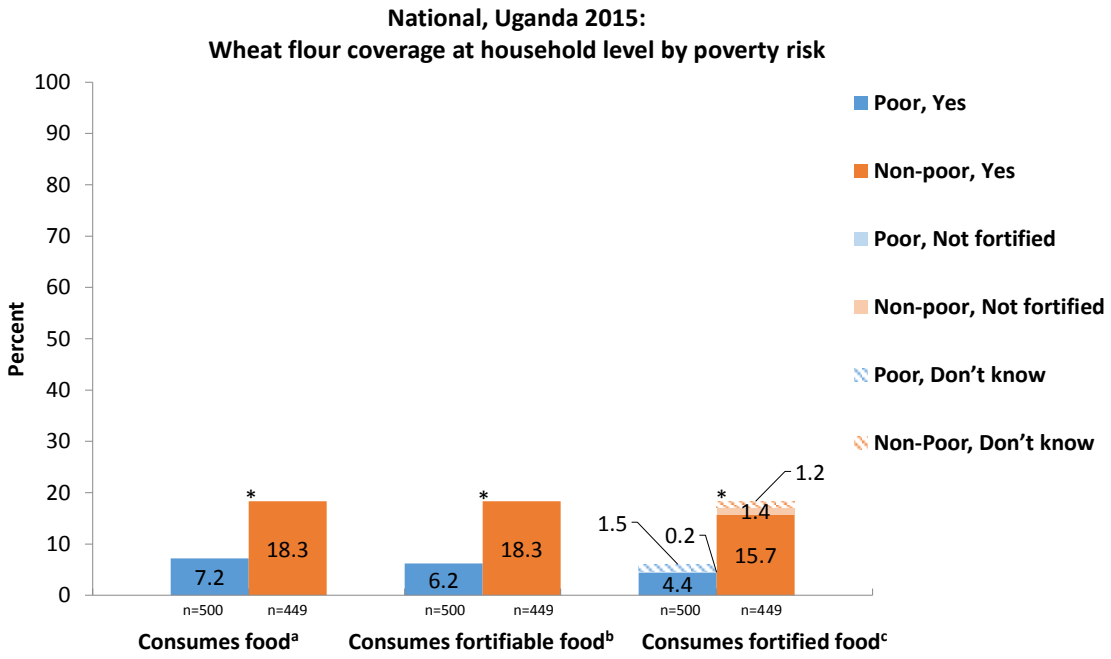
Figure 2. Household coverage of foods by poverty risk.[1,2,3,4]

A.



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic level; "Not fortified" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses not to contain the nutrient above the intrinsic level; "Don't know" refers to households that could not be classified because no sample or reported brand was available; Households that did not consume a fortifiable food are not shown. * P < 0.05

B.



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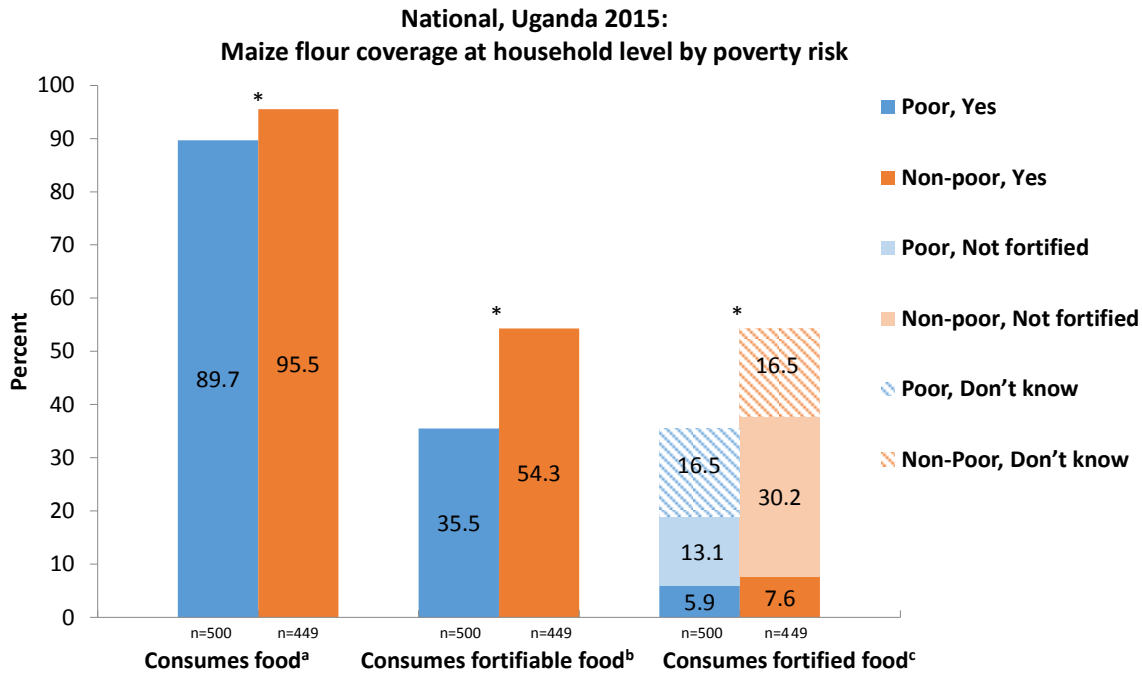
C.



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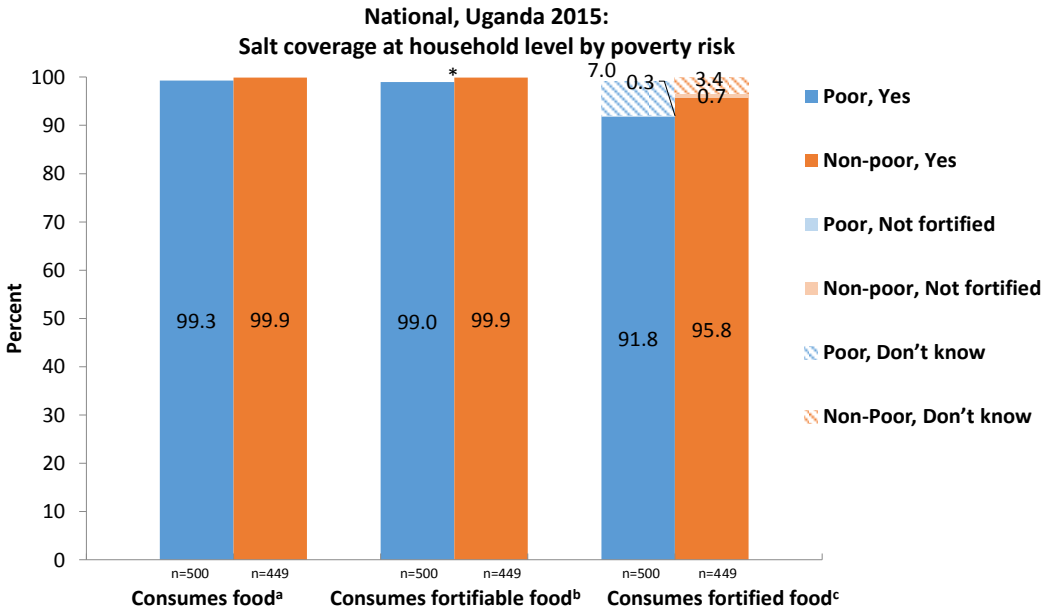

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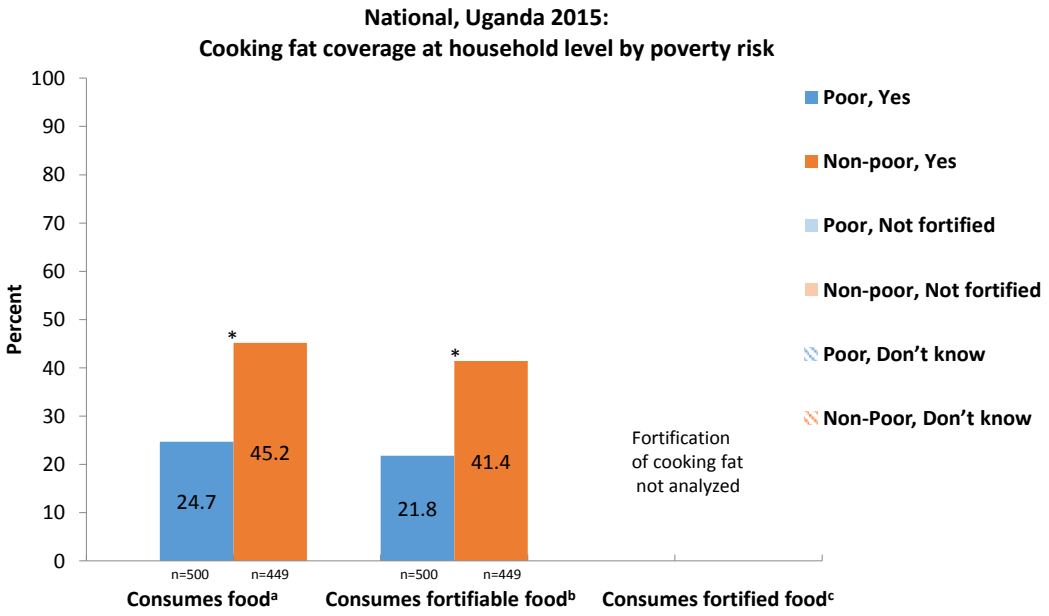
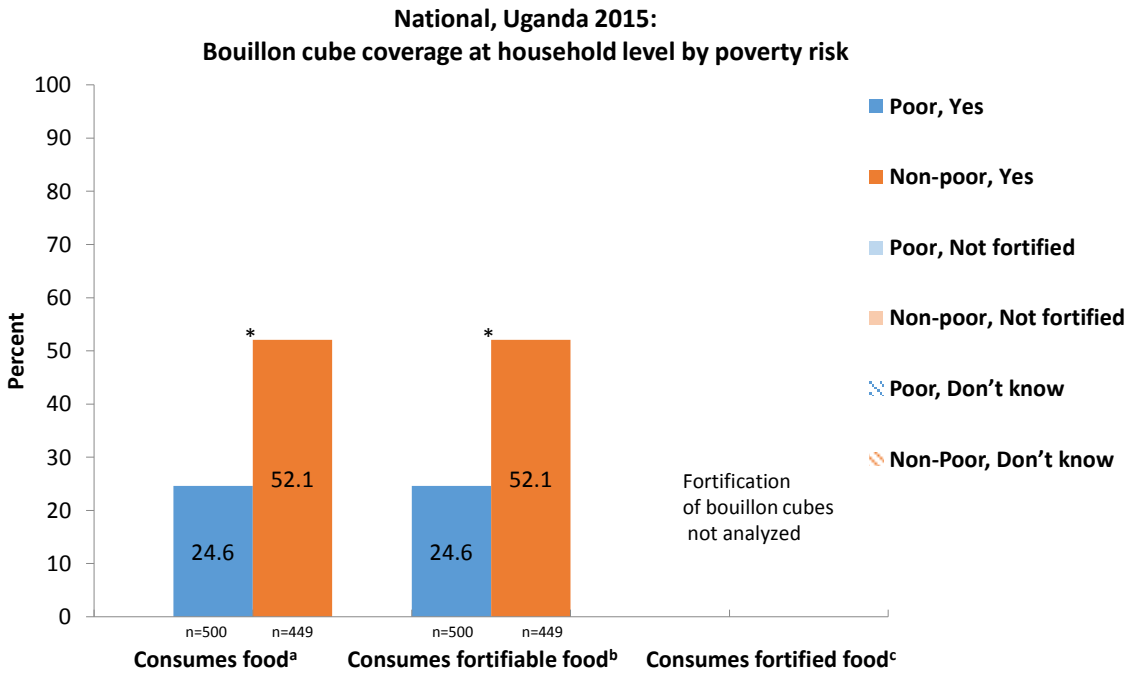
E.



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] Laboratory analyses were not conducted on this food product. * P < 0.05

F.



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] Laboratory analyses were not conducted on this food product. * P < 0.05

[1] "Consumes food" refers to households that reported preparing this food at home. "Consumes fortifiable food" refers to households that reported consuming a food that was not made at home and is assumed to be industrially processed. "Consumes fortified food" refers to households that consumed a food that was confirmed to be fortified by quantitative analyses (i.e. if the sample or brand provided met or exceeded the following nutrient content cut-off criteria: oil with ≥3.0 IU/kg vitamin A, wheat flour ≥35.0 mg/kg iron, maize flour ≥15.0 mg/kg iron, salt ≥7.6 mg/kg iodine. "Consumes fortified food" was determined as follows:

(A) In households where a food sample was collected and analyzed, if the sample met the fortified criteria then the household was classified as "yes" for consumes fortified food. If the sample did not meet the fortified criteria, then the household was classified as "not fortified" for consumes fortified food.

(B) In households where a food sample was not taken and the brand name was available, the median nutrient value in the branded samples analyzed from other households was used. If the value met the fortified criteria then the household was classified as "yes: for consumes fortified food. If the value did not meet the fortified criteria then the household was classified as "not fortified" for consumes fortified food.

(C) In households where a food sample was not collected and the brand name was not available, the household was classified as "don't know" for consumes fortified food.

(D) Households that did not consume a fortifiable food are not shown.

[2] The "N" below each bar refers to the total number of households in the denominator.

[3] Multidimensional Poverty Index (MPI) greater than or equal to 0.33 is defined as "poor" and MPI less than 0.33 is defined as "non-poor".

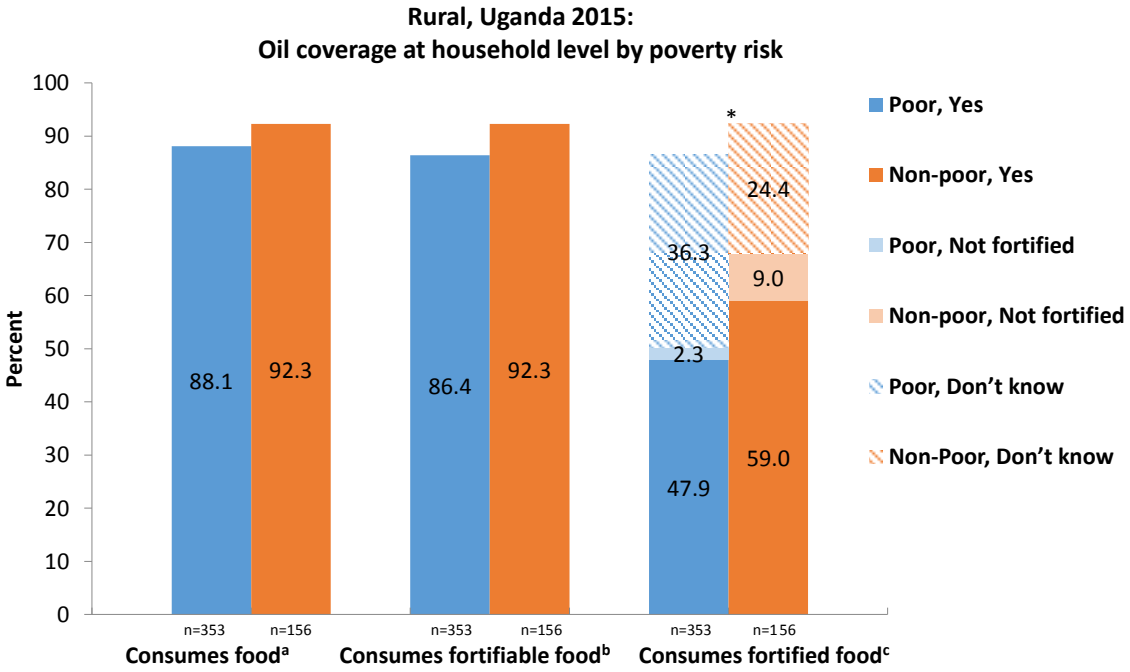
[4] All bouillon cubes are assumed to be fortifiable because they are industrially made outside of the household.

<u>Household coverage of foods by poverty risk among rural households</u>

Household coverage of foods was stratified by poverty risk for rural households. Significantly fewer poor households consumed wheat flour, maize flour, cooking fat, and bouillon cubes compared to non-poor households in rural areas (**Figures 2H 2I, 2K, and 2L respectively**). Significantly fewer poor households also consumed fortifiable wheat flour as well as fortified oil, fortified wheat and maize flour compared to non-poor households in rural areas (**Figures 2H, 2G, 2H, and 2I respectively**).

There were no differences in the consumption of fortifiable oil, fortifiable maize flour, fortifiable salt or fortified salt among poor and non-poor households (**Figures 2G, 2I, 2J respectively**).

G.



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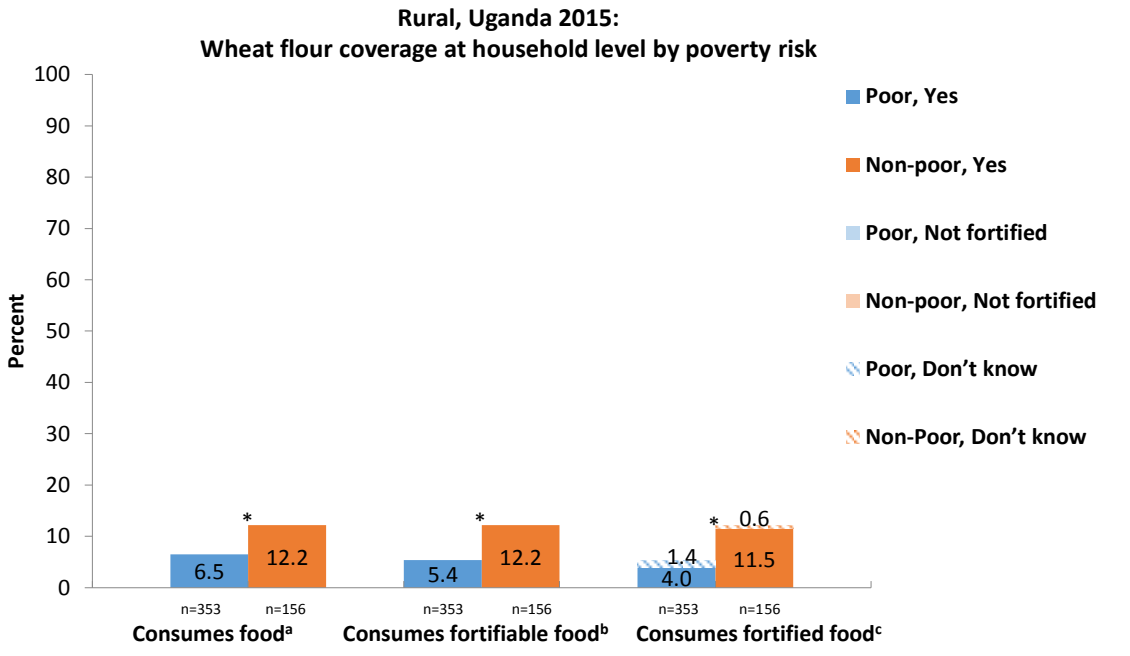
H.



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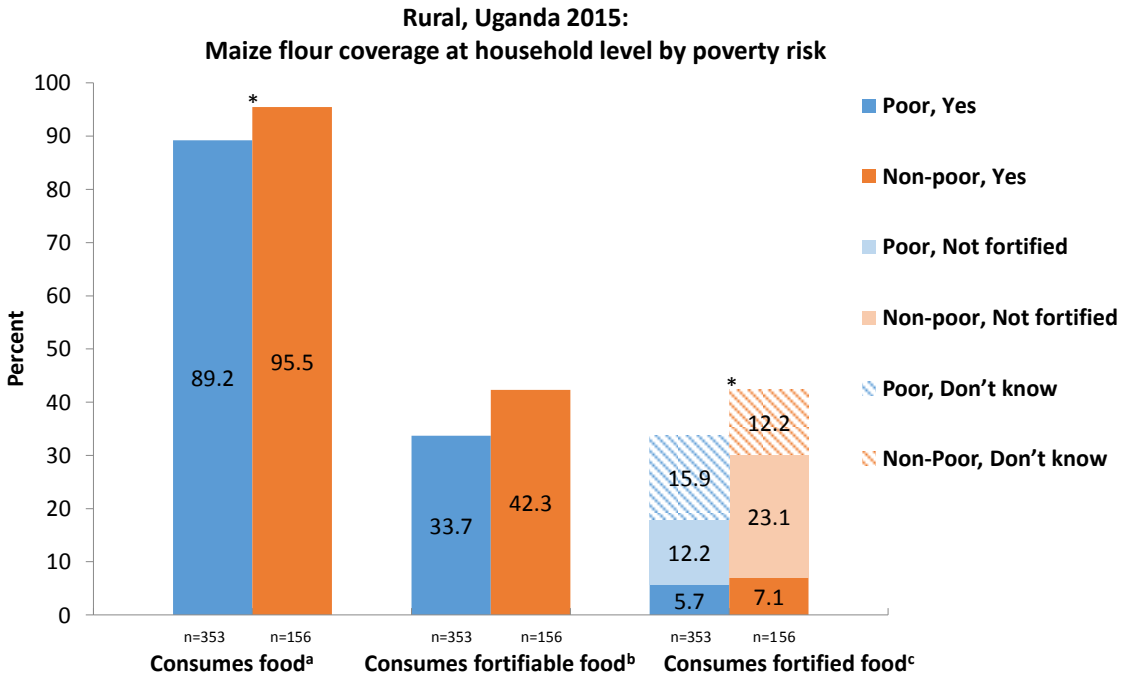
I.



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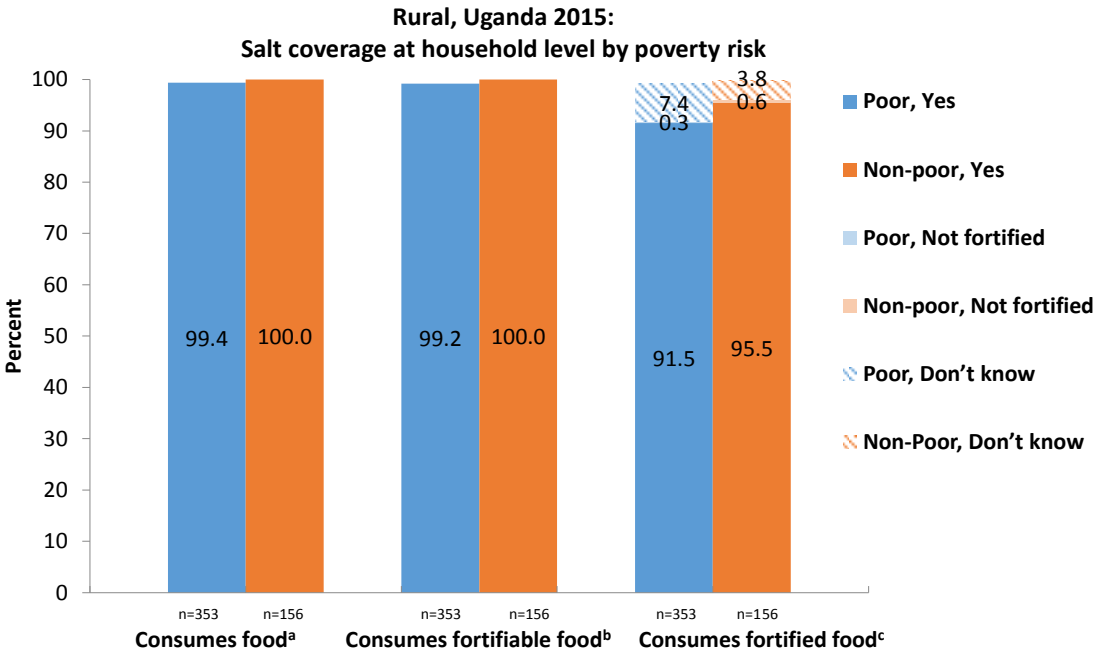
J.



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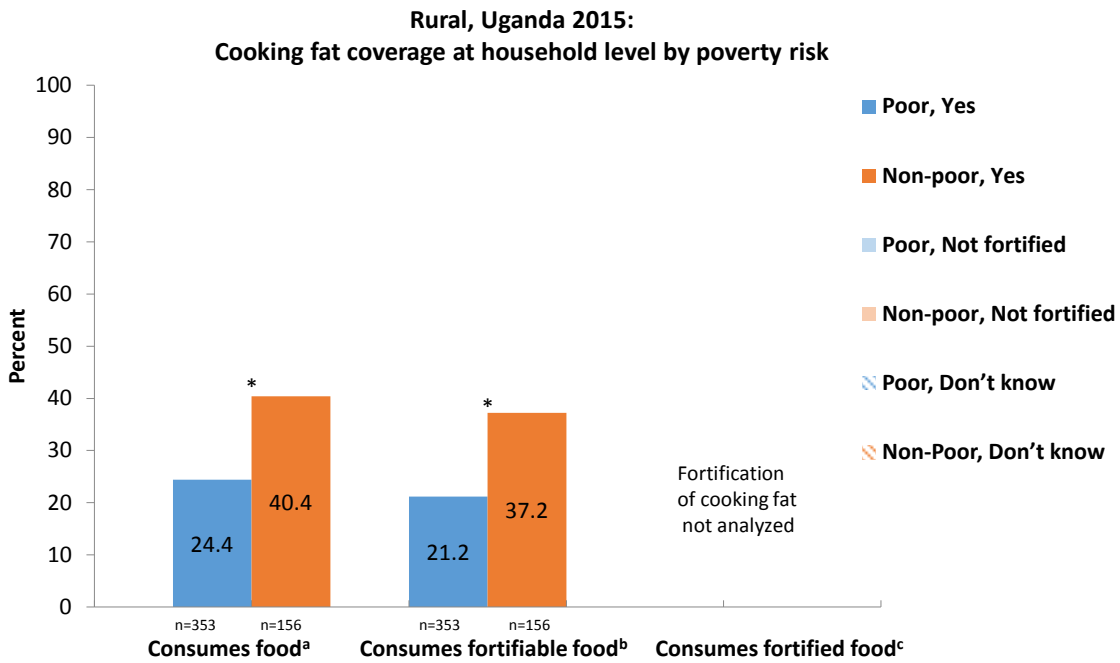
K.



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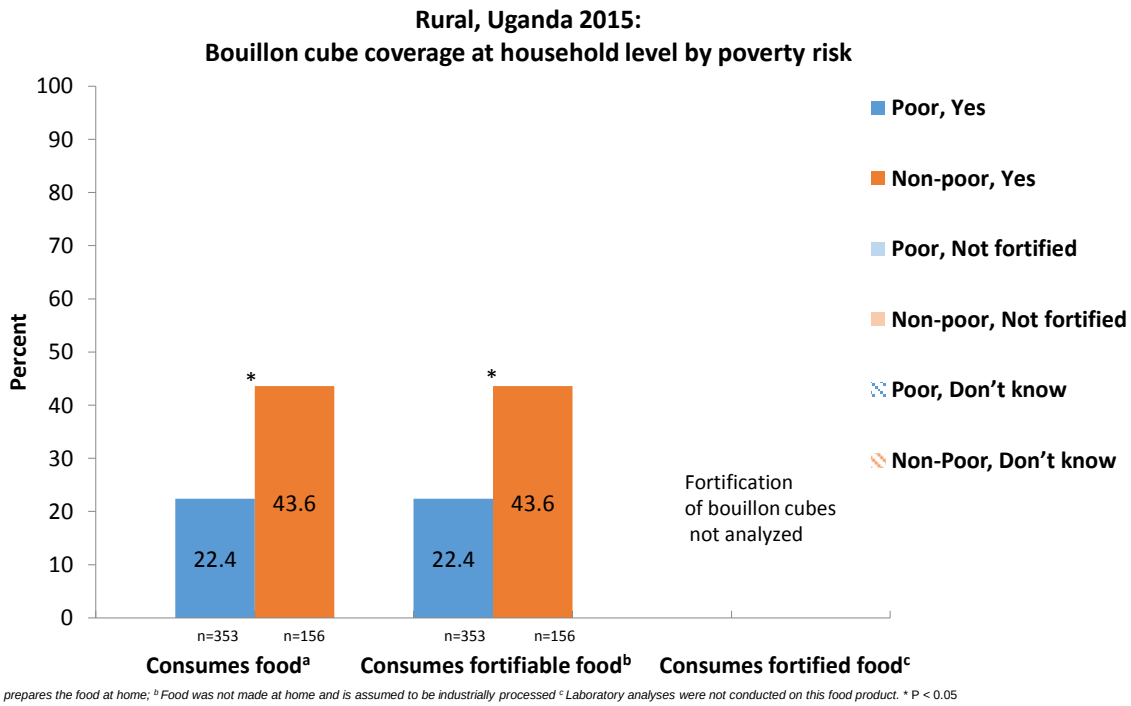
L.



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[1] *"Consumes food" refers to households that reported preparing this food at home. "Consumes fortifiable food" refers to households that reported consuming a food that was not made at home and is assumed to be industrially processed. "Consumes fortified food" refers to households that consumed a food that was confirmed to be fortified by quantitative analyses (i.e. if the sample or brand provided met or exceeded the following nutrient content cut-off criteria: oil with ≥3.0 IU/kg vitamin A, wheat flour ≥35.0 mg/kg iron, maize flour ≥15.0 mg/kg iron, salt ≥7.6 mg/kg iodine. "Consumes fortified food" was determined as follows:*

(A) In households where a food sample was collected and analyzed, if the sample met the fortified criteria then the household was classified as "yes" for consumes fortified food. If the sample did not meet the fortified criteria, then the household was classified as "not fortified" for consumes fortified food.
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(C) In households where a food sample was not collected and the brand name was not available, the household was classified as "don't know" for consumes fortified food.
(D) Households that did not consume a fortifiable food are not shown.
[2] The "N" below each bar refers to the total number of households in the denominator.
[3] Multidimensional Poverty Index (MPI) greater than or equal to 0.33 is defined as "poor" and MPI less than 0.33 is defined as "non-poor".
[4] All bouillon cubes are assumed to be fortifiable because they are industrially made outside of the household.

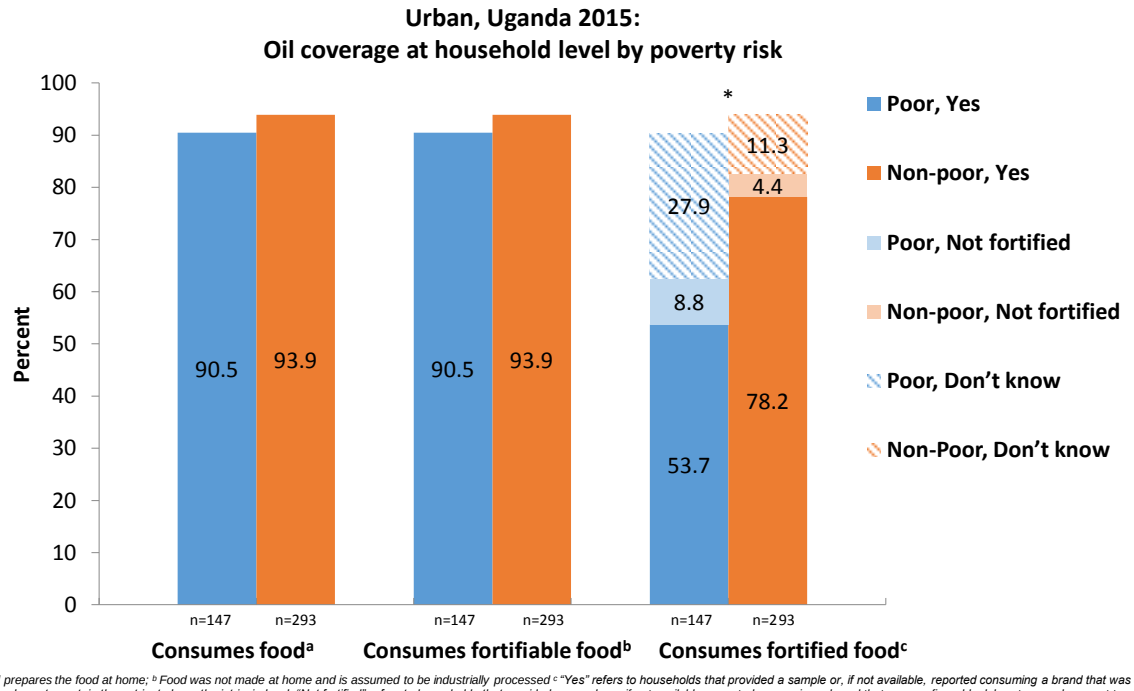
Household coverage of foods by poverty risk among urban households

Household coverage of foods was also stratified by poverty risk for urban households. There was no difference in the consumption of oil or fortifiable oil, but significantly fewer poor households consumed fortified oil compared to non-poor households in urban areas (**Figure 2M**). Also, significantly fewer poor households consumed wheat flour, fortifiable wheat flour, and fortified wheat flour compared to non-poor households (**Figure 2N**).

There was no difference by poverty risk between those consuming maize flour, but significantly fewer poor households consumed fortifiable maize flour and fortified maize flour compared to non-poor households (**Figure 2O)**.

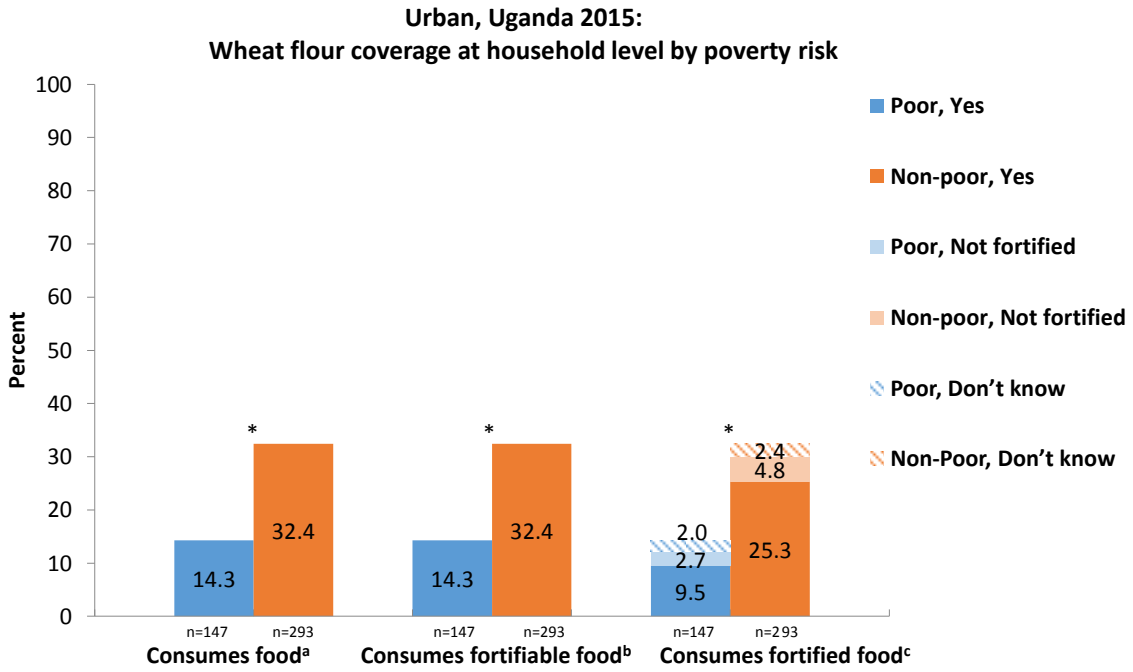
There were no significant differences by poverty risk in the consumption of salt, fortifiable salt, or fortified salt in urban households (**Figure 2P**). Consumption of cooking fat, bouillon cubes, fortifiable cooking fat and fortifiable bouillon cubes were all significantly lower among urban poor households compared to urban non-poor households **(Figure 2Q and 2R)**.

M.



*[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic level; "Not fortified" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses not to contain the nutrient above the intrinsic level; "Don't know" refers to households that could not be classified because no sample or reported brand was available; Households that did not consume a fortifiable food are not shown. * P < 0.05*

N.



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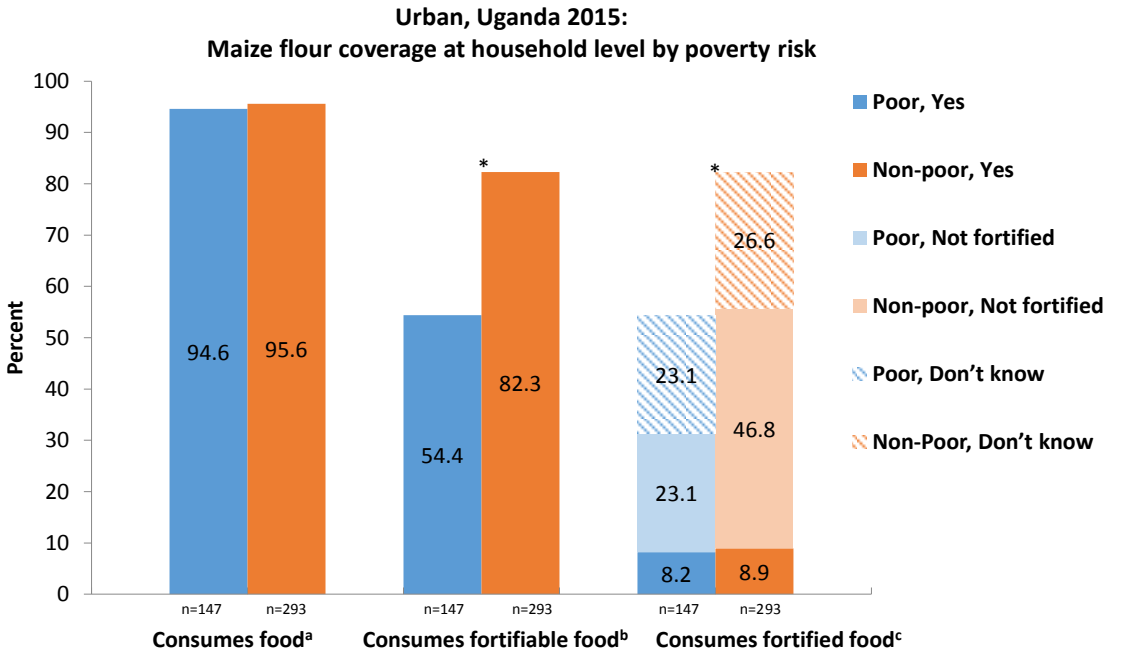
O.



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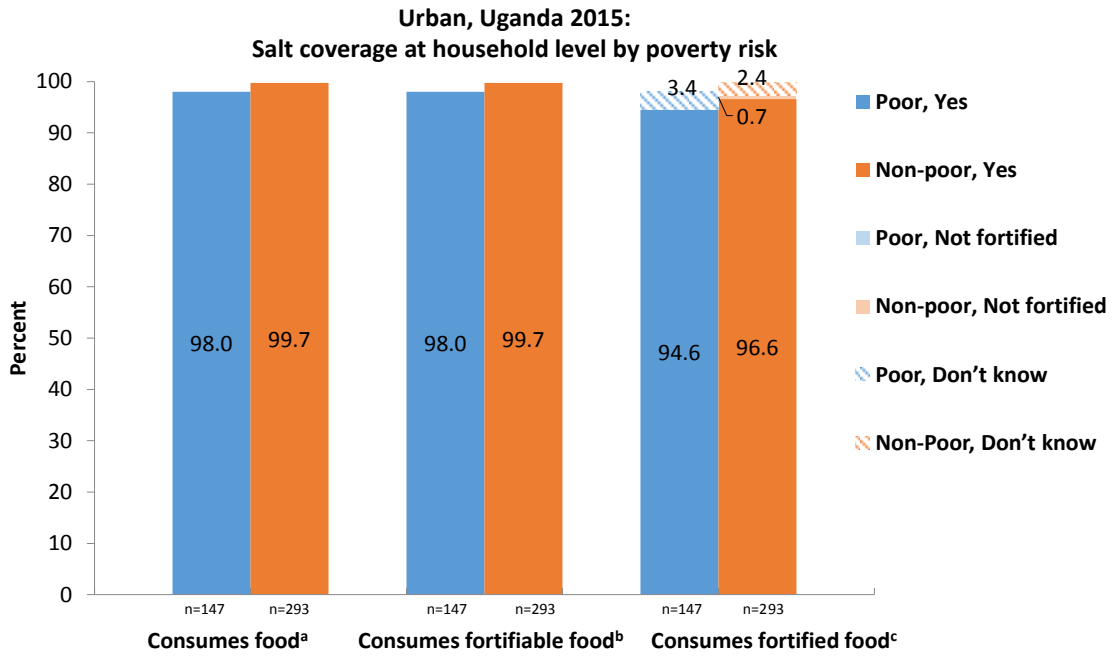
P.



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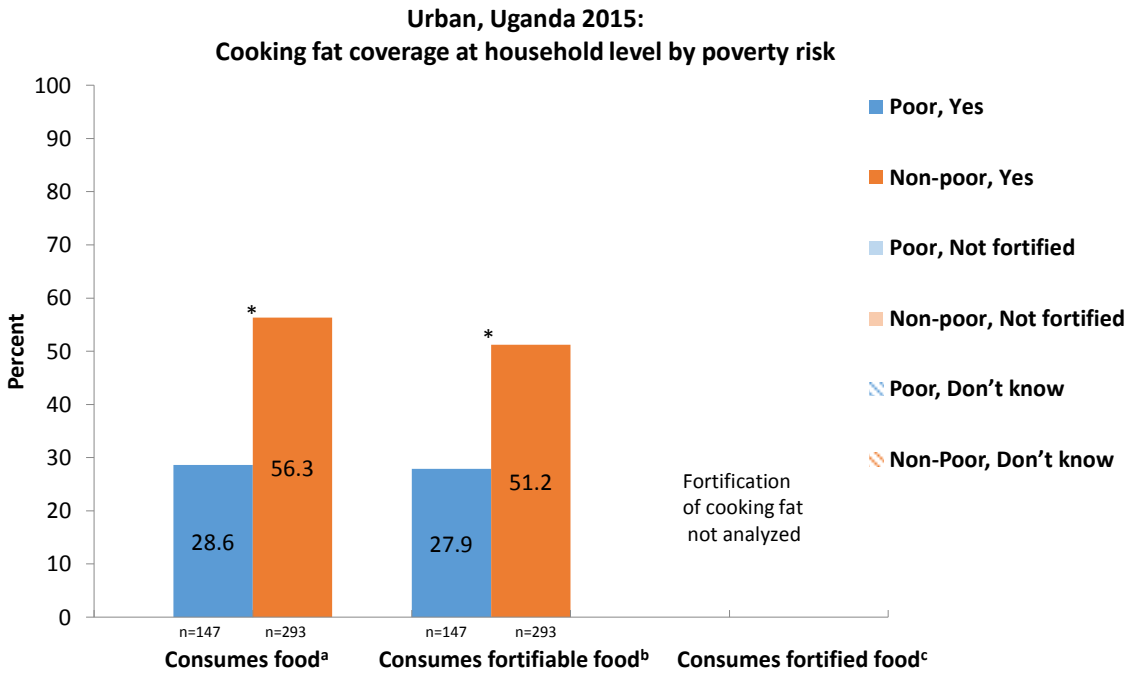
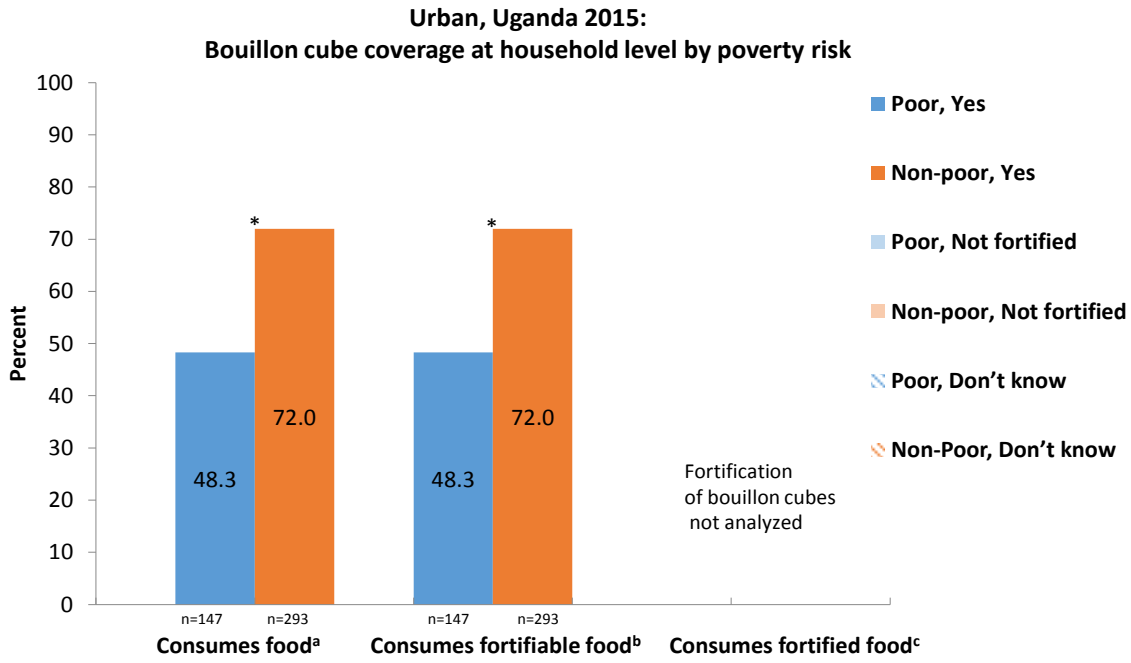
Q.



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] Laboratory analyses were not conducted on this food product. * P < 0.05

R.



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] Laboratory analyses were not conducted on this food product. * P < 0.05

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(A) In households where a food sample was collected and analyzed, if the sample met the fortified criteria then the household was classified as "yes" for consumes fortified food. If the sample did not meet the fortified criteria, then the household was classified as "not fortified" for consumes fortified food.

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(D) Households that did not consume a fortifiable food are not shown.

[2] *The "N" below each bar refers to the total number of households in the denominator.*

[3] *Multidimensional Poverty Index (MPI) greater than or equal to 0.33 is defined as "poor" and MPI less than 0.33 is defined as "non-poor".*

[4] *All bouillon cubes are assumed to be fortifiable because they are industrially made outside of the household.*

Household coverage of foods by women's dietary diversity score

The next series of figures show household coverage of foods stratified by women's dietary diversity score: lower dietary diversity (below the median for the strata) or higher dietary diversity (at or above the median) (**Figure 3** and the data are presented in table format in **Annex H**). There were no differences in the consumption of oil, wheat flour, fortifiable oil, fortifiable wheat flour, fortified oil, or fortified wheat flour between WRA who had a higher dietary diversity score and WRA who had a lower dietary diversity score at the national level (**Figure 3A and 3B**).

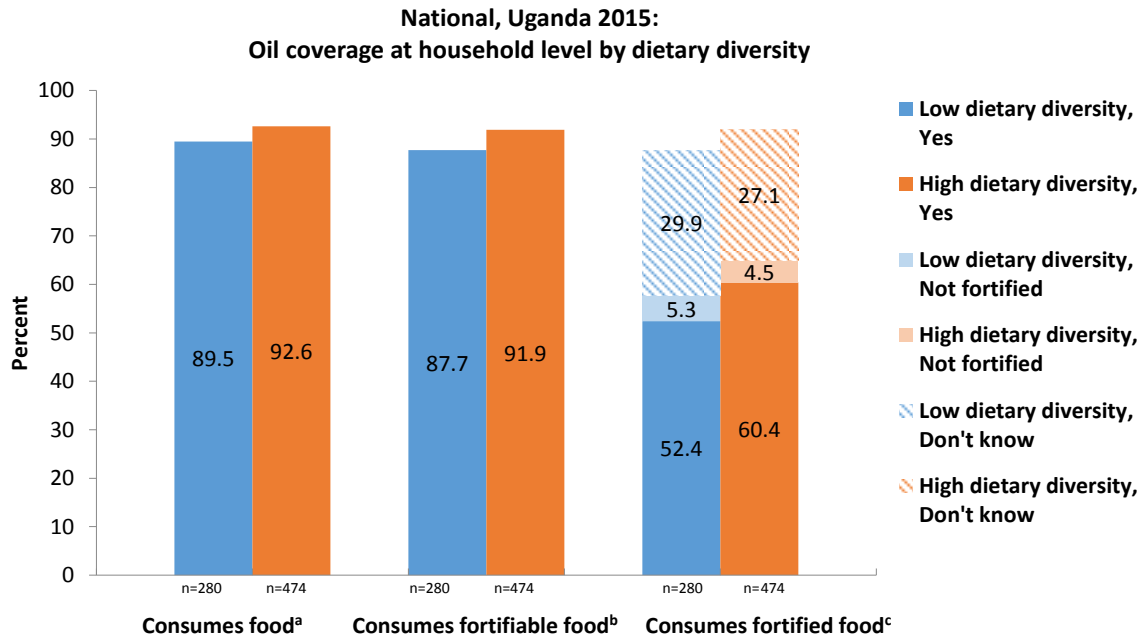
The proportion of WRA consuming maize flour was significantly greater for WRA with a higher dietary diversity score compared to WRA with a lower dietary diversity (**Figure 3C**). Further, there were no differences between WRA with a higher dietary diversity compared to WRA with

a lower dietary diversity score on consumption of salt and fortified salt, (**Figure 3D**). WRA with a higher dietary diversity score had a higher coverage of fortifiable salt than did WRA with a lower dietary diversity score.

Nationally, cooking fat consumption and fortifiable cooking fat consumption was significantly higher among WRA with a higher dietary diversity score compared to those with a lower dietary diversity score **(Figure 3E)**. Consumption of bouillon cubes and fortifiable bouillon cubes was also significantly higher in households where women had a higher dietary diversity score compared to women with a lower dietary diversity score **(Figure 3F)**.

Figure 3. Household coverage of foods by women's dietary diversity score.[1,2,3,4]

A.



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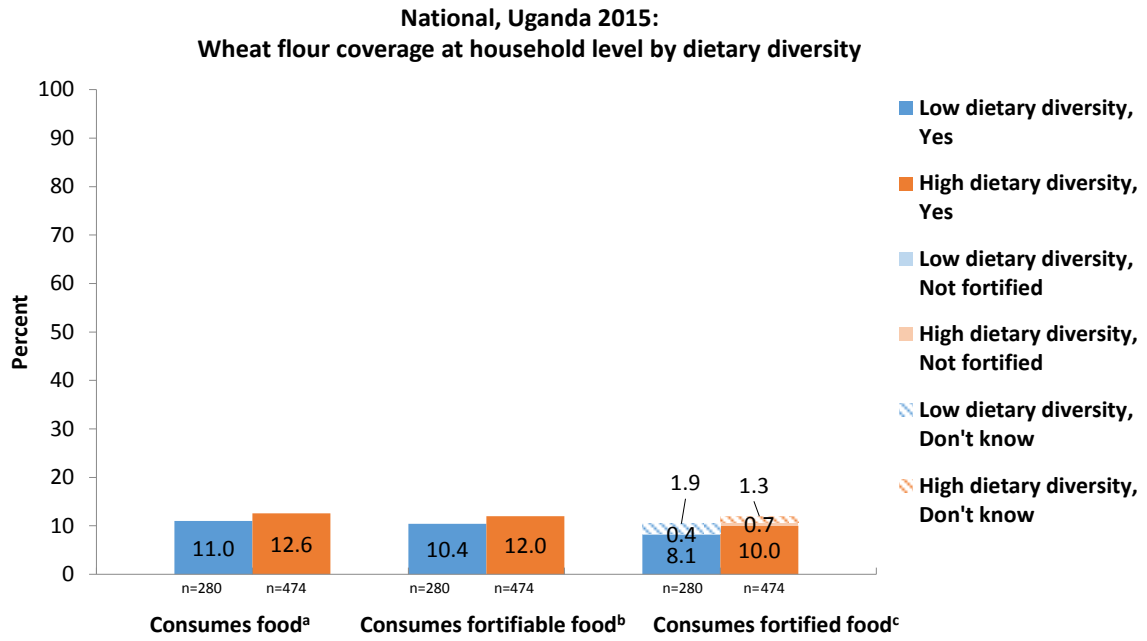
B.



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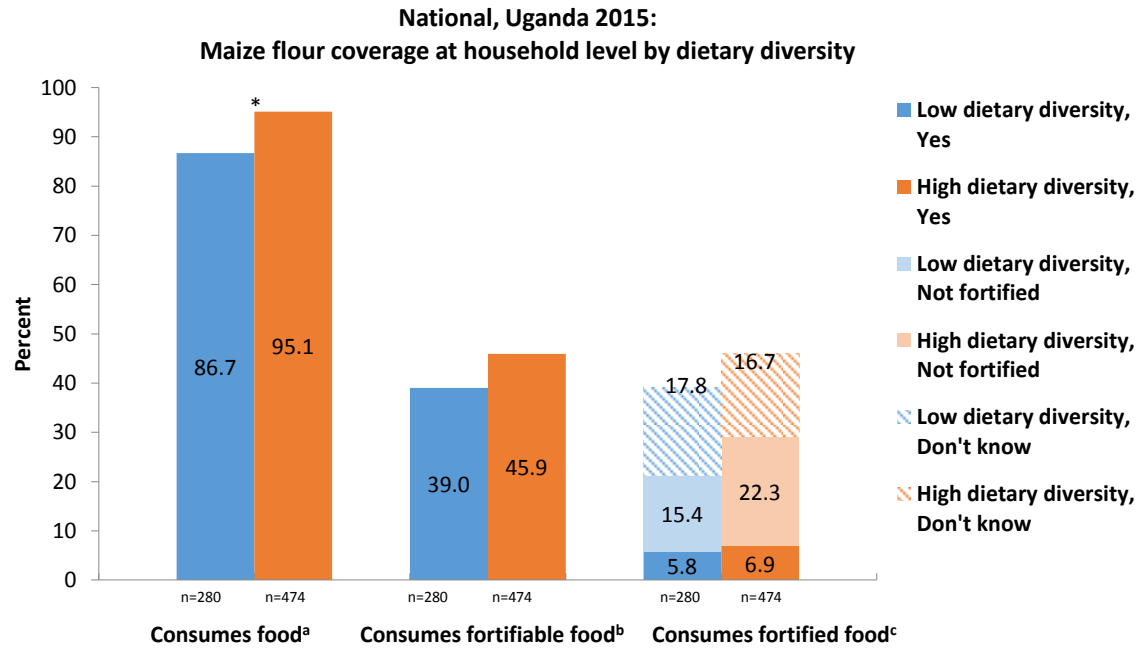
C.



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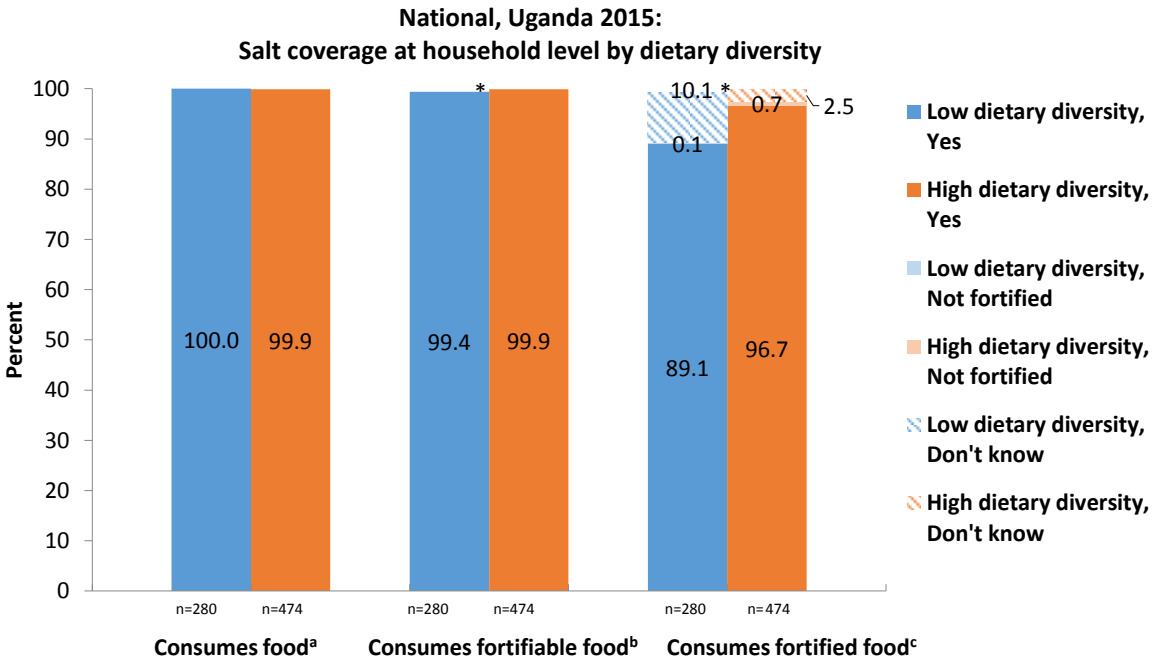
D.



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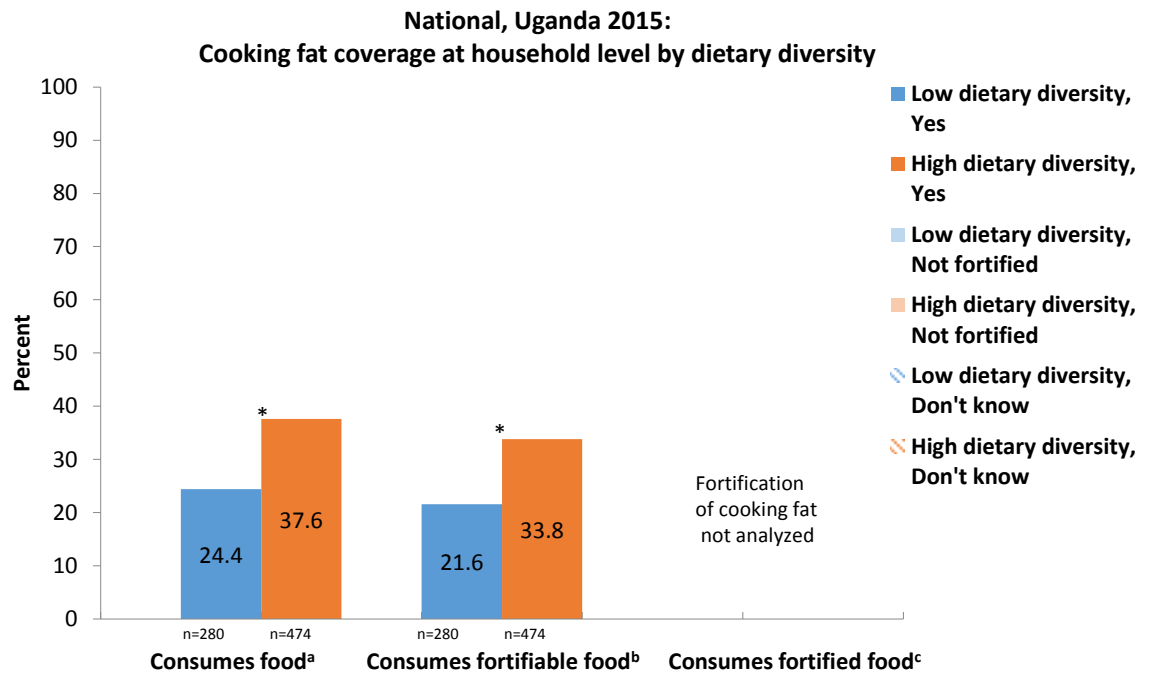
E.



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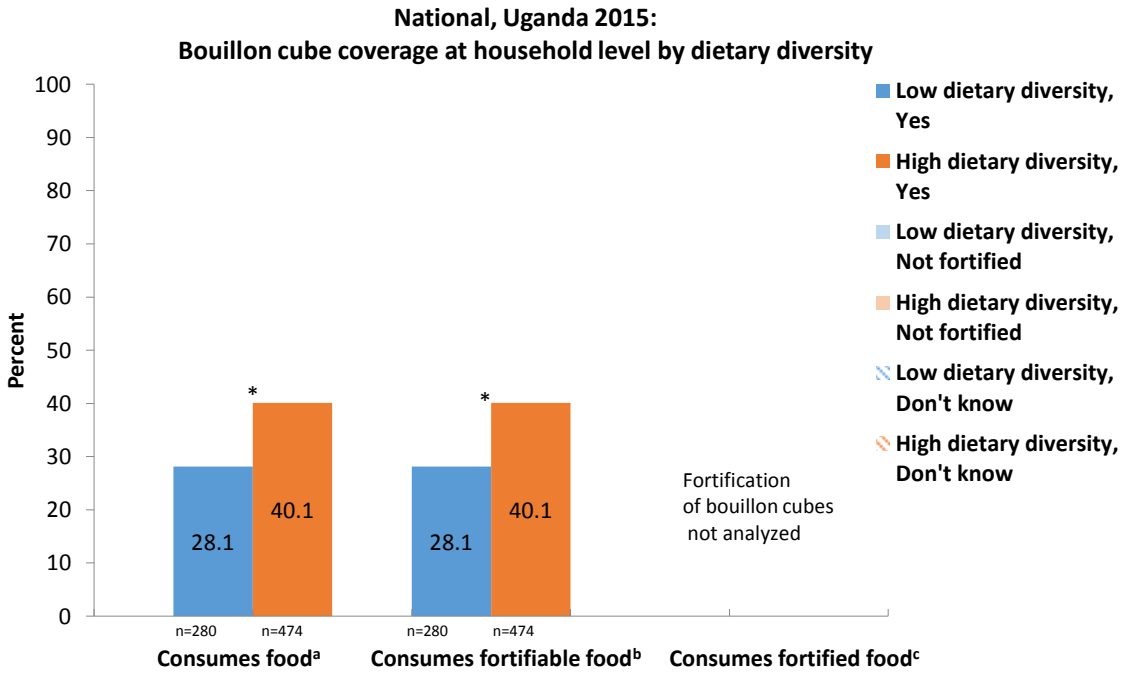
F.



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(D) Households that did not consume a fortifiable food are not shown.

[2] *The "N" below each bar refers to the total number of households in the denominator.*

[3] *Lower dietary diversity refers to a dietary diversity score lower than the population median in each stratum (i.e. rural or urban residence). Higher dietary diversity refers to a dietary diversity score greater than or equal to the population median in each stratum (i.e. rural or urban residence). The population median is 4 in rural areas and 5 in urban areas. When more than one woman of reproductive age answered the dietary diversity information per household, the dietary diversity score of one woman was randomly selected and applied to the household.*

[4] *All bouillon cubes are assumed to be fortifiable because they are industrially made outside of the household.*

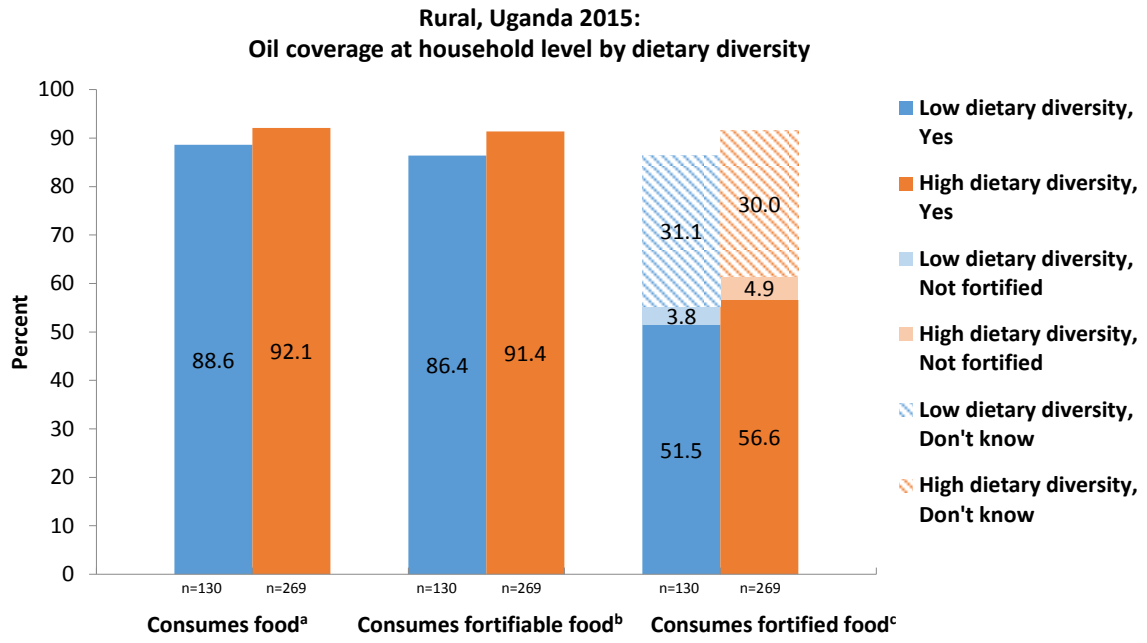
Household coverage foods by women's dietary diversity score among rural households

The next series of figures show household coverage of foods stratified by women's dietary diversity score: (lower dietary diversity (below the median) or higher dietary diversity (at or above the median) among rural households (**Figure 3** and in the same data in table format in **Annex H**). Among rural households, for oil, wheat flour, and salt there were no differences between WRA reporting higher dietary diversity scores and WRA with lower dietary diversity scores on all indicators (consumes food, consumes fortifiable food, consumes fortified food) (**Figures 3G, 3H, and 3J**).

Among rural households, a significantly higher percentage of WRA meeting the criteria for higher dietary diversity consumed maize flour compared to WRA reporting a lower dietary diversity score (**Figure 3I**).

Cooking fat consumption and fortifiable cooking fat consumption was significantly higher among rural households with WRA meeting the criteria for higher dietary diversity compared to rural households where WRA reported a lower dietary diversity score **(Figure 3K)**. More than a third of WRA (34.1%) who reported a higher dietary diversity consumed bouillon cubes; this was a significantly higher percentage compared to WRA with a lower dietary diversity score **(Figure 3L)**.

G.



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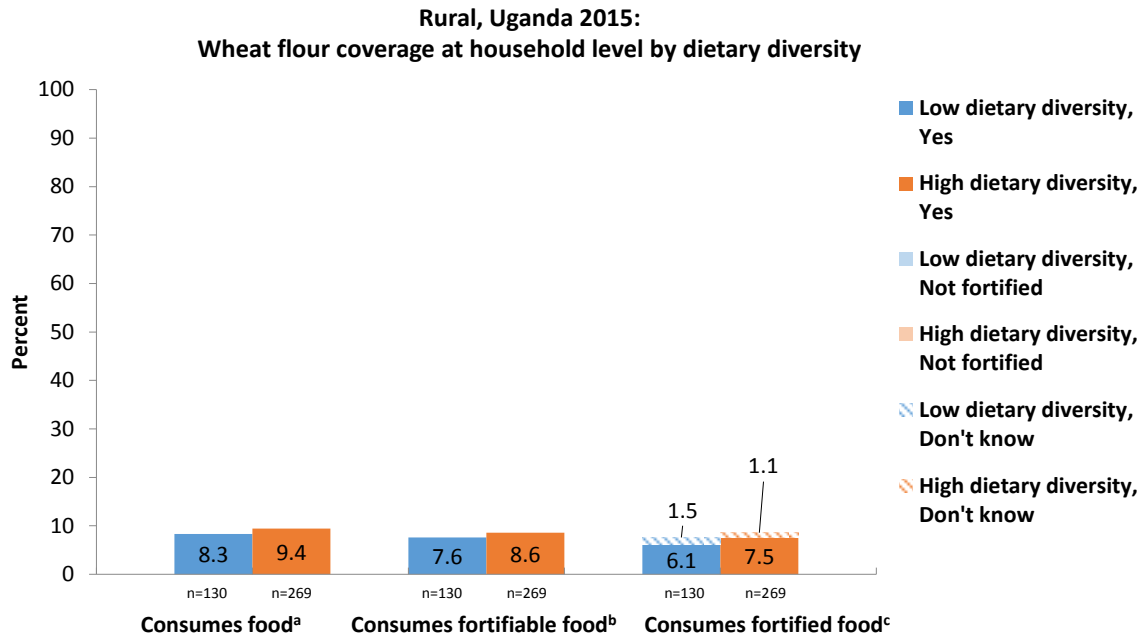
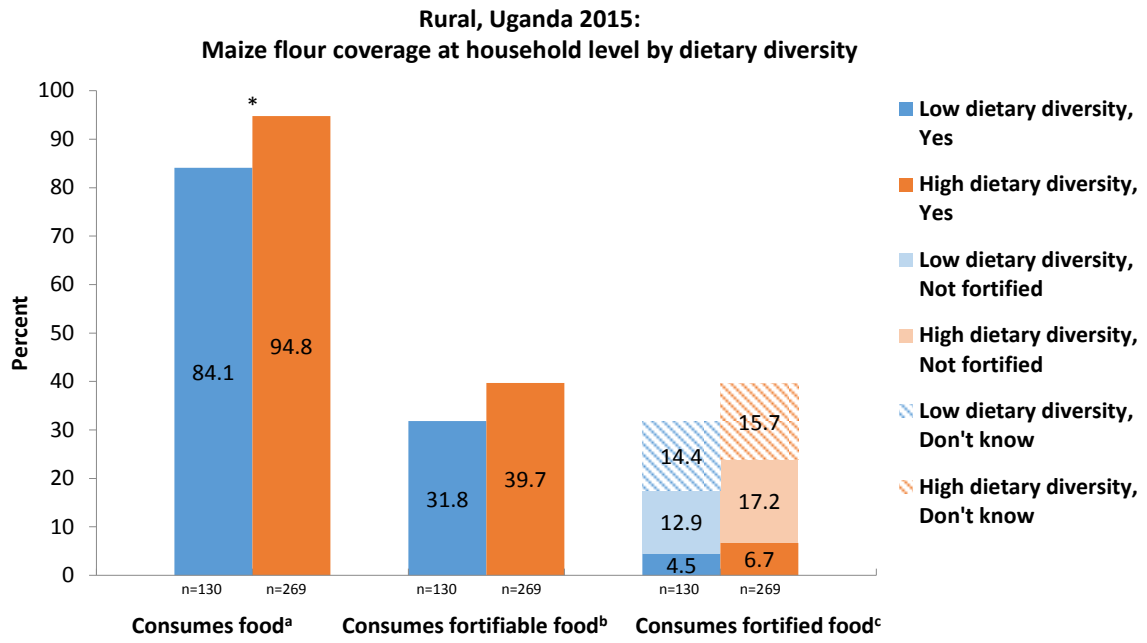
H.



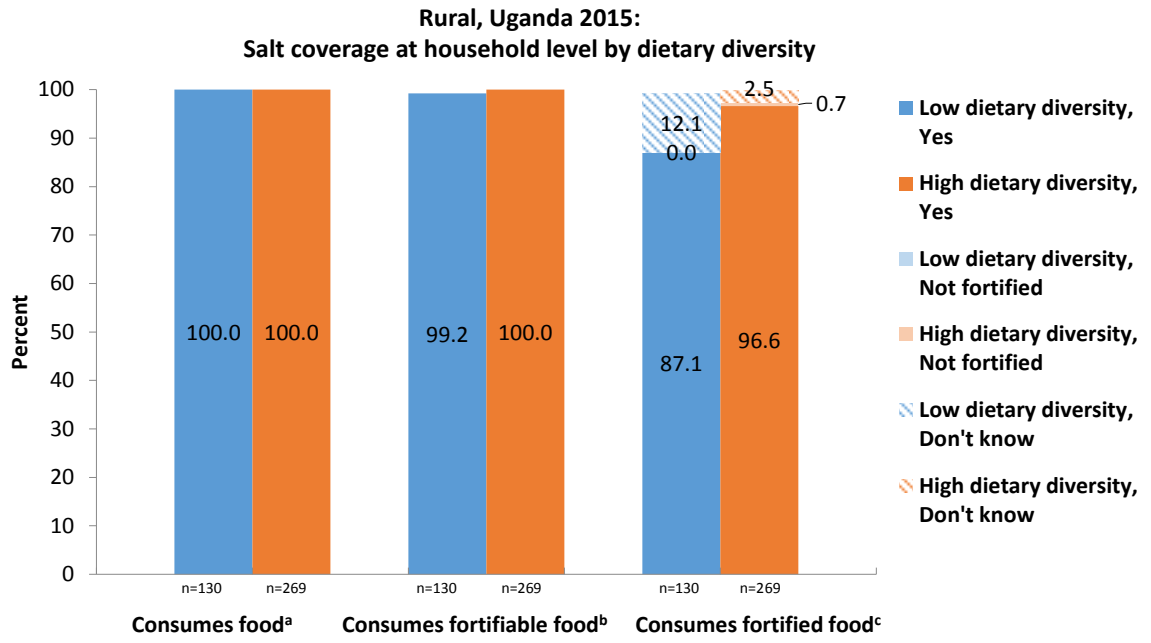
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic level; "Not fortified" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses not to contain the nutrient above the intrinsic level; "Don't know" refers to households that could not be classified because no sample or reported brand was available; Households that did not consume a fortifiable food are not shown. * P < 0.05

I.



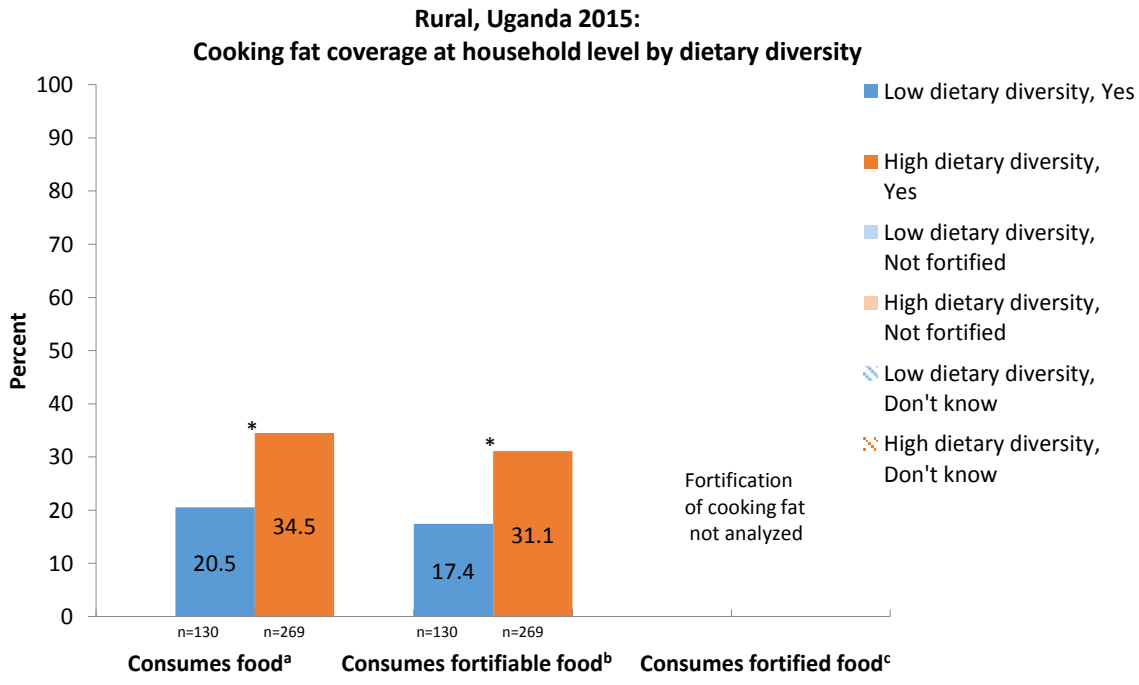
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic level; "Not fortified" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses not to contain the nutrient above the intrinsic level; "Don't know" refers to households that could not be classified because no sample or reported brand was available; Households that did not consume a fortifiable food are not shown. * P < 0.05

J.



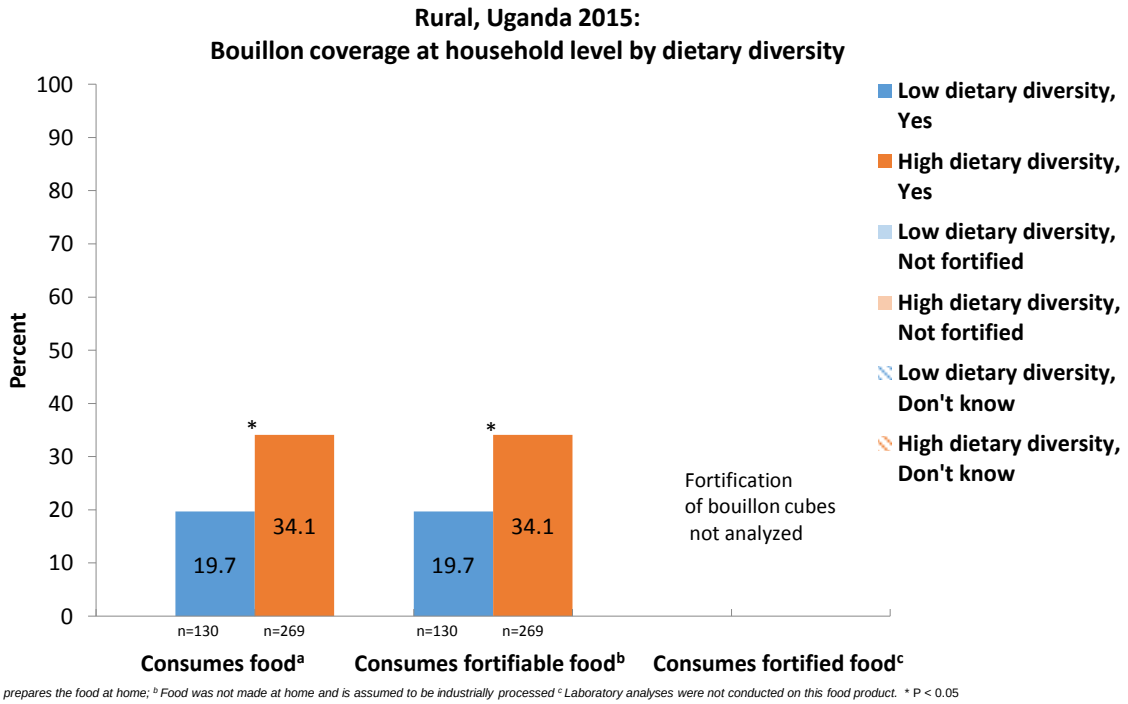
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic level; "Not fortified" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses not to contain the nutrient above the intrinsic level; "Don't know" refers to households that could not be classified because no sample or reported brand was available; Households that did not consume a fortifiable food are not shown. * P < 0.05

K.



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] Laboratory analyses were not conducted on this food product. * P < 0.05

L.



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] Laboratory analyses were not conducted on this food product. * P < 0.05

[1] *"Consumes food" refers to households that reported preparing this food at home. "Consumes fortifiable food" refers to households that reported consuming a food that was not made at home and is assumed to be industrially processed. "Consumes fortified food" refers to households that consumed a food that was confirmed to be fortified by quantitative analyses (i.e. if the sample or brand provided met or exceeded the following nutrient content cut-off criteria: oil with ≥3.0 IU/kg vitamin A, wheat flour ≥35.0 mg/kg iron, maize flour ≥15.0 mg/kg iron, salt ≥7.6 mg/kg iodine. "Consumes fortified food" was determined as follows:*

(A) In households where a food sample was collected and analyzed, if the sample met the fortified criteria then the household was classified as "yes" for consumes fortified food. If the sample did not meet the fortified criteria, then the household was classified as "not fortified" for consumes fortified food.

(B) In households where a food sample was not taken and the brand name was available, the median nutrient value in the branded samples analyzed from other households was used. If the value met the fortified criteria then the household was classified as "yes: for consumes fortified food. If the value did not meet the fortified criteria then the household was classified as "not fortified" for consumes fortified food.

(C) In households where a food sample was not collected and the brand name was not available, the household was classified as "don't know" for consumes fortified food.

(D) Households that did not consume a fortifiable food are not shown.

[2] *The "N" below each bar refers to the total number of households in the denominator.*

[3] *Lower dietary diversity refers to a dietary diversity score lower than the population median in each stratum (i.e. rural or urban residence). Higher dietary diversity refers to a dietary diversity score greater than or equal to the population median in each stratum (i.e. rural or urban residence). The population median is 4 in rural areas and 5 in urban areas. When more than one woman of reproductive age answered the dietary diversity information per household, the dietary diversity score of one woman was randomly selected and applied to the household.*

[4] *All bouillon cubes are assumed to be fortifiable because they are industrially made outside of the household.*

Household coverage of fortifiable and fortified foods by women's dietary diversity score among urban households

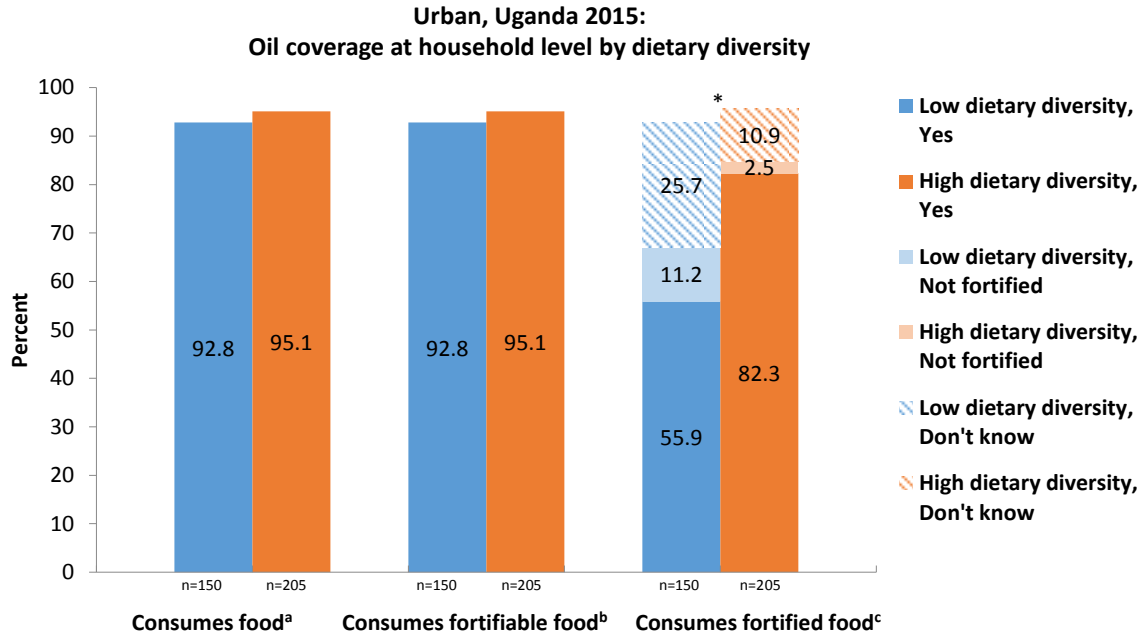
The next series of figures show household coverage of foods stratified by women's dietary diversity score: lower dietary diversity (below the median) or higher dietary diversity (at or above the median) among urban households (**Figure 3** and the data are also presented in table format in **Annex H**). Among households with WRA meeting the criteria for higher dietary diversity, consumption of fortified oil was higher than in households where WRA did not meet the criteria for higher dietary diversity (**Figure 3M**). Wheat flour consumption and fortifiable wheat flour consumption were also higher among households with WRA meeting the criteria for higher dietary diversity compared to those households where WRA did not (**Figure 3N**).

For maize flour, a significantly greater percentage of households with WRA meeting the criteria for higher dietary diversity consumed fortifiable maize flour compared to households with WRA who did not meet the criteria. However, the opposite was true for fortified maize intake where a higher percentage of households with WRA not meeting the criteria for higher dietary diversity consumed significantly more fortified maize flour compared to households with WRA meeting the criteria for higher dietary diversity (**Figure 3O**).

For salt (**Figure 3P**) there was no difference by dietary diversity of WRA in households between those consuming salt, consuming fortifiable salt, or consuming fortified salt.

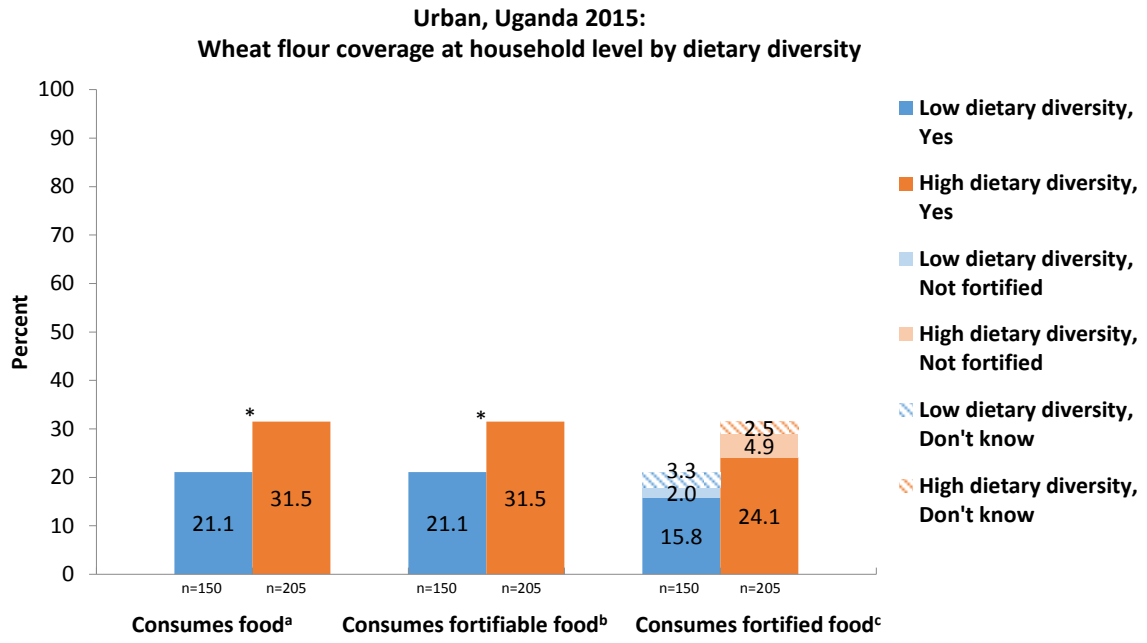
National cooking fat consumption and fortifiable cooking fat consumption was significantly higher among households with WRA reporting they met the criteria for higher dietary diversity compared to households with WRA not meeting the criteria **(Figure 3Q)**. This was the same for bouillon cubes and fortifiable bouillon cubes **(Figure 3R)**.

M.



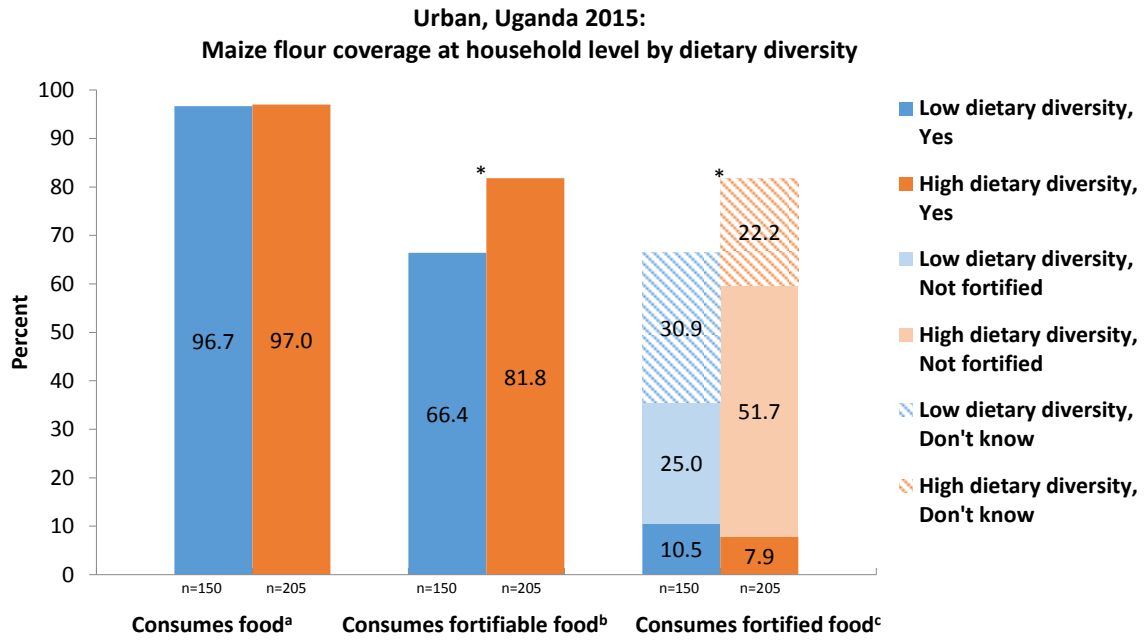
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic level; "Not fortified" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses not to contain the nutrient above the intrinsic level; "Don't know" refers to households that could not be classified because no sample or reported brand was available; Households that did not consume a fortifiable food are not shown. * P < 0.05

N.



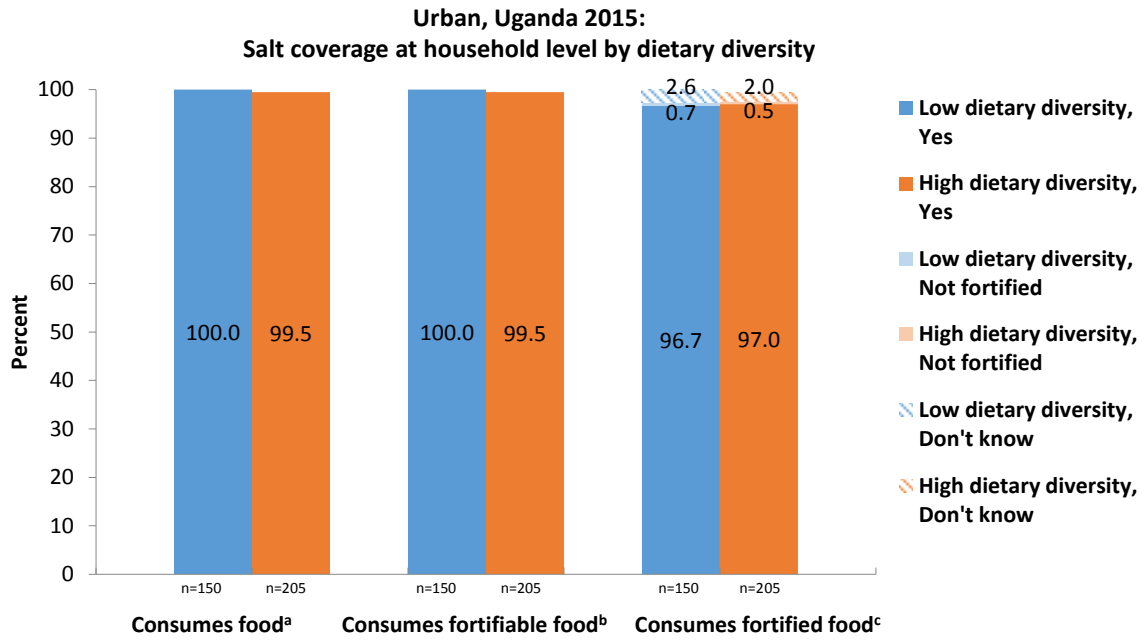
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic level; "Not fortified" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses not to contain the nutrient above the intrinsic level; "Don't know" refers to households that could not be classified because no sample or reported brand was available; Households that did not consume a fortifiable food are not shown. * P < 0.05

O.



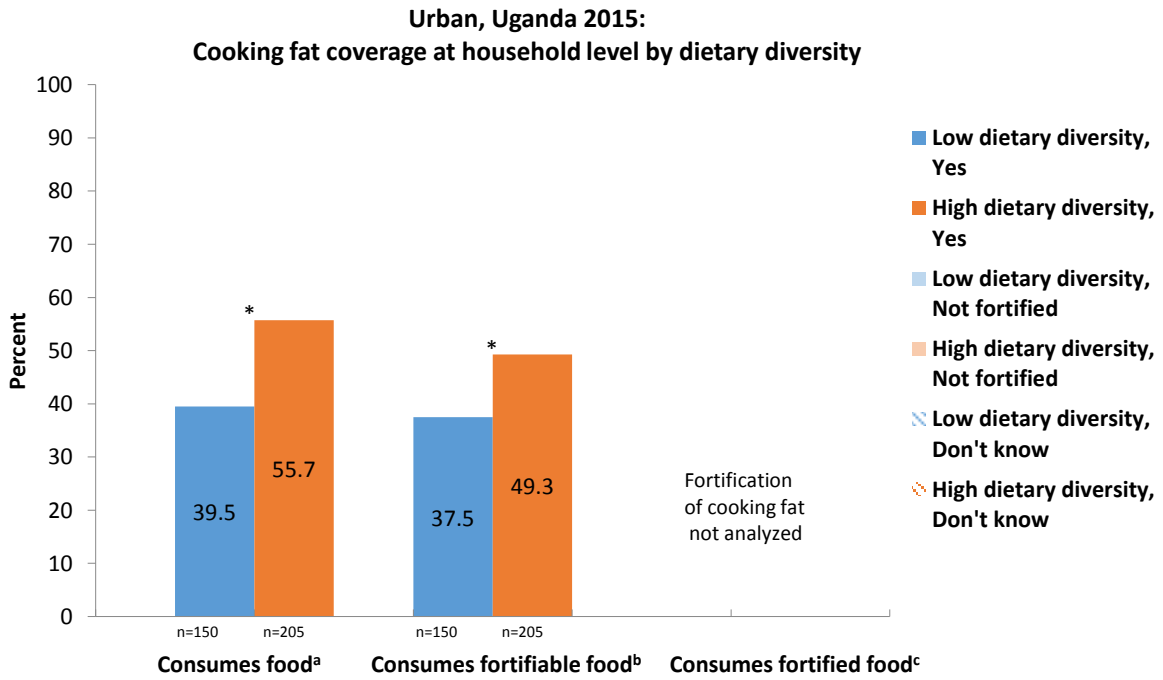
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic level; "Not fortified" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses not to contain the nutrient above the intrinsic level; "Don't know" refers to households that could not be classified because no sample or reported brand was available; Households that did not consume a fortifiable food are not shown. * P < 0.05

P.



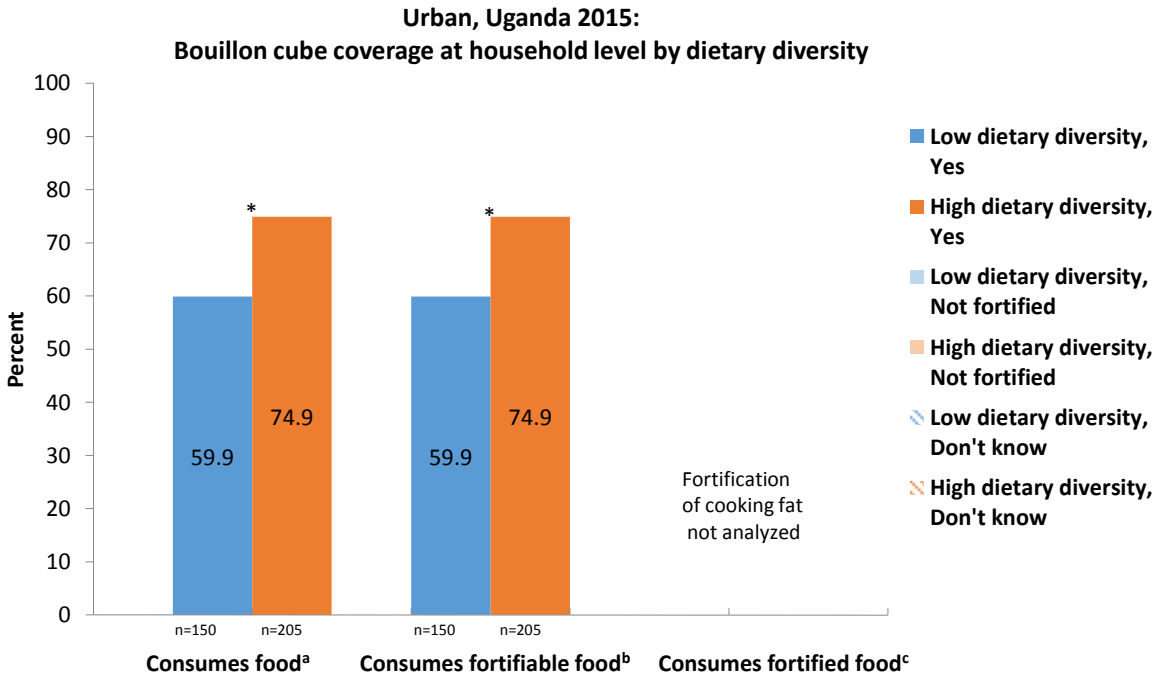
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic level; "Not fortified" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses not to contain the nutrient above the intrinsic level; "Don't know" refers to households that could not be classified because no sample or reported brand was available; Households that did not consume a fortifiable food are not shown. * P < 0.05

Q.



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] Laboratory analyses were not conducted on this food product. * P < 0.05

R.



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] Laboratory analyses were not conducted on this food product. * P < 0.05

[1] *"Consumes food" refers to households that reported preparing this food at home. "Consumes fortifiable food" refers to households that reported consuming a food that was not made at home and is assumed to be industrially processed. "Consumes fortified food" refers to households that consumed a food that was confirmed to be fortified by quantitative analyses (i.e. if the sample or brand provided met or exceeded the following nutrient content cut-off criteria: oil with ≥3.0 IU/kg vitamin A, wheat flour ≥35.0 mg/kg iron, maize flour ≥15.0 mg/kg iron, salt ≥7.6 mg/kg iodine. "Consumes fortified food" was determined as follows:*

(A) In households where a food sample was collected and analyzed, if the sample met the fortified criteria then the household was classified as "yes" for consumes fortified food. If the sample did not meet the fortified criteria, then the household was classified as "not fortified" for consumes fortified food.
(B) In households where a food sample was not taken and the brand name was available, the median nutrient value in the branded samples analyzed from other households was used. If the value met the fortified criteria then the household was classified as "yes: for consumes fortified food. If the value did not meet the fortified criteria then the household was classified as "not fortified" for consumes fortified food.
(C) In households where a food sample was not collected and the brand name was not available, the household was classified as "don't know" for consumes fortified food.
(D) Households that did not consume a fortifiable food are not shown.
[2] *The "N" below each bar refers to the total number of households in the denominator.*
[3] *Lower dietary diversity refers to a dietary diversity score lower than the population median in each stratum. Higher dietary diversity refers to a dietary diversity score greater than or equal to the population median in each stratum. The population median is 4 in rural areas and 5 in urban areas. When more than one woman of reproductive age answered the dietary diversity information per household, the dietary diversity score of one woman was randomly selected and applied to the household.*
[4] *All bouillon cubes are assumed to be fortifiable because they are industrially made outside of the household.*

Adequacy of food fortification compared to national or WHO standards and by rural and urban setting

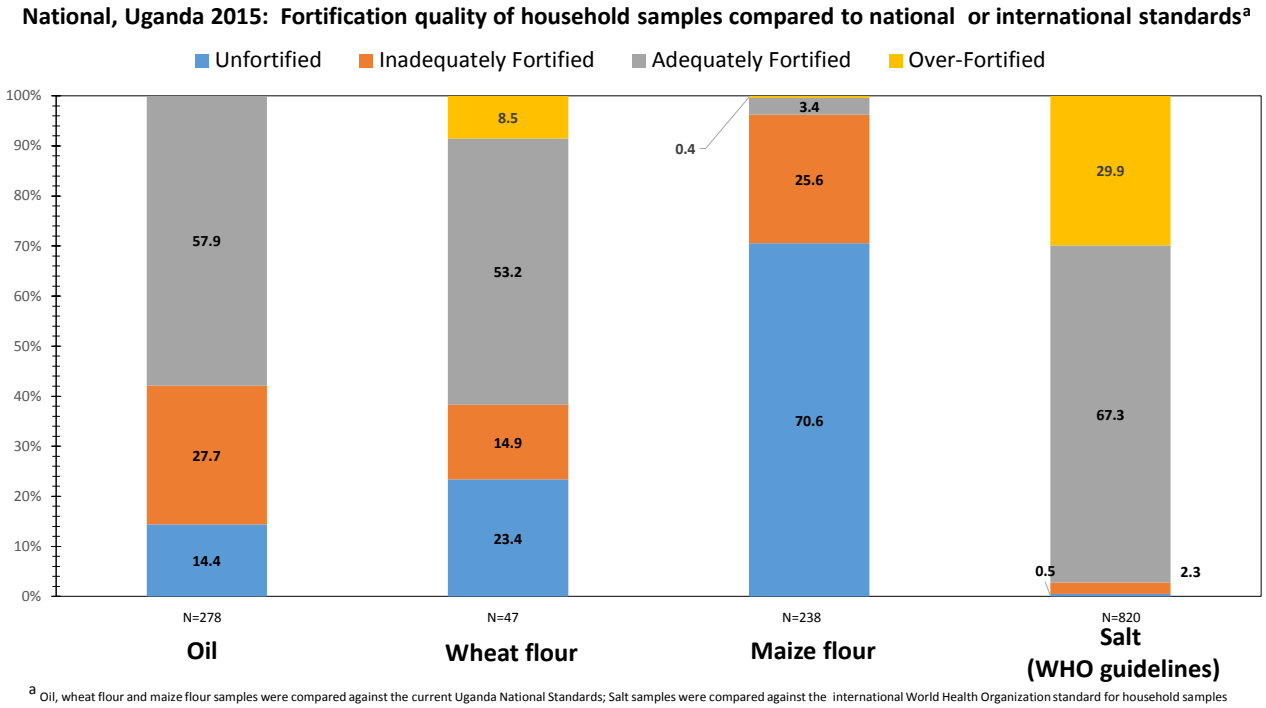
The fortification quality level compared to national or international standards varied greatly depending on the food (**Figure 4** and the same data in table format in **Annex H**). Foods were analyzed by BioAnalyt in Germany to determine fortification levels (**Annex G)** describes these analytic methods). Among the food samples analyzed in the laboratory, nationally, 14.4% of oil samples, 23.4% of wheat flour samples, 70.6% of maize samples and 0.5% of the salt samples were unfortified (**Figure 4A**). The percentage of inadequately fortified samples

ranged from 2.3% for salt to 27.7% for oil. In increasing order, the percentage of adequately fortified samples was as follows: 3.4% for maize flour, 53.2% for wheat flour, 57.9% for oil, and 67.3% for salt according to WHO standards. A total of 8.5% of wheat flour samples were above standard, as well as 29.9% of salt samples according to WHO standards.

The results for fortification quality levels for food samples collected among rural and urban households were similar to those for the national sample. There were only seven wheat flour samples collected in rural households. In rural settings, the percentage of food samples that were adequately fortified in increasing order was: 2.6% for maize flour, 61.7% for oil, 70.6% for salt according to WHO standards, and 71.4% for wheat flour (**Figure 4B**). In urban settings, the percentage of food samples adequately fortified in increasing order was: 3.7% for maize flour, 50.0% for wheat flour, 55.0% for oil, and 63.8% for salt according to WHO standards (**Figure 4C**).

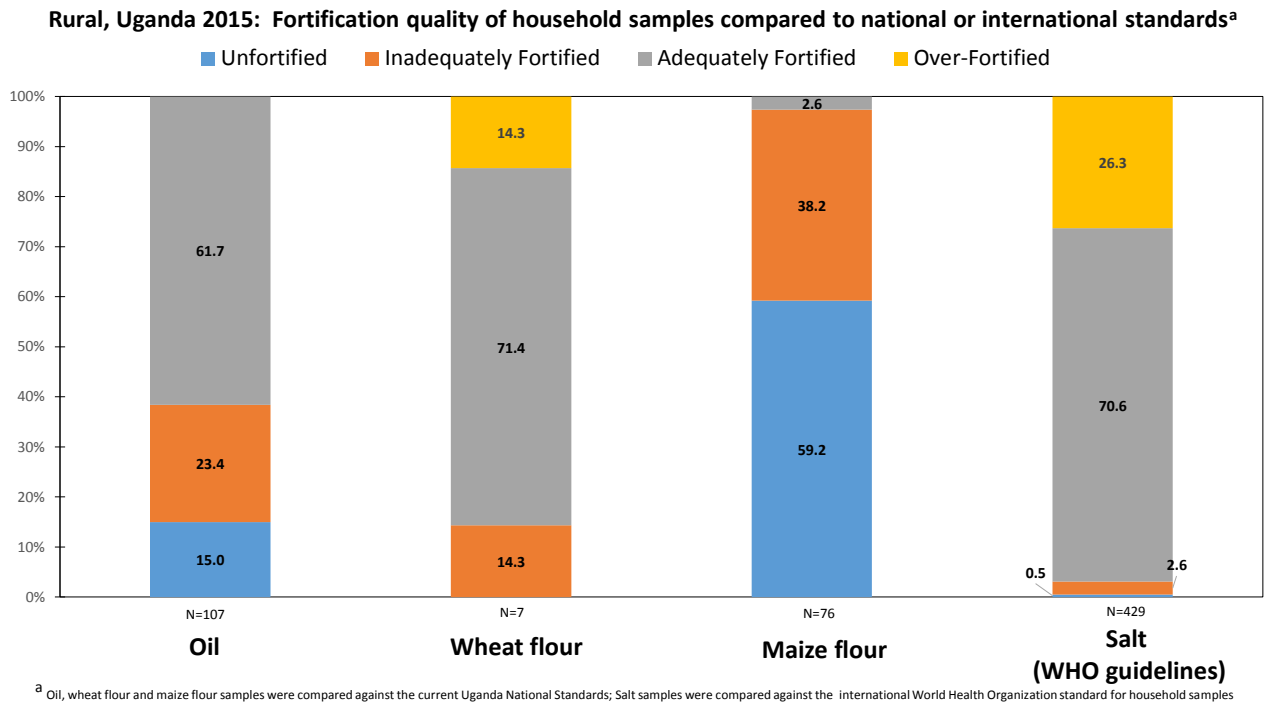
Figure 4. Fortification quality of household food samples compared to Uganda national standards for oil, wheat and maize flour and international standards for salt. [1,2,3,4,5,6]

A.



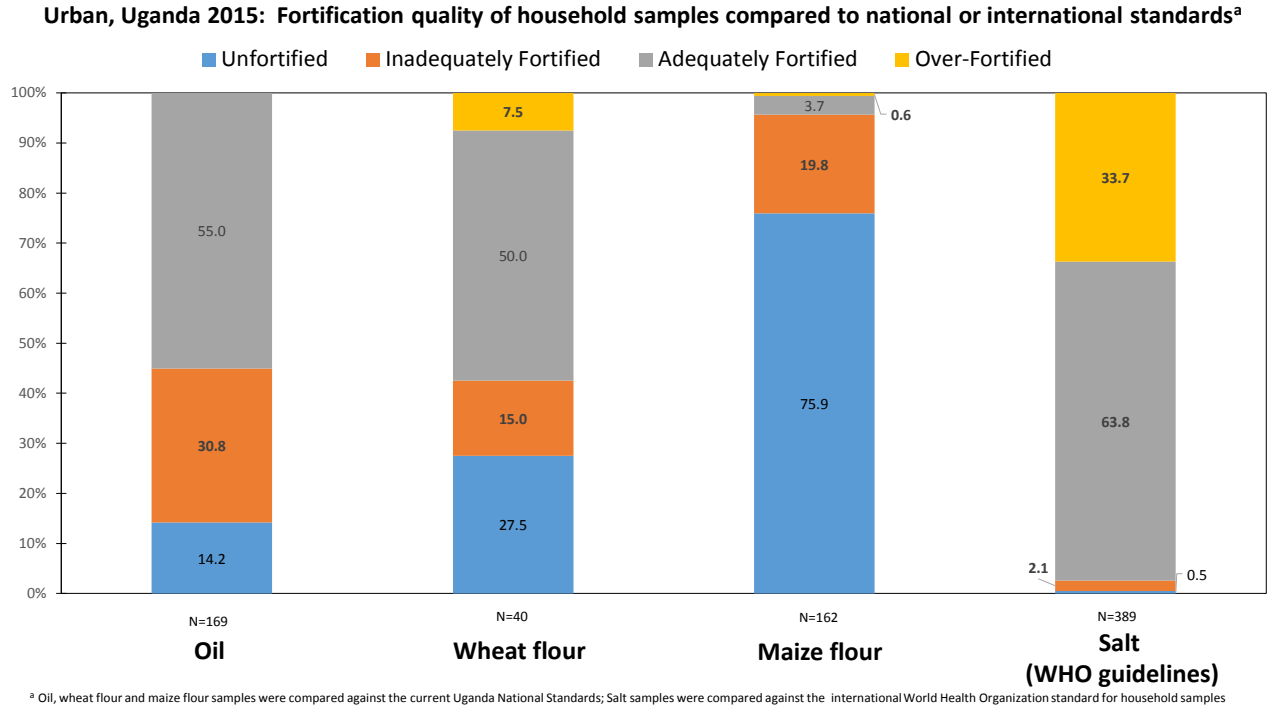
[a] Oil, wheat flour and maize flour samples were compared against the current Uganda National Standards; Salt samples were compared against the international World Health Organization standard for household samples

B.



[a] Oil, wheat flour and maize flour samples were compared against the current Uganda National Standards; Salt samples were compared against the international World Health Organization standard for household samples

C.



[a] Oil, wheat flour and maize flour samples were compared against the current Uganda National Standards; Salt samples were compared against the international World Health Organization standard for household samples

[1] The "N" below each bar refers to the total number of samples analyzed.

[2] Fortification quality for oil was determined by analyzing the vitamin A levels in samples collected from households. "Unfortified" had <3.0 mg RE/kg vitamin A, "inadequately fortified" had 3.0 to <20.0 mg RE/kg vitamin A, "adequately fortified" had 20.0 to <40.0 mg RE/kg vitamin A and "above standard" had ≥40.0 mg RE/kg vitamin A. Red palm oil was not included in these analyses because it is not required to be fortified in Uganda and was considered not fortifiable.

[3] *Fortification quality for wheat flour was determined by analyzing the iron levels in samples collected from households. "Unfortified" had <35.0 mg/kg iron, "inadequately fortified" had 35.0 to <50.0 mg/kg iron, "adequately fortified" had 50.0 to <80.0 mg/kg iron and "above standard" had ≥80.0 mg/kg iron.*

[4] *Fortification quality for maize flour was determined by analyzing the iron levels in samples collected from households. "Unfortified" had <15.0 mg/kg iron, "inadequately fortified" had 15.0 to <30.0 mg/kg iron, "adequately fortified" had 30.0 to <45.0 mg/kg iron and "above standard" had ≥45.0 mg/kg iron.*

[5] *Fortification quality for salt was determined by analyzing the iodine levels in samples taken from households and comparing the result to the World Health Organization international standard for household samples as follows: "Unfortified" <7.6 ppm iodine (minimum level of detection based on laboratory test used), "inadequately fortified" 7.6 to <15 ppm iodine, "adequately fortified" 15 to <40 ppm iodine, and "above standard" ≥40 ppm of iodine.*

[6] **Some oil and salt samples were missing rural/urban labels and were only analyzed at the national level; aggregating the number of rural and urban samples that were missing labels will not add up to the total number of national samples analyzed.*

Fortification labelling

For Uganda's fortification logo, nationally 10.4% of all respondents reported ever seeing the logo; more than twice as many reported seeing the logo in urban than rural households (**Table 9**). Less than 6% of respondents reported seeing a Kenyan logo nationwide. Few respondents reported that the Ugandan or the Kenyan logo provides positive attributes such as "good for health" or "better quality". (<5%) or influences their decision to buy fortified food (<5%) on a national level. It should be noted that the "positive attributes" and "influences decision to buy" questions were asked of all respondents, not only those who responded affirmatively to the "ever saw logo" question.

Table 9. Fortification logo and knowledge results.[1,2,3]

Characteristic	National N=949	Rural N=509	Urban N=440	p-value[2]
	% (95% CI)	% (95% CI)	% (95% CI)	
Uganda fortification logo				
Reported ever seeing fortification logo	10.4 (7.8, 13.0)	8.8 (6.4, 11.3)	18.2 (14.6, 21.8)	<0.0001
Reported positive attributes[3] to logo	2.4 (1.3, 3.5)	2.0 (0.8 3.2)	4.8 2.8 6.8	0.0001
Reported that logo influences decision to buy	2.5 (1.5, 3.5)	2.0 (0.8, 3.2)	5.2 (3.1, 7.3)	0.0003
Kenya fortification logo				
Reported ever seeing fortification logo	5.9 (3.9, 8.0)	5.7 (3.7, 7.7)	7.0 (4.6, 9.4)	0.6087
Reported positive attributes[3] to logo	0.5 (0.0, 1.1)	0.6 (0.0 1.3)	0.2 (0.0, 0.7)	0.3773
Reported that logo influences decision to buy	0.7 (0.0, 1.4)	0.6 (0.0, 1.3)	1.1 (0.1, 2.1)	0.4761

Abbreviation: CI, Confidence Interval

[1] *All values are percent and adjusted for probability of selection by population proportional to size (PPS) sampling. National values are weighted.*

[2] *Comparing rural versus urban. Chi-square test was used to compare percentages.*

[3] *Reported that the logo means "fortified / enriched / added micronutrients", "good for health" or "better quality".*

Estimates of the contribution of fortified flour-containing foods to the RNI among WRA

Based on their assessment of how much flour-containing foods they consumed and with what frequency, it was estimated that nationally, women consume 24.8 grams of wheat flour per day; in urban areas the intake was higher (47.3 grams/day) compared to rural areas (19.5 grams/day) (**Table 10**). Added iron intake from wheat flour was estimated to meet 2.6% of the RNI (per the World Health Organization) for WRA nationally and was slightly higher in urban areas compared to rural areas.

Table 10. Daily food consumption (grams/day) by and micronutrient contribution (% RNI) for all surveyed women of reproductive age based on individual assessment of women.

	National N=965	Rural N=517	Urban N=448	p-value[2]
	Median[1] (25%, 75%)	Median[1] (25%, 75%)	Median[1] (25%, 75%)	
Wheat flour consumed[4] (grams/day)	24.8 (9.8, 52.2)	19.5 (8.9, 43.1)	47.3 (21.8, 77.9)	<0.0001
Added iron from wheat flour (% RNI[4])	2.6 (1.1, 5.3)	2.2 (1.0, 4.9)	4.0 (1.9, 7.1)	<0.0001

Abbreviation: RNI, recommended nutrient intakes

[1] All values are median as indicated and adjusted for probability of selection by population proportional to size (PPS) sampling. National values are weighted.

[2] Comparing rural versus urban. Chi-square test was used to compare percentages. Wilcoxon rank sum test was used to compare median values. P-values were derived from Wilcoxon nonparametric medians tests. The daily food consumption is shown as median with population distribution spread presented as 25th and 75th percentiles and not 95% CI. Thus overlapping 25th and 75th percentiles does not indicate non-significance as the test is based on the median point estimates between rural and urban areas.

[3] Women were asked to report the frequency in the past 7 days with which they consumed foods containing wheat flour. They were asked to approximate the portion size they ate at each sitting, using picture cards of different portion sizes. The flour in the portion sizes was estimated from recipes and used in conjunction with the frequency and number of portion sizes to estimate the daily flour consumed by women. The grand median nutrient value for all wheat flour samples analyzed in each stratum or nationally was multiplied with women's daily flour consumed, to estimate daily nutrient consumed. The amount of nutrient consumed daily was then translated into a percentage of the daily reference nutrient intake (RNI) for the women based on World Health Organization guidelines.

[4] The iron RNI for women, assuming 12% bioavailability, was drawn from the World Health Organization (2004) and is as follows: 25.8 mg/day (15-18 years), 24.5 mg/day (19-50 years), 24.5 mg/day (pregnant women), 12.5 mg/day (lactating women). The percent of RNI met was calculated as follows: amount of iron consumed from flour / iron RNI x 100%. Intrinsic iron amounts were deducted before analyses and these results refer only to the contribution of added iron.

The contribution of wheat flour to women's RNIs for iron was stratified by households' poverty risk (**Table 11**). Nationally, women from non-poor households consumed more fortifiable wheat flour per day (31.8 grams/day vs 19.2 grams/day) and had a higher contribution to the percent of iron RNI met (3.1% vs 2.1%) compared to women from poor households. In rural settings, there was no difference in the amount of wheat flour consumed per day or the percent contribution of wheat flour to the iron RNI met for WRA living in poor and non-poor households. In urban settings, both consumption of wheat flour per day (26.0 grams/day vs 54.7 grams/day) and percent RNI contribution of iron from wheat flour (2.6% vs 4.4%) were significantly lower among WRA from poor households compared to WRA living in non-poor households.

Table 11. Daily food consumption (grams/day) by and micronutrient contribution (% RNI) for all surveyed women of reproductive age based on individual assessment of women by poverty risk.

	Poor[1,2] Median (25%, 75%)	Non-poor[1,2] Median (25%, 75%)	p-value[3]
National	**N=488**	**N=477**	
Wheat flour consumed[4] (grams/day)	19.2 (8.9, 47.6)	31.8 (11,58.9)	<0.0001
Added iron from wheat flour (% RNI[5])	2.1 (1.0, 5.0)	3.1 (1.2, 5.6)	<0.0001
Rural	**N=346**	**N=171**	
Wheat flour consumed[4] (grams/day)	19.0 (8.9, 46.1)	22.3 (9.2, 41.2)	0.7152
Added iron from wheat flour (%RNI[5])	2.0 (1.0, 5.0)	2.4 (0.9, 4.6)	0.9995
Urban	**N=131**	**N=317**	
Wheat flour consumed[4] (grams/day)	26.0 (17.4, 63.7)	54.7 (27.3, 83.4)	0.0002
Added iron from wheat flour (% RNI[5])	2.6 (1.3, 5.5)	4.4 (2.4, 7.2)	0.0002

Abbreviation: RNI, recommended nutrient intakes

[1] Multidimensional Poverty Index (MPI) greater than or equal to 0.33 is defined as "poor" and MPI less than 0.33 is defined as "non-poor".

[2]All values are median as indicated and adjusted for probability of selection by population proportional to size (PPS) sampling. National values are weighted.

[3] Comparing poor versus non-poor. Chi-square test was used to compare percentages. Wilcoxon rank sum test was used to compare median values. P-values were derived from Wilcoxon nonparametric medians tests. The daily food consumption is shown as median with population distribution spread presented as 25th and 75th percentiles and not 95% CI. Thus overlapping 25th and 75th percentiles does not indicate non-significance as the test is based on the median point estimates between poor and non-poor.

[4] Women were asked to report the frequency in the past 7 days with which they consumed foods containing wheat flour. They were asked to approximate the portion size they ate at each sitting, using picture cards of different portion sizes. The flour in the portion sizes was estimated from recipes and used in conjunction with the frequency and number of portion sizes to estimate the daily flour consumed by women. The grand median nutrient value for all wheat flour samples analyzed in each stratum or nationally was multiplied with women's daily flour consumed, to estimate daily nutrient consumed. The amount of nutrient consumed daily was then translated into a percentage of the daily reference nutrient intake (RNI) for the women based on World Health Organization guidelines.

[5] The iron RNI for women, assuming 12% bioavailability, was drawn from the World Health Organization and is as follows: 25.8 mg/day (15-18 years), 24.5 mg/day (19-50 years), 24.5 mg/day (pregnant women), 12.5 mg/day (lactating women). The percent of RNI met was calculated as follows: amount of iron consumed from flour / iron RNI x 100%. Intrinsic iron amounts were deducted before analyses and these results refer only to the contribution of added iron.

The contribution of wheat flour to women's iron RNI was stratified by the individual women's dietary diversity score of one randomly selected WRA in the household (**Table 12**). Nationally, and among urban households, iron added to flour contributed a greater percentage of the iron RNI among WRA with a higher dietary diversity score than among those with a lower dietary diversity score. Among urban households, a greater amount of wheat flour was consumed and a correspondingly higher percentage of iron RNI by WRA meeting the criteria for higher dietary diversity than those who did not. In rural households, there was no difference in the amount of wheat flour consumed per day or the nutrition contribution (% RNI) between WRA who met the criteria for higher dietary diversity and those who did not.

Table 12. Daily food consumption (grams/day) by and micronutrient contribution (% RNI) for all surveyed women of reproductive age based on individual assessment of women by women's dietary diversity score.[1]

Food	Lower dietary diversity[1,2]	Higher dietary diversity[1,2]	p-value[3]
	Median (25%, 75%), % (SE)	Median (25%, 75%), % SE	
National	**N=358**	**N=607**	
Wheat flour consumed[4] (grams/day)	22.4 (9.1, 43.1)	25.3 (10.2, 55.2)	0.0561
Added iron from wheat flour (% RNI[5])	2.5 (1.0, 4.8)	2.7 (1.2, 5.5)	0.0119
Rural	**N=171**	**N=346**	
Wheat flour consumed[4] (grams/day)	16.4 (8.0, 36.0)	20.5 (8.9, 48.6)	0.1852
Added iron from wheat flour (% RNI[5])	2.1 (0.9, 4.1)	2.3 (1.0, 5.0)	0.2831
Urban	**N=192**	**N=256**	
Wheat flour consumed[4] (grams/day)	40.0 (16.8, 68.2)	54.7 (26.2, 84.5)	0.0013
Added iron from wheat flour (% RNI\[5])	3.1 (1.5, 5.5)	2.3 (1.0, 5.0)	0.0002

Abbreviation: RNI, recommended nutrient intakes

[1] All values are median or percent as indicated, and adjusted for probability of selection by population proportional to size (PPS) sampling.

[2] Lower dietary diversity refers to a dietary diversity score lower than the population median in each stratum (i.e. rural or urban residence). Higher dietary diversity refers to a dietary diversity score greater than or equal to the population median in each stratum (i.e. rural or urban residence). The population median is 4 in rural areas and 5 in urban areas. When more than one woman of reproductive age answered the dietary diversity information per household, the dietary diversity score of one woman was randomly selected and applied to the household.

[3] Comparing lower dietary diversity versus higher dietary diversity. Wilcoxon rank sum test was used to compare median values. P-values as derived from Wilcoxon nonparametric medians tests. The daily food consumption is shown as median with population distribution spread presented as 25th and 75th percentiles and not 95% CI. Thus overlapping 25th and 75th percentiles does not indicate non-significance as the test is based on the median point estimates between higher and lower dietary diversity.

[4] Women were asked to report the frequency in the past 7 days with which they consumed foods containing wheat flour. They were asked to approximate the portion size they ate at each sitting, using picture cards of different portion sizes. The flour in the portion sizes was estimated from recipes and used in conjunction with the frequency and number of portion sizes to estimate the daily flour consumed by women. The grand median nutrient value for all wheat flour samples analyzed in each stratum or nationally was multiplied with women's daily flour consumed, to estimate daily nutrient consumed. The amount of nutrient consumed daily was then translated into a percentage of the daily reference nutrient intake (RNI) for the women based on World Health Organization guidelines.

[5] The iron RNI for women, assuming 12% bioavailability, was drawn from the World Health Organization (2004) and is as follows: 25.8 mg/day (15-18 years), 24.5 mg/day (19-50 years), 24.5 mg/day (pregnant women), 12.5 mg/day (lactating women). The percent of RNI met was calculated as follows: amount of iron consumed from flour / iron RNI x 100%. Intrinsic iron amounts were deducted before analyses and these results refer only to the contribution of added iron.

Using information on the amount of foods purchased by households and how long they lasted, estimates were made of how many foods were apparently consumed by women of reproductive age and what this contributed to their RNIs for select nutrients (**Table 13**). Nationally, women of reproductive age in households that consumed fortifiable oil, 5.8 milliliters of fortifiable oil was apparently consumed per day and this contributed to 18.1% of their vitamin A RNI. When stratified by urban and rural setting, apparent oil consumption and percent contribution of RNI for vitamin A for WRA was significantly higher in urban settings compared to rural settings. Women apparently consumed 125.4 grams of fortifiable wheat flour daily and this contributed to 6.9% of women's iron RNI nationally. When stratified by urban and rural setting, apparent wheat flour consumption and percent contribution of RNI for iron for WRA was significantly higher in rural settings compared to urban settings.

While WRA apparently consumed 127.3 grams daily of fortifiable maize flour, this did not contribute at all to women's iron RNI at the national level. For salt nationally, women apparently consumed 8.0 grams daily of fortifiable salt, contributing 165.4% to their iodine RNI. This is well over the recommended intakes provided by WHO and UNICEF (WHO, UNICEF, ICCIDD, 2007).

WRA apparently consumed 1.4 grams of fortifiable bouillon cubes per day.

Table 13. Daily apparent food consumption and micronutrient contribution (%RNI) for women of reproductive age among households that reported consuming the food based on household assessment and adult male equivalent methodology.[1]

Food	National[1]	Rural[1]	Urban[1]	p-value[2]
	Median (25%, 75%)	Median (25%, 75%)	Median (25%, 75%)	
	N=631	**N=337**	**N=294**	
Fortifiable[3] oil apparently consumed[4] (milliliters/day)	5.8 (3.6, 9.3)	5.4 (3.6, 9.0)	7.3 (4.8, 12.2)	<0.0001
Vitamin A from fortifiable[3] oil (% RNI[5])	18.1 (10.4, 30.3)	17.1 (10.0, 27.8)	24.5 (13.1, 44.2)	<0.0001
	N=119	**N=32**	**N=87**	
Fortifiable[3] wheat flour apparently consumed[6] (grams/day)	125.4 (77.0, 189.8)	139.9 (30.2, 209.8)	52.0 (20.3,136.2)	0.0081
Iron from fortifiable[4] wheat flour (% RNI[5])	6.9 (2.1, 22.3)	15.3 (2.9, 39.3)	2.7 (0.1,10.5)	<0.0001
	N=399	**N=149**	**N=250**	
Fortifiable[3] maize flour apparently consumed[4] (grams/day)	125.4 (77.0, 189.8)	131.0 (79.7, 213.9)	110.1 (63.4,169.9)	0.0048
Iron from fortifiable[3] maize flour (% RNI[5])	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	--
	N=708	**N=381**	**N=327**	
Fortifiable[3] salt apparently consumed[4] (grams/day)	8.0 (5.7, 11.1)	8.1 (5.9, 11.3)	6.7 (4.9, 9.9)	<0.0001
Iodine from fortifiable[3] salt (% RNI[5])	165.4 (105.2, 233.5)	169.9 (105.6, 233.5)	140.3 (100.4, 231.2)	0.0328
	N=353	**N=118**	**N=235**	
Fortifiable[3] bouillon cubes apparently consumed (grams/day)	1.4 (0.8, 2.9)	1.2 (0.7, 2.4)	1.7 (1.1, 3.5)	0.0007

Abbreviation: RNI, recommended nutrient intakes

[1] All values are median as indicated, and adjusted for probability of selection by population proportional to size (PPS) sampling.

[2] Comparing rural versus urban. Chi-square test was used to compare percentages. Wilcoxon rank sum test was used to compare median values. P-values were derived from Wilcoxon nonparametric medians tests. The daily food consumption is shown as median with population distribution spread presented as 25th and 75th percentiles and not 95% CI. Thus overlapping 25th and 75th percentiles does not indicate non-significance as the test is based on the median point estimates between rural and urban areas.

[3] Fortifiable is defined as any food that was not made at home and is assumed to be industrially processed.

[4] Households were asked to report the amount of food purchased and the period the food lasted. With this information, the daily amount of food available for consumption in the home was estimated. The nutrient level assigned to each food in a household was done as follows: (A) If a food sample was collected from the home and analyzed, the nutrient value measured in the food sample was assigned to the household. (B) In households where

a food sample was not collected and the brand name was available, the median nutrient value in the branded samples analyzed from other households within each stratum was used. (C) In households where a food sample was not collected and the brand name was not available, the median nutrient value in the unbranded samples analyzed from other households within each stratum was used. The total number of persons (and their age and sex) usually living in the household was collected. This information was used to determine the "apparent food consumption" by women of reproductive age using the adult male equivalent methodology (Sununtnasuk, 2013).

[5] The iron RNI for women, assuming 12% bioavailability, was drawn from the World Health Organization (2004) and is as follows: 25.8 mg/day (15-18 years), 24.5 mg/day (19-50 years), 24.5 mg/day (pregnant women), 12.5 mg/day (lactating women). Intrinsic iron amounts were deducted before analyses and these results refer only to the contribution of added iron. The vitamin A RNI for women, per the World Health Organization, is as follows: 600 micrograms retinol equivalents (mcg RE)/day (15-18 years), 500 mcg RE/day (19-50 years), 800 mcg RE/day (pregnant women), and 850 mcg RE/day (lactating women). The iodine RNI for women, per the World Health Organization, is as follows: 150 mcg/day (15-18 years), 150 mcg/day (19-50 years), 200 mcg/day (pregnant women), and 200 mcg/day (lactating women). For women who were both pregnant and lactating, the pregnancy RNI was used for all nutrients. The percent of RNI met was calculated as follows: amount of nutrient consumed from food / nutrient RNI x 100%. The pregnancy and lactation status of all women in the household was not known. This information was known for the subset of women who answered the women's survey. All non-surveyed women were assumed to be non-pregnant and non-lactating.

The apparent food consumption and nutrient contributions for WRA was stratified by households' poverty risk (**Table 14**). Nationally, among WRA in poor households consuming fortifiable oil, the apparent consumption of fortifiable oil was lower and maize and salt apparent consumption was higher when compared to non-poor households. This led to a higher percentage of WRA meeting the vitamin A RNI in non-poor households compared to WRA in poor households. This also led WRA in poor households to meet a significantly higher percentage of iodine RNI than WRA in non-poor households.

The daily apparent food consumption and micronutrient contribution (% RNI) WRA living in rural households did not differ by poverty status. However, among urban households where the products were consumed, WRA living in poor households apparently consumed more fortifiable maize flour and salt than women from non-poor households. This led WRA in poor households to meet a significantly higher percentage of iodine RNI through intake of salt compared to WRA in non-poor households. All WRA in poor and non-poor households were well above the 100 percent level for iodine RNI values.

Table 14. Daily apparent food consumption and micronutrient contribution (% RNI) for women of reproductive age among households that reported consuming the food based on household assessment and adult male equivalent methodology by poverty risk.

	Poor[1,2]	Non-poor[1,2]	p-value[3]
	Median (25%, 75%)	**Median (25%, 75%)**	
National	**N=311**	**N=320**	
Fortifiable[4] oil apparently consumed[5] (milliliters/day)	5.7 (3.6, 9.2)	6.0 (3.8, 9.9)	0.0077
Vitamin A from fortifiable[4] oil (% RNI[6])	16.9 (10.5, 27.6)	20.0 (9.7, 35.9)	0.0023
	N=30	**N=89**	
Fortifiable[4] wheat flour apparently consumed[5] (grams/day)	66.5 (30.1, 157.7)	129.2 (22.1,198.9)	0.4571
Iron from fortifiable[4] wheat flour (% RNI[6])	5.0 (2.5, 20.1)	10.0 (1.3, 22.4)	0.8181
	N=151	**N=248**	
Fortifiable[4] maize flour apparently consumed[5] (grams/day)	131.1 (84.6, 188.7)	122.3 (70.8, 190.9)	0.0060
Iron from fortifiable[4] maize flour (% RNI[6])	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	--
	N=349	**N=359**	
Fortifiable[4] salt apparently consumed[5] (grams/day)	8.2 (6.0, 11.9)	7.3 (5.2,10.1)	<.0001
Iodine from fortifiable[4] salt (% RNI[6])	173.8 (108.4, 250.7)	156 (101.7,213.3)	0.0007
	N=115	**N=238**	
Fortifiable[4] bouillon cubes apparently consumed[5] (grams/day)	1.4 (0.7,3.2)	1.4 (0.8,2.7)	0.4442
Rural	**N=223**	**N=114**	
Fortifiable[4] oil apparently consumed[5] (milliliters/day)	5.4 (3.5, 9.0)	5.4 (3.7,8.9)	0.9614
Vitamin A from fortifiable[4] oil (% RNI[6])	16.3 (10.3, 26.8)	18.6 (8.8,30.2)	0.7027
	N=15	**N=17**	
Fortifiable[4] wheat flour apparently consumed[5] (grams/day)	70.3 (29.1,161.4)	175.7 (30.3,212.9)	0.4059
Iron from fortifiable[4] wheat flour (% RNI[6])	9.6 (2.8,24.4)	18.1 (3.1,45)	0.5456
	N=95	**N=54**	
Fortifiable[4] maize flour apparently consumed[5] (grams/day)	131.0 (79.9,188.1)	125.0 (79.2,233.4)	0.3483
Iron from fortifiable[4] maize flour (% RNI[6])	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	--
	N=254	**N=127**	
Fortifiable[4] salt apparently consumed[5] (grams/day)	8.2 (6.0, 11.9)	7.7 (5.7,10.3)	0.1133
Iodine from fortifiable[4] salt (% RNI[6])	172.6 (106.2, 245.6)	167.1 (105.2, 215.2)	0.7413
	N=61	**N=57**	
Fortifiable[4] bouillon cubes apparently consumed[5] (grams/day)	1.4 (0.7, 3.2)	1.0 (0.7, 2.0)	0.2028

Urban	N=88	N=206	
Fortifiable[4] oil apparently consumed[5] (milliliters/day)	6.7 (4.5, 11.7)	7.9 (4.9,12.3)	0.2702
Vitamin A from fortifiable[4] oil (% RNI[6])	20.1 (11.5, 40.2)	26.1 (13.3, 45.5)	0.1145
	N=15	**N=72**	
Fortifiable[4] wheat flour apparently consumed[5] (grams/day)	37 (14.8, 65.0)	63 (21.3,143.1)	0.0952
Iron from fortifiable[4] wheat flour (% RNI[6])	2.4 (0.0, 4.1)	2.5 (0.2,15.9)	0.2905
	N=56	**N=194**	
Fortifiable[4] maize flour apparently consumed[5] (grams/day)	131.5 (91.7,208.7)	99.2 (57.7,155.4)	0.0010
Iron from fortifiable[4] maize flour (% RNI[6])	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	--
	N=95	**N=232**	
Fortifiable[4] salt apparently consumed[5] (grams/day)	8.0 (5.5,11.6)	6.6 (4.5,9.1)	0.0043
Iodine from fortifiable[4] salt (% RNI[6])	183.4 (121.0, 282.6)	132.4 (94.5, 200.4)	0.0001
	N=88	**N=206**	
Fortifiable[4] bouillon cubes apparently consumed[5] (grams/day)	6.7 (4.5, 11.7)	7.9 (4.9, 12.3)	0.3278

Abbreviation: RNI, recommended nutrient intakes

[1] All values are median as indicated, and adjusted for probability of selection by population proportional to size (PPS) sampling.

[2] Multidimensional Poverty Index (MPI) greater than or equal to 0.33 is "poor" and MPI less than 0.33 is "non-poor".

[3] Comparing poor versus non-poor. Chi-square test was used to compare percentages. Wilcoxon rank sum test was used to compare median values. P-values were derived from Wilcoxon nonparametric medians tests. The daily food consumption is shown as median with population distribution spread presented as 25th and 75th percentiles and not 95% CI. Thus overlapping 25th and 75th percentiles does not indicate non-significance as the test is based on the median point estimates between poor and non-poor.

[4] Fortifiable is defined as any food that was not made at home and is assumed to be industrially processed.

[5] Households were asked to report the amount of food purchased and the period the food lasted. With this information, the daily amount of food available for consumption in the home was estimated. The nutrient level assigned to each food in a household was done as follows: (A) If a food sample was collected from the home and analyzed, the nutrient value measured in the food sample was assigned to the household. (B) In households where a food sample was not collected and the brand name was available, the median nutrient value in the branded samples analyzed from other households within each stratum was used. (C) In households where a food sample was not collected and the brand name was not available, the median nutrient value in the unbranded samples analyzed from other households within each stratum was used. The total number of persons (and their age and sex) usually living in the household was collected. This information was used to determine the "apparent food consumption" by women of reproductive age using the adult male equivalent methodology *(Sununtnasuk, 2013).*

[6] The iron RNI for women, assuming 12% bioavailability, was drawn from the World Health Organization (2004) and is as follows: 25.8 mg/day (15-18 years), 24.5 mg/day (19-50 years), 24.5 mg/day (pregnant women), 12.5 mg/day (lactating women). *Intrinsic iron amounts were deducted before analyses and these results refer only to the contribution of added iron.* The vitamin A RNI for women, per the World Health Organization, is as follows: 600 micrograms retinol equivalents (mcg RE)/day (15-18 years), 500 mcg RE/day (19-50 years), 800 mcg RE/day (pregnant women), and 850 mcg RE/day (lactating women). The iodine RNI for women, per the World Health Organization, is as follows: 150 mcg/day (15-18 years), 150 mcg/day (19-50 years), 200 mcg/day (pregnant women), and 200 mcg/day (lactating women). For women who were both pregnant and lactating, the pregnancy RNI was used for all nutrients. The percent of RNI met was calculated as follows: amount of nutrient consumed from food / nutrient RNI x 100%. The pregnancy and lactation status of all women in the household was not known. This information was known for the subset of women who answered the women's survey. All non-surveyed women were assumed to be non-pregnant and non-lactating.

The information presented below describes the apparent food consumption and nutrient contributions for WRA stratified by women's dietary diversity score (**Table 15**). Nationally, in households where the product was consumed WRA's apparent consumption of fortifiable wheat flour, salt, and bouillon cubes and the contribution of wheat flour and salt to women's nutrient intakes did not differ by women's dietary diversity score. WRA with a higher dietary diversity score apparently consumed greater amounts of fortifiable oil, which contributed to meeting a higher % RNI for vitamin A compared to WRA with a lower dietary diversity score. However, WRA with higher dietary diversity had lower intakes of fortifiable maize flour than those with lower dietary diversity, but this did not result in contributing to a difference in % RNI for iron met. When stratified by rural and urban setting, the findings were similar.

Table 15. Daily apparent food consumption and micronutrient contribution (% RNI) for women of reproductive age among households that reported to consume the food based on household assessment and adult male equivalent methodology by women's dietary diversity score.

	Lower dietary diversity[1,2]	Higher dietary diversity[1,2]	p-value[3]
	(Median (25%, 75%)	(Median (25%, 75%))	
National	**N=239**	**N=420**	
Fortifiable[4] oil apparently consumed[5] (milliliters/day)	6.2 (3.4, 9.7)	6.5 (4.1, 11.8)	0.0292
Vitamin A from fortifiable[4] oil (% RNI[6])	16.9 (9.2, 30.3)	21.3 (12.0, 39.4)	0.0025
	N=38	**N=80**	
Fortifiable[4] wheat flour apparently consumed[5] (grams/day)	169.8 (45.8, 227.7)	84.7 (29.6, 175.2)	0.0866
Iron from fortifiable[4] wheat flour (% RNI[6])	17.4 (1.8, 38.8)	11.2 (2.3, 29.3)	0.3603
	N=133	**N=261**	
Fortifiable[4] maize flour apparently consumed[5] (grams/day)	156.4 (95.2, 240.9)	130.9 (77.0, 190.5)	0.0124
Iron from fortifiable[4] maize flour (% RNI[6])	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	--
	N=266	**N=452**	
Fortifiable[4] salt apparently consumed[5] (grams/day)	8.8 (6.1,12.0)	8.1 (5.8, 12.5)	0.3460
Iodine from fortifiable[4] salt (% RNI[6])	186.0 (118.3, 269.6)	176.6 (104.3, 269.5)	0.2935
	N=104	**N=232**	
Fortifiable[4] bouillon cubes apparently consumed[5] (grams/day)	1.5 (0.9, 3.0)	1.4 (0.8, 2.7)	0.7702
Rural			
	N=109	**N=240**	
Fortifiable[4] oil apparently consumed[5] (milliliters/day)	5.6 (3.2, 8.3)	6 (3.9, 10.7)	0.0484
Vitamin A from fortifiable[4] oil (% RNI[6])	16.1 (9, 29.2)	20.1 (11.6, 36.7)	0.0258
	N=10	**N=23**	
Fortifiable[4] wheat flour apparently consumed[5] (grams/day)	220.7 (73.8, 239.9)	146.8 (58.2, 205.7)	0.1894
Iron from fortifiable[4] wheat flour (% RNI[6])	18.6 (3.5, 41.4)	16.5 (4.4, 54.3)	1.0000
	N=39	**N=106**	
Fortifiable[4] maize flour apparently consumed[5] (grams/day)	164.9 (113, 277.7)	141.4 (82.5, 216.2)	0.0852
Iron from fortifiable[4] maize flour (% RNI[6])	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	--
	N=127	**N=263**	
Fortifiable[4] salt apparently consumed[5] (grams/day)	9.1 (6.1, 12.2)	8.3 (6.0, 12.6)	0.2792
Iodine from fortifiable[4] salt (% RNI[6])	187.6 (119.2, 273.4)	181.5 (105.0, 270.5)	0.6027
	N=22	**N=91**	

Fortifiable[4] bouillon cubes apparently consumed[5] (grams/day)	1.2 (0.8, 3.0)	1.2 (0.7, 2.2)	0.3477
Urban			
	N=130	**N=180**	
Fortifiable[4] oil apparently consumed[5] (milliliters/day)	6.8 (4.8, 12.0)	8.9 (5.4, 17.5)	0.0239
Vitamin A from fortifiable[4] oil (% RNI[6])	21.3 (12.0, 43.2)	32.4 (15.1, 57.0)	0.0037
	N=28	**N=57**	
Fortifiable[4] wheat flour apparently consumed[5] (grams/day)	67.7 (29.9, 163.2)	42.6 (17.8, 124.6)	0.0933
Iron from fortifiable[4] wheat flour (% RNI[6])	3.9 (0.1, 15.9)	2.4 (0.1, 7.1)	0.2652
	N=94	**N=155**	
Fortifiable[4] maize flour apparently consumed[5] (grams/day)	144.8 (90.3, 190.9)	106 (62.3, 170.1)	0.0143
Iron from fortifiable4 maize flour (% RNI[6])	0.0 (0.0, 0.0)	0.0 (0.0, 0.0)	--
	N=139	**N=189**	
Fortifiable[4] salt apparently consumed[5] (grams/day)	7.6 (5.2, 10.9)	6.8 (5.1, 10.8)	0.4323
Iodine from fortifiable[4] salt (% RNI[6])	166.6 (108.8, 261.2)	139.3 (102.2, 248.3)	0.2285
	N=82	**N=141**	
Fortifiable[4] bouillon cubes apparently consumed[5] (grams/day)	1.2 (0.8, 3.0)	1.2 (0.7, 2.2)	0.3477

Abbreviation: RNI, recommended nutrient intake

[1] All values are median as indicated, and adjusted for probability of selection by population proportional to size (PPS) sampling.

[2] Lower dietary diversity refers to a dietary diversity score lower than the population median in each stratum (i.e. rural or urban residence). Higher dietary diversity refers to a dietary diversity score greater than or equal to the population median in each stratum (i.e. rural or urban residence). The population median is 4 in rural areas and 5 in urban areas. When more than one woman of reproductive age answered the dietary diversity information per household, the dietary diversity score of one woman was randomly selected and applied to the household.

[3] Comparing lower dietary diversity versus higher dietary diversity. Chi-square test was used to compare percentages. Wilcoxon rank sum test was used to compare median values. P-values were derived from Wilcoxon nonparametric medians tests. The daily food consumption is shown as median with population distribution spread presented as 25th and 75th percentiles and not 95% CI. Thus overlapping 25th and 75th percentiles does not indicate non-significance as the test is based on the median point estimates between higher and lower dietary diversity.

[4] Fortifiable is defined as any food that was not made at home and is assumed to be industrially processed.

[5] Households were asked to report the amount of food purchased and the period the food lasted. With this information, the daily amount of food available for consumption in the home was estimated. The nutrient level assigned to each food in a household was done as follows: (A) If a food sample was collected from the home and analyzed, the nutrient value measured in the food sample was assigned to the household. (B) In households where a food sample was not collected and the brand name was available, the median nutrient value in the branded samples analyzed from other households within each stratum was used. (C) In households where a food sample was not collected and the brand name was not available, the median nutrient value in the unbranded samples analyzed from other households within each stratum was used. The total number of persons (and their age and sex) usually living in the household was collected. This information was used to determine the "apparent food consumption" by women of reproductive age using the adult male equivalent methodology (Sununtnasuk, 2013).

[6] The iron RNI for women, assuming 12% bioavailability, was drawn from the World Health Organization (2004) and is as follows: 25.8 mg/day (15-18 years), 24.5 mg/day (19-50 years), 24.5 mg/day (pregnant women), 12.5 mg/day (lactating women). The vitamin A RNI for women, per the World Health Organization, is as follows: 600 micrograms retinol equivalents (mcg RE)/day (15-18 years), 500 mcg RE/day (19-50 years), 800 mcg RE/day (pregnant women), and 850 mcg RE/day (lactating women). The iodine RNI for women, per the World Health Organization, is as follows: 150 mcg/day (15-18 years), 150 mcg/day (19-50 years), 200 mcg/day (pregnant women), and 200 mcg/day (lactating women). For women who were both pregnant and lactating, the pregnancy RNI was used for all nutrients. The percent of RNI met was calculated as follows: amount of nutrient consumed from food / nutrient RNI x 100%. The pregnancy and lactation status of all women in the household was not known. This information was known for the subset of women who answered the women's survey. All non-surveyed women were assumed to be non-pregnant and non-lactating.

9. ANNEXES

Annex A: Household questionnaire 1 and 2, and WRA questionnaire

Household questionnaire 1

INTERVIEWER INFORMATION			
DATEINT	Date of interview	DD / MM / YY	☐☐/☐☐/15
TEAMID	Team number		☐☐
INTID	Enumerator name and code		☐☐
INTDUR	Start Time (HH:MM) ☐☐ : ☐☐	End Time (HH:MM) ☐☐ : ☐☐	

HOUSEHOLD IDENTIFICATION			
	Residence Code	Urban ……..1 Rural ……..2	☐
Disid	District name and code		☐☐
subid	Sub-county name		
areaname	Parish name		
EA	Cluster (EA) name and code		☐
HH	Household Number		☐☐☐

RESPODENT INFORMATION AND CONSENT			
HH2resp	Respondent Name		
Lnr	Line number of respondent *Fill later by copying from household roster.*		☐☐
READ CONSENT FORM IN ITS ENTIRETY TO RESPONDENT AND ASK THEM IF YOU SHOULD PROCEED WITH INTERVIEW			
Cons	Was ORAL consent obtained?	Yes ……1 No……..2	If “NO”, thank respondent and leave household

FINAL OUTCOME OF THE INTERVIEW Fill in ONLY after exhausting visits to the household		
Visitno	Number of attempts to visit household (up to one return visit) *Record at the time of completing the interview or after second household visit*	☐
Outhh	Interview completed.....1 Interview ONLY PARTIALLY completed……..……..…2 Refused/Consent NOT obtained.....3 No household member or No eligible respondent at home at all visits.....4 Eligible respondent incapacitated or intoxicated……....5 Dwelling vacant for extended period of time.....6 Household permanently moved out of EA or address is not a dwelling.....7 Dwelling destroyed.....8 Other: _____.....99	

LANGUAGE USED FOR THE INTERVIEW				
lang1	Language of the questionnaire	☐☐	Languages: 01 Alur 02 Ateso 03 Adhola 04 English 05 Kupsabiny 06 Luganda 07 Lugbara 08 Lugisu 09 Lugwere 10 Luo	11 Lusamia 12 Lusoga 13 Madi 14 Ngakaramojong 15 Rukiga 16 Rukonzo 17 Runyankole 18 Runyoro 19 Rutoro 20 Swahili 21 Others specify
lang2	Language used in the interview	☐☐		
lang3	Native language of the respondent	☐☐		
Trans	Use of translator	Not at all……..…1 Some of the time…….....2 All the time…….....3		

TEAM LEADERS CHECK AND COMMENTS *(Fill this part after checking/editing the questionnaire)*			
TLID	Team Leader's name and code		☐☐
TLCK1	Did you accompany enumerator for this questionna	Yes …… No. ……	
TLCK2	Did you back-check this questionnaire?	Yes …… No. ……...	
TLCK3	Did you review/Edit this questionnaire?	Yes …… No. ……	

Comments

HOUSEHOLD ROSTER

Now we are going to **LIST ALL MEMBERS OF YOUR HOUSEHOLD** – i.everyone who lives in this household or homestead, who eats from the same pot of food (does not cook separately), and also recognizes the same head of the household. A member of the household must have lived in the household for the last six months or will be staying for at least the next 6 months. Household members include small children recently born to members of the household. We also need to include maids and other people who regularly stay in the household and eat from the same cooking pot.

Enumerator: Start by listing the head of the household, the spouse to head of the household (if applicable), all children of the households head, and then other members of the household.

	A	B	C		D	E	F
	NAME of household member (Surname, First name)	**SEX**	**AGE** *Record in years ONLY if 5 years or older AND Years and Months if <5 years*		**RELATION** to Head of Household	Highest Level of education completed	Currently attending school or college?
			Years	Months	See Codes "D"	See Codes "E"	
01		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2
02		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2
03		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2
04		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2
05		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2
06		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2
07		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2
08		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2
09		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2
10		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2
11		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2
12		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2
13		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No……2

14		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No…….2
15		M / F	☐☐	☐☐	☐☐	☐	Yes……1 No…….2

hh1a	*Just to make sure that I have a complete listing:* Are there any other persons such as small children or infants that we have not listed? *If YES, add name to table.*
hh1b	Are there any other people who may not be members of your family, such as domestic servants, lodgers, or friends who usually live here and share the same cooking pot? *If YES, add name to table.*
Note: Add a new page if more people in the household	

Check the roster regarding completion!

Codes D : Relation to household head	**Codes E: Highest Level of Education**
1. Household head 2. Spouse to household head 3. Son or daughter 4. Brother or sister 5. Grand child 6. Niece/Nephew 7. Parent 8. Parent in-law 9. Brother/sister in-law 10. Other relative 11. Non-relative 12. Don't know	1. No formal education 2. Pre-school 3. Primary 1-4 4. Primary 5-7 5. Secondary 1-4 6. Secondary 5-6 7. Technical college 8. University

SHORT BIRTH HISTORY

"**We are now going to talk about children born in this household in the last 5 years i.e. from 2010 to 2015. We want to know the number of children born in that period when they were alive i.e they showed signs of life such as crying, etc"**

N°	QUESTIONS	ANSWERS	SKIPS
bh1	Altogether, how many live births have there been in your household in the last 5 years? Please include any baby who cried or showed other signs of life. *(WRITE IN THE NUMBER.)* *(IF 'NONE', RECORD 00. IF 'DON'T KNOW', RECORD 88.)*	☐☐	If 00 or 88, skip to HH Characteristics module hc1

bh2	Is this child / are these children still alive? *(CIRCLE ONLY **ONE** ANSWER.)*	All alive.....1 One or more has died in the past 5 years.....2 Don't know……88	

HOUSEHOLD CHARACTERISTICS			
N°	QUESTIONS	ANSWERS	SKIPS
hc1	Does your household have electricity? *(DO NOT ASSUME, ASK)* *(CIRCLE ONLY **ONE**ANSWER.)*	Yes……..1 No…….2	
hc2	What fuel does your household MAINLY use for cooking? *(CIRCLE ONLY **ONE**ANSWER.)*	Electricity.....1 LPG.....2 Natural gas.....3 Biogas.....4 Kerosene.....5 Coal / Lignite.....6 Charcoal.....7 Wood.....8 Straw / Shrubs / Grass.....9 Agricultural crop.....10 Animal dung.....11 No food cooked in household.....12 Don't know.....88 Other: _____ 99	

hc3	Does your household or anyone in the household own a … ? ***(PROMPT FOR EACH ITEM**;* *RECORD ALL ITEMS OWNED BY HOUSEHOLD OR A MEMBER...)* *(CIRCLE ONLY **<u>ONE</u**ANSWERFOR EACH ITEM. NO RESPONSE SHOULD BE LEFT BLANK)*	A. Radio	Yes…1 No…2	
		B. CD/Cassette player	Yes…1 No…2	
		C. Television	Yes…1 No…2	
		D. Mobile telephone	Yes…1 No…2	
		E. Fixed phone	Yes…1 No…2	
		F. Refrigerator	Yes…1 No…2	
		G. Table	Yes…1 No…2	
		H. Chair	Yes…1 No…2	
		I. Sofa set	Yes…1 No…2	
		J. Bed	Yes…1 No…2	
		K. Cupboard	Yes…1 No…2	
		L. Clock	Yes…1 No…2	
		M. Watch	Yes…1 No…2	
		N. Bicycle	Yes…1 No…2	
		O. Motorcycle/scooter	Yes…1 No…2	
		P. Animal drawn cart	Yes…1 No…2	
		Q. Car or truck	Yes…1 No…2	
		R. Boat with motor	Yes…1 No…2	
		S. Boat without motor	Yes…1 No…2	

N°	*QUESTIONS*	*ANSWERS*	*SKIPS*
hc4	*WHAT IS THE MAIN MATERIAL OF THE FLOOR OF THE DWELLING?*	**<u>Natural Floor</u>** Earth or sand **1**	

	(OBSERVATION.) *(CIRCLE ONLY **ONE**ANSWER.)*	Earth smeared with dung ..... **2** **Finished floors** Parquet or polished wood ..... **3** Mosaic or tiles ..... **4** Bricks ..... **5** Cement ..... **6** Stone ..... **7** **Others** **99**	
hc5	*WHAT IS THE MAIN MATERIAL OF THE ROOF OF THE DWELLING?* *(OBSERVATION.)* *(CIRCLE ONLY **ONE**ANSWER.)*	Grass/thatch ..... 1 Earth/mud ..... 2 Wood/planks ..... 3 Iron sheets ..... 4 Asbestos ..... 5 Clay tiles ..... 6 Roofing shingles ..... 7 Tin/scrap metal ..... 8 Cement slab ..... 9 Other 99	
hc6	*WHAT IS THE MAIN MATERIAL OF THE EXTERIOR WALLS OF THE DWELLING?* *(OBSERVATION.)* *(CIRCLE ONLY **ONE**ANSWER.)*	**Natural walls** Thatch straw ..... **1** **Rudimentary Walls** Mud and pole ..... **2** Unburnt clay bricks with mud mortar ..... **3** Unburnt clay bricks with cement mortar ..... **4** Burnt clay bricks with mud mortar ..... **5** **Finished walls** Burnt clay bricks with cement mortar ..... **6** Cement blocks ..... **7** Stone ..... **8** Timber ..... **9** **Other** **99**	

WATER, SANITATION, AND HYGIENE (WASH)			
N°	QUESTIONS	ANSWERS	SKIPS
w1	What is the main source of drinking water for the members of your household? *(CIRCLE ONLY **ONE** ANSWER.)*	Piped water Piped into dwelling.....1 Piped to yard / plot.....2 Public tap / standpipe.....3 Water from open well/spring Open well/ spring in yard/ plot…….4 Open public well/ spring……5 Water from protected well/spring Protected well/ spring in yard/ plot……..6 Protected public well/ spring ……..7 Water from borehole Borehole in yard/ plot…….....8 Public borehole……....9 Surface water (river/ dam, etc.) River/ stream……...10 Pond/ lake…….11 Dam…….....12 Rain water……..……13 Tanker truck……..….14 Vendor…….....15 Bottle water…….....16 Don't know.....88 Other: …….....99	
w2	Where is that water source located? *(CIRCLE ONLY **ONE** ANSWER.)*	In own dwelling……1 In own yard/plot……2 Elsewhere……3	If **1 or 2**, skip to **w4**
w3	How long does it take to go there, get water and come back? *(WRITE IN THE NUMBER.)* *(IF 'DON'T KNOW', RECORD 888.)*	Minutes…… ☐☐☐	

w4	Do you **<u>usually</u>** do anything to your drinking water to make it safer to drink? *(CIRCLE ONLY **<u>ONE</u>** ANSWER.)*	Yes……..1 No……2	If **no**, skip to **w6**

N°	QUESTIONS	ANSWERS		SKIPS
w5	What do you **usually** do to the water to make it safer to drink? *(DO **NOT** PROMPT. PROBE "ANYTHING ELSE?")* *(CIRCLE YES FOR EACH ITEM MENTIONED AND NO FOR EACH ITEM NOT MENTIONED.)*	A. Boil	Yes…1 No…2	
		B. Add bleach / chlorine	Yes…1 No…2	
		C. Strain through a cloth	Yes…1 No…2	
		D. Use a water filter	Yes…1 No…2	
		E. Solar disinfection	Yes…1 No…2	
		F. Let it stand and settle	Yes…1 No…2	
		G. Add Water guard	Yes…1 No…2	
		H. Don't know	Yes…1 No…2	
		I. Other:	Yes…1 No…2	
w6	What kind of toilet facility do members of your household usually use? *(DO **NOT** PROMPT.)* *(CIRCLE ONLY **ONE** ANSWER.)*	Flush or pour flush toilet……..1 VIP latrine……..2 Covered pit latrine no slab……..3 Covered pit latrine with slab……..……4 Uncovered pit latrine no slab……..……..5 Uncovered pit latrine with slab……..……6 Composting toilet.....7 No facilities / bush / field.....8 Ecosan……..……9 Don't know.....88 Other: _____ 99		
w7	Do you share this facility with other households? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……..1 No…….2		

HEALTH SERVICES ACCESS			
N°	QUESTIONS	ANSWERS	SKIPS
hs1	If you need health care services, how long does it take to travel to the nearest health facility? (*THIS INCLUDES HEALTH POST 1,2,3,4, HOSPITAL, PRIVATE OR PUBLIC FACILITIES)* *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)* *(IF 'DON'T KNOW', RECORD 88.)*	A. Duration ☐☐ B. Minute(s)……....1 Hour(s).....2 Day(s).....3	If **A** is **88**, end.

***** CHECK THE QUESTIONNAIRE & THANK THE RESPONDENT*****

STICK HH2 LABEL HERE

INTERVIEWER INFORMATION			
DATEINT	Date of interview	DD / MM / YY	☐☐/☐☐/1 5
TEAMID	Team number		☐☐
INTID	Enumerator name and code		☐☐
INTDUR	Start Time (HH:MM) ☐☐ : ☐☐	End Time (HH:MM) ☐☐ : ☐☐	

HOUSEHOLD IDENTIFICATION			
	Residence Code	Urban ……..1 Rural ……..2	☐
Disid	District name and code		☐☐
subid	Sub-county name		
areaname	Parish name		
EA	Cluster (EA) name and code		☐☐
HH	Household Number		☐☐☐

RESPONDENT INFORMATION AND CONSENT			
HH2resp	Respondent Name		
lnr	Line number of respondent *Copy from household roster in household questionnaire 1.*		☐☐
READ CONSENT FORM IN ITS ENTIRETY TO RESPONDENT AND ASK THEM IF YOU SHOULD PROCEED WITH INTERVIEW			
Cons	Was <u>ORAL</u> consent obtained?	Yes ……1 No……..2	If “NO”, thank respondent and leave household

FINAL OUTCOME OF THE INTERVIEW Fill in ONLY after exhausting visits to the household		
visitno	Number of attempts to visit household (up to one return visit) *Record at the time of completing the interview or after second household visit*	☐
outhh	Interview completed.....1 Interview ONLY PARTIALLY completed……..……..…..2 Refused/Consent NOT obtained.....3 No household member or No eligible respondent at home at all visits.....4 Eligible respondent incapacitated or intoxicated……...5 Dwelling vacant for extended period of time.....6 Household permanently moved out of EA or address is not a dwelling.....7 Dwelling destroyed.....8 Other: _____.....99	

LANGUAGE USED FOR THE INTERVIEW				
lang1	Language of the questionnaire	☐☐	Languages: 01 Alur 02 Ateso 03 Adhola 04 English 05 Kupsabiny 06 Luganda 07 Lugbara 08 Lugisu 09 Lugwere 10 Luo	11 Lusamia 12 Lusoga 13 Madi 14 Ngakaramojong 15 Rukiga 16 Rukonzo 17 Runyankole 18 Runyoro 19 Rutoro 20 Swahili 21 Others specify
lang2	Language used in the interview	☐☐		
lang3	Native language of the respondent	☐☐		
trans	Use of translator	Not at all……..…1 Some of the time…….....2 All the time…….....3		

TEAM LEADERS CHECK AND COMMENTS *(Fill out after checking/editing the questionnaire)*			
TLID	Team Leader's name and code		☐☐
TLCK1	Did you accompany enumerator for this questionr		Yes …… No. ……
TLCK2	Did you back-check this questionnaire?		Yes …… No. ……
TLCK3	Did you review/Edit this questionnaire?		Yes …… No. ……
Comments			

HOUSEHOLD HUNGER SCALE

"In this part, we are going to talk about the AVAILABILITY of food in your household over the previous 30 days or 4 weeks".

(*ENUMERATOR: HELP THE RESPONDENT TO ESTABLISH THE BEGINNING AND END POINT TO THE 30-DAY PERIOD BEFORE YOU START ASKING QUESTIONS*

N°	QUESTIONS	ANSWERS	SKIPS
hh1	How many times in the last month did anyone in your house go to **SLEEP AT NIGHT HUNGRY** because there was not enough food? *(WRITE IN THE NUMBER. IF 'NONE', RECORD 00.)*	Number of times ☐☐	
hh2	How many times in the last month did anyone in your house go for a **WHOLE DAY AND NIGHT** without eating **ANYTHING AT ALL** because there was not enough food? *(WRITE IN THE NUMBER. IF 'NONE', RECORD 00.)*	Number of times ☐☐	
hh3	How many times in the last month was there ever **NO FOOD TO EAT OF ANY KIND** in your house because of lack of resources to get food? *(WRITE IN THE NUMBER. IF 'NONE', RECORD 00.)*	Number of times ☐☐	

FORTIFICATION COVERAGE

"In this section, we are going to talk about the use of these foods by your household: cooking oil, cooking fats, maize flour, wheat flour, and salt. Do you have any of these foods in the household now? If you do, please bring them here now so that you won't have to get up several times during the interview.

COOKING OIL FORTIFICATION COVERAGE

First I would like to talk with you about COOKING OIL.

N°	QUESTIONS	ANSWERS	SKIPS
of1	Does your household use cooking oil to prepare food or add to food? *(CIRCLE ONLY **ONE**ANSWER.)* *(IF YES, PROBE FOR FREQUENCY OF USE)*	Yes, regularly (at least once per week).....1 Yes, sometimes …….2 No, never ……3	If **3**, skip to **cooking fats** module.
of2	What is the **MAIN TYPE** of cooking oil that is used in your household for most meals on most days? ASK FIRST, THEN CONFIRM BY READING LABEL IF AVAILABLE *(CIRCLE ONLY **ONE**ANSWER.)*	Sunflower oil.....1 Corn oil……..2 Sesame oil…….…….3 Red palm oil.....4 Shea nut oil…….……5 Soybean oil.....6 Groundnut oil.....7 Olive oil.....8 Mixed vegetable oil ……..…9 Don't know / Don't remember.....88 Other:_____.....98	
of3	Can you please **SHOW** me this **MAIN TYPE** cooking oil used by your household? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes (SHOWN) ……..1 No (NOT SHOWN)…..……....2	
of4	***(IF MAIN OIL TYPE IS AVAILABLE):*** When your household got this **[MAIN OIL TYPE]**, where did you get it from? ***(IF MAIN OIL TYPE IS NOT AVAILABLE):***	Purchased ……..…...1 Received from food aid.....2 Received as gift from family, etc. …….3 Made by self at home (home-made).....4	If 4 (**home-made),** skip to **cooking fats**

	The **last time** your household got **[MAIN OIL TYPE]**, where did you get it from? *(CIRCLE ONLY **ONE**ANSWER.)*	Don't know / Don't remember.....88 Other: _____...99	module.
of5	*(IF MAIN OIL TYPE IS AVAILABLE):* When your household got this [MAIN OIL TYPE], how was it packaged? *(IF MAIN OIL TYPE IS NOT AVAILABLE):* The **last time** your household got [MAIN OIL TYPE], how was it packaged? *(READ **ALL** RESPONSES)* *(CIRCLE ONLY **ONE**ANSWER.)*	Original manufacturer's package……..1 Re-packaged by vendor ……...2 Dispensed into my own container at vendor's outlet …….....3 Don't know/Don't remember.....88 Other: _____.....99	
of6	*(IF MAIN OIL TYPE IS AVAILABLE):* When your household got this [MAIN OIL TYPE], how much did you get? *(IF MAIN OIL TYPE IS NOT AVAILABLE):* The **last time** your household got [MAIN OIL TYPE], how much did you get? *(SHOW PHOTO OF COMMONLY USED CONTAINERS AND MEASURES.)* *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*	A. Quantity ☐☐☐☐ B. Unit of Quantity Mili-litres (ML).....1 Liters (L).....2 Kendos (small) ..……3 Kendos (medium) ..……4 Kendos (large) ..……5 Sachets (50 ml)…….6 Sachets (100 ml)…….....7 Sachets (200ml)……....8 Sachets/jerrycans (500 ml)……9 Sachets/jerrycans (1 liter) ……....10 Jerrycans 2 litres ……11 Jerrycan 3 litres ……..12 Jerrycan 5 litres ……..13 Jerrycan 10 litres ……14 Jerrycans 20 litres ……..15	

N°	*QUESTIONS*	ANSWERS	SKIPS
of7	How long does this quantity of MAIN OIL TYPE usually last in your household? *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*	A. Duration ☐☐ B. Day(s).....1 Month(s).....2	
of8	*IF MAIN OIL TYPE IS AVAILABLEAND IN ORIGINAL CONTAINER):* ***OBSERVE BRAND**.* *(IF MAIN OIL TYPE IS NOT AVAILABLE OR NOT IN ORIGINAL PACKAGE, **ASK THE RESPONDENT**):* What is the brand of this [MAIN OIL TYPE]? *(CIRCLE ONLY **ONE** ANSWER.)*	**MUKWANO INDUSTRIES** Mukwano Unspecified.....1 Mukwano Roki.....2 3-Star……3 Sunseed ……....4 **BIDCO INDUSTRIES (UGANDA)** Golden Fry.....5 Fortune.....6 Fortune Bhuto ……..…....7 Ufuta.....8 Sungold ……...9 Soya Gold ……....10 Elianto Corn Oil ……..11 **OTHER BRANDS** Nile oil, Nile Agro Uganda Ltd .....12 USA oil., USAID.....13 Sunola – Mt Meru Kenya Ltd ……..…...14 Floral,- Mt. Meru Kenya Ltd .....15 Rina Oil - Kapa Oil Refineries Ltd…..…16 Rinsun oil – Kapa Oil Refineries Ltd ....17 Captain Cook – Kapa Oil Refineries Ltd..18 Not branded/No brand name……..77 Don't know .....88 Other:…….....99	

N°	*QUESTIONS*	ANSWERS	SKIPS
of9	*(IF MAIN OIL TYPE IS AVAILABLE AND IN ORIGINAL CONTAINER):* ***OBSERVE PRODUCER****.* *(IF MAIN OIL TYPE IS NOT AVAILABLE OR NOT IN ORIGINAL PACKAGE,* ***ASK THE RESPONDENT****):* Who is the producer of this [MAIN OIL TYPE]? *(CIRCLE ONLY* ***ONE****ANSWER.)*	Mukwano Industries Uganda Ltd .....1 Bidco Industries Uganda Ltd.....2 A.K oils and Fats Uganda .....3 Mukono Industries Uganda Ltd .....4 Nile Agro Industries .....5 Kapa Oil refineries Kenya Ltd……6 Mt. Meru Ltd, Kenya ……..7 Local area small scale producer……...8 Don't know.....88 Other:…….....99	If **oil is not availabl e,** skip to **fat meal** module.
of1 0	***LOOK FOR FORTIFICATION LOGO*** *(CIRCLE ONLY* ***ONE*** *ANSWER.)*	OBSERVED - Fortification logo ONLY ….1 OBSERVED - Fortification writing ONLY …….….2 OBSERVED – Both Fortification logo & writing……...3 NOT OBSERVED – No fortification logo or writing on label……4 NOT OBSERVED – No label on package……..…5	
of1 1	May I take a small sample? *(IF 'YES', TAKE SAMPLE AND STICK COOKING OIL LABEL ON SAMPLE CONTAINER.)*	Sample taken……1 Sample NOT taken …….……2	

COOKING FAT FORTIFICATION COVERAGE			
N°	QUESTIONS	ANSWERS	SKIPS
cf1	Now I would like to talk with you about cooking fats, such as ghee, margarine, Kimbo or Cowboy. Does your household prepare foods using cooking fats? *(CIRCLE ONLY **ONE**ANSWER.)*	Yes, regularly (at least once per week)....1 Yes, sometimes ……2 No, never ……3	If **3**, skip to **maize flour** module.

N°	QUESTIONS	ANSWERS	SKIPS
cf2	What is the **MAIN** type of cooking **fat** that is used in your household for most meals on most days? *(CIRCLE ONLY **ONE**ANSWER.)*	Vegetable Fat ……......1 Milk based (ghee) .....2 Animal fat (Lard, etc)……3 Don't know / Don't remember.....88 Other:…….....99 _____	
cf3	Can you please show me this MAIN TYPE of cooking fat used in your household? *(CIRCLE ONLY **ONE**ANSWER.)*	Yes (SHOWN) ……..1 No (NOT SHOWN)…..…….....2	
cf4	*(IF MAIN FAT TYPE IS AVAILABLE):* When your household got this [MAIN FAT TYPE], where did you get it from? *(IF MAIN FAT TYPE IS NOT AVAILABLE):* The **last time** your household got [MAIN FAT TYPE], where did you get it from? *(CIRCLE ONLY **ONE**ANSWER.)*	Purchased ……..1 Received from food aid.....2 Received as gift from family, etc. ……..…3 Made by self at home (home-made)…....4 Don't know / Don't remember.....88 Other:……...99	If **4** skip to **maize flour** module.

cf5	*(IF MAIN FAT TYPE IS AVAILABLE):* When your household got this [MAIN FAT TYPE], how was it packaged? *(IF MAIN FAT TYPE IS NOT AVAILABLE):* The **last time** your household got [MAIN FAT TYPE], how was it packaged? *(READ **ALL** RESPONSES)* *(CIRCLE ONLY **ONE**ANSWER.)*	Original manufacturer's package……..1 Re-packaged by vendor …….....2 Dispensed into my own container at vendor's outlet …….....3 Don't know/Don't remember.....88 Other:……...99	
cf6	*(IF MAIN FAT TYPE IS AVAILABLE):* When your household got this [MAIN FAT TYPE], how much did you get? *(IF MAIN FAT TYPE IS NOT AVAILABLE):* The **last time** your household got [MAIN FAT TYPE], how much did you get? *(SHOW EXAMPLES OF COMMONLY USED CONTAINERS AND MEASURES.)* *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*	A. Quantity ☐☐☐☐ B. Units of Quantity Kg.....1 Grams.....2 Tub/sachet (50g)…….....3 Tub/sachet (100g)…….....4 Tub/sachets (250g)…….....5 Tub/sachets (500g)…….....6 Tub/sachets (1Kg)…….....7 Tub/sachets (2kg)…….....8 Tub/sachets (4kg)…….....9 Tub/sachets (10Kg)…….....10 Tub/sachets (17Kg)…….....11	
cf7	How long does this quantity of FAT usually last in your household? *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*	A. Duration ☐☐ B. Day(s).....1 Month(s).....2	
cf8	*(IF MAIN FAT TYPE IS AVAILABLE AND IN ORIGINAL CONTAINER):* ***OBSERVE BRAND***. *(IF MAIN FAT TYPE IS NOT*	**MUKWANO INDUSTRIES UGANDA** Tamu.....1 Nicefry ……2 **BIDCO INDUSTRIES**	

	*AVAILABLE, **ASK THE RESPONDENT**):* What is the brand of this [MAIN FAT TYPE]? *(CIRCLE ONLY **ONE**ANSWER.)*	Kimbo.....2 Cowboy.....3 Chipsy.....4 Chipo …….5 Yellow Gold Mallo **KAPA OIL REFINERIES** Kasuku.....6 Tilly. .....7 Alpha.....8 Rina Seagull.....9 Kapa Ghee.....10 White Gold..... 11 Prestige Margarine ……...12 Bredbest margarine ……..13 Blueband margarine, Uniliver .....14 Goldband.....15 Not branded/No brand name……...16 Don't know .....88 Other:…….....99 _____	
cf9	*(IF MAIN FAT TYPE IS AVAILABLEAND IN ORIGINAL CONTAINER):* ***OBSERVE PRODUCER**.* *(IF MAIN OIL TYPE IS NOT AVAILABLE OR NOT IN ORIGINAL PACKAGE, **ASK THE RESPONDENT**):* Who is the producer of this [MAIN FAT TYPE]? *(CIRCLE ONLY **ONE**ANSWER.)*	Mukwano Industries Uganda Ltd .....1 Bidco Industries Uganda Ltd.....2 A.K oils and Fats Uganda .....3 Mukono Industries Uganda Ltd .....4 Nile Agro Industries .....5 Kapa Oil refineries Kenya Ltd……..6 Mt. Meru Ltd, Kenya …….7 Uniliver Kenya Ltd ……8 Local area small scale producer……. 9 Don't know.....88 Other:_____ 99	If **fat is not availabl e,** skip to **maize flour** module.
cf10	***LOOK FOR FORTIFICATION LOGO**.* *(CIRCLE ONLY **ONE** ANSWER.)*	OBSERVED - Fortification logo ONLY ……..…1 OBSERVED - Fortification writing ONLY ……..…. 2	

		OBSERVED – Both Fortification logo & writing……....3 NOT OBSERVED – No fortification logo or writing on label…….4 NOT OBSERVED – No label on package……..5	
cf11	May I take a small sample? *(IF 'YES', TAKE SAMPLE AND STICK FAT LABEL ON SAMPLE CONTAINER.)*	Sample taken……1 Sample NOT taken ……..……2	

MAIZE FLOURFORTIFICATION COVERAGE			
N°	QUESTIONS	ANSWERS	SKIPS
mf1	Now, I would like to talk with you about maize flour. Does your household prepare foods using maize flour (e.g., posho, porridge)? *(CIRCLE ONLY **ONE**ANSWER.)*	Yes, regularly (at least once per week)....1 Yes, sometimes ……2 No, never ……3	If **3**, skip to **wheat flour** module.
mf2	Can you show me the **MAIN TYPE** of **maize** flour your household uses? *(CIRCLE ONLY **ONE**ANSWER.)*	Yes (SHOWN) ……..1 No (NOT SHOWN)…..……....2	
mf3	*(IF MAIZE FLOUR IS AVAILABLE):* When your household got this maize flour, where did you get it from? *(IF MAIZE FLOUR IS NOT AVAILABLE):* The **last time** your household got maize flour, where did you get it from? *(CIRCLE ONLY **ONE**ANSWER.)*	Purchased ……..…....1 Received from food aid.....2 Received as gift from family, etc. …….3 Made by self at home (home-made).....4 Don't know / Don't remember.....88 Other: _____...99	If **4 (home-made)** skip to **wheat flour** module.
mf4	*(IF MAIZE FLOUR IS AVAILABLE):* When your household got this maize flour, how was it packaged? *(IF MAIZE FLOUR IS NOT AVAILABLE):* The **last time** your household got maize flour, how was it packaged? *(READ **ALL** RESPONSES)* *(CIRCLE ONLY **ONE**ANSWER.)*	Original manufacturer's package……..1 Re-packaged by vendor ……....2 Dispensed into my own container at vendor's outlet …….....3 Don't know/Don't remember.....88 Other: _____.....99	
mf5	*(IF MAIZE FLOUR IS AVAILABLE):* When your household got this maize flour, how much did you get?	A. Quantity ☐☐☐☐	

	(IF MAIZE FLOUR IS NOT AVAILABLE): The **last time** your household got maize flour, how much did you get? *(SHOW EXAMPLES OF COMMONLY USED CONTAINERS AND MEASURES.)* *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*	B. Units of Quantity Kg.....1 Grams.....2 Pack (2Kg).....3 Pack (5Kg)……4 Pack (10 Kg)……..5 Pack (25Kg)……6 Pack (50Kg) ……7	
mf6	How long does this amount usually last in your household? *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*	A. Duration ☐☐ B. Day(s).....1 Month(s).....2	
mf7	*(IF MAIZE FLOUR IS AVAILABLE AND IN ORIGINAL CONTAINER):* ***OBSERVE BRAND****.* *(IF MAIZE FLOUR IS NOT AVAILABLE OR NOT IN ORIGINAL PACKAGE,* ***ASK THE RESPONDENT****):* What is the **brand** of this maize flour? *(CIRCLE ONLY* ***ONE****ANSWER.)*	Maganjo Fortified Maize flour .....1 Maganjo Ordinary Maize flour .....2 Shibe's Maize flour.....3 Pearl Fortified Flour .....4 Not branded/No brand name ……5 Don't know .....88 Other: _____99	
mf8	*(IF MAIZE FLOUR IS AVAILABLE AND IN ORIGINAL CONTAINER):* ***OBSERVE****.* *(IF MAIZE FLOUR IS NOT AVAILABLE OR NOT IN ORIGINAL PACKAGE,* ***ASK THE RESPONDENT****):* Who is the **producer** of this maize flour?	Maganjo Millers .....1 Mukwano Industries .....2 Reco Industries, Kasese.....3 Local area small scale producer…….4	If **maize flour is NOT availabl e,** skip to **wheat flour** module.

	*(CIRCLE ONLY **ONE**ANSWER.)*	Don't know.....88 Other: _____.....99	
mf9	***LOOK FOR FORTIFICATION LOGO***. *(CIRCLE ONLY **ONE** ANSWER.)*	OBSERVED - Fortification logo ONLY ……1 OBSERVED - Fortification writing ONLY ..…..2 OBSERVED – Both Fortification logo & writing…… …….3 NOT OBSERVED – No fortification logo or writing on label……...4 NOT OBSERVED – No label on package……5	
mf10	May I take a small sample? *(IF 'YES', TAKE SAMPLE AND STICK MAIZE FLOUR LABEL ON SAMPLE CONTAINER.)*	Sample taken……1 Sample NOT taken ……2	

WHEAT FLOUR FORTIFICATION COVERAGE

N°	QUESTIONS	ANSWERS	SKIPS
wf1	Now, I would like to talk with you about wheat flour. Does your household prepare foods using wheat flour(e.g.bread or other wheat flour products)? *(CIRCLE ONLY **ONE**ANSWER.)*	Yes, regularly (at least once per week).....1 Yes, sometimes ……2 No, never ……3	If **3**, skip to **salt** module.
wf2	Can you show me what **MAIN** wheat flour your household uses? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes (SHOWN) ……...1 No (NOT SHOWN)…..……....2	

N°	*QUESTIONS*	ANSWERS	SKIPS
wf3	*(IF WHEAT FLOUR IS AVAILABLE):* When your household got this wheat flour, where did you get it from? *(IF WHEAT FLOUR IS NOT AVAILABLE):* The **last time** your household got wheat flour, where did you get it from? *(CIRCLE ONLY **ONE** ANSWER.)*	Purchased ……..…...1 Received from food aid.....2 Received as gift from family, etc.….3 Made by self at home (home-made)…….…....4 Don't know / Don't remember.....88 Other: _____...99	If **4,** skip to **salt** module.
wf4	*(IF WHEAT FLOUR IS AVAILABLE):* When your household got this wheat flour, how was it packaged? *(IF WHEAT FLOUR IS NOT AVAILABLE):* The **last time** your household got wheat flour, how was it packaged? *(READ **ALL** RESPONSES)* *(CIRCLE ONLY **ONE** ANSWER.)*	Original manufacturer's package…..1 Re-packaged by vendor ……....2 Dispensed into my own container at vendor's outlet …….....3 Don't know/Don't remember.....88 Other: _____.....99	
wf5	*(IF WHEAT FLOUR IS AVAILABLE):* When your household got this wheat flour, how much did you get? *(IF WHEAT FLOUR IS NOT AVAILABLE):* The **last time** your household got wheat flour, how much did you get? *(SHOW EXAMPLES OF COMMONLY USED CONTAINERS AND MEASURES.)* *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*	A. Quantity ☐☐☐☐ B. Units Kg.....1 Grams.....2	
wf6	How long does this amount usually last in your household? *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*	A. Duration ☐ ☐ B. Day(s).....1 Month(s).....2	

wf7	*(IF WHEAT FLOUR IS AVAILABLEAND IN ORIGINAL CONTAINER):* ***OBSERVE B RAND**.* *(IF WHEAT FLOUR IS NOT AVAILABLE OR NOT IN ORIGINAL PACKAGE, **ASK THE RESPONDENT**):* What is the brand of this MAIN TYPE wheat flour? *(CIRCLE ONLY **ONE**ANSWER.)*	Azam.....1 Pembe.....2 EXE.....3 Drum.....4 Don't know .....88 Other: _____...99	
wf8	*(IF WHEAT FLOUR IS AVAILABLEAND IN ORIGINAL CONTAINER):* ***OBSERVE PRODUCER*** *(IF WHEAT FLOUR IS NOT AVAILABLE OR NOT IN ORIGINAL PACKAGE, **ASK THE RESPONDENT**):* Who is the producer of this wheat flour? *(CIRCLE ONLY **ONE**ANSWER.)*	Bakhresa Uganda Ltd .....1 Bajaba Millers U Ltd.....2 Ahmed Raza Foods .....3 Engaano Millers .....4 Local area small scale producer…...6 Don't know.....88 Other:……..……..99 _____	If **wheat flour is not availabl e,** skip to **salt** module.
wf9	***LOOK FOR FORTIFICATION LOGO**.* *(CIRCLE ONLY **ONE** ANSWER.)*	OBSERVED - Fortification logo ONLY ……...1 OBSERVED - Fortification writing ONLY……...2 OBSERVED – Both Fortification logo & writing……...3 NOT OBSERVED – No fortification logo or writing on label……..4 NOT OBSERVED - No label on package……..5	
wf10	May I take a small sample? *(IF 'YES', TAKE SAMPLE AND STICK WHEAT FLOUR LABEL ON SAMPLE CONTAINER.)*	Sample taken……1 Sample NOT taken ……2	

SALT IODIZATION COVERAGE			
N°	QUESTIONS	ANSWERS	SKIPS
si1	Now, I would like to talk with you about salt. Does your household use salt? *(CIRCLE ONLY **ONE**ANSWER.)*	Yes, regularly (at least once per week)……..1 Yes, sometimes ……2 No, never ……3	If **3**, skip to **bouillon cube** module.
si1a	What is the **MAIN** type of **salt** that is used in your household? *(CIRCLE ONLY **ONE** ANSWER.)* (*READ OUT OPTIONS 1,2 AND 3)*	White salt, Refined…….1 White salt, Coarse/Large Crystals..… 2 Crude/ Rock salt…….....3 Don't know / Don't remember.....88 Other: _____.....99	
si2	Can you show me this **mainsalt**? *(CIRCLE ONLY **ONE**ANSWER.)*	Yes (SHOWN) ……..1 No (NOT SHOWN)…..……....2	
si3	*(IF SALT IS AVAILABLE):* When your household got this salt, where did you get it from? *(IF SALT IS NOT AVAILABLE):* The **last time** your household got salt, where did you get it from? *(CIRCLE ONLY **ONE**ANSWER.)*	Purchased ……..…...1 Received from food aid.....2 Received as gift from family, etc. …….3 Made by self at home (home-made).....4 Don't know / Don't remember.....88 Other:……99 _____	If "**4",** skip to **bouillon cube** module.
si4	*(IF SALT IS AVAILABLE):* When your household got this salt, how was it packaged?	Original manufacturer's package……..1 Re-packaged by vendor ……....2 Dispensed into my own container at	

	(IF SALT IS NOT AVAILABLE): The **last time** your household got salt, how was it packaged? *(READ **ALL** RESPONSES)* *(CIRCLE ONLY **ONE** ANSWER.)*	vendor's outlet …….....3 Don't know/Don't remember.....88 Other: _____.....99	
si5	*(IF SALT IS AVAILABLE):* When your household got this salt, how much did you get? *(IF SALT IS NOT AVAILABLE):* The **last time** your household got salt, how much did you get? *(SHOW EXAMPLES OF COMMONLY USED CONTAINERS AND MEASURES.)* *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*	A. Quantity ☐☐☐☐ **B. Units of Quantity** Kg.....1 Grams.....2 Pack 150 Grams ……..……...3 Pack 200 Grams ……..…..4 Pack 500 Grams ……5 Pack 1 Kg ……..6 Pack 2 Kg ……7	
si6	How long does this amount usually last in your household? *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*	A. Duration ☐☐ B. Day(s).....1 Month(s).....2	
si7	*(IF SALT IS AVAILABLEAND IN ORIGINAL CONTAINER):* ***OBSERVE BRAND.*** *(IF SALT IS NOT AVAILABLE OR NOT IN ORIGINAL PACKAGE, **ASK THE RESPONDENT**):* What is the brand of this salt? *(CIRCLE ONLY **ONE** ANSWER.)*	Habari.....1 Kay.....2 Kyoga .....3 Ken Salt.....4 Bahari …….5 Chiluma ……6 Don't know .....88 Other: _____..99	

si8	*(IF SALT IS AVAILABLEAND IN ORIGINAL CONTAINER):* ***OBSERVE PRODUCER****.* *(IF SALT IS NOT AVAILABLE OR NOT IN ORIGINAL PACKAGE,* ***ASK THE RESPONDENT****):* Who is the producer of this salt? *(CIRCLE ONLY* ***ONE****ANSWER.)*	Krystalline Salt Ltd .....1 Kensalt Limited.....2 Kurawa Industries Ltd.....3 Magadi Salt Packing Ltd ……..…..4 Kemu Salt Packers ……5 Katwe Salt Miners Ltd ……..6 Local area small scale producer……..7 Don't know.....88 Other: _____.....99	If **salt is not available,** skip to **bouillon cube** module.
si9	***LOOK FOR FORTIFICATION LOGO****.* *(CIRCLE ONLY* ***ONE*** *ANSWER.) (FORTIFICATION AND IODIZATION HAVE THE SAME MEANING)*	OBSERVED - Fortification logo ONLY ……....1 OBSERVED - Fortification writing ONLY ……....2 OBSERVED – Both Fortification logo & writing……..……....3 NOT OBSERVED – No fortification logo or writing on label……..……..4 NOT OBSERVED – No label on package……..…….5	
si10	May I take a small sample? *(IF 'YES', TAKE SAMPLE AND STICK SALT LABEL ON SAMPLE CONTAINER.)*	Sample taken……1 Sample NOT taken ……..……2	

BOUILLON CUBE AND SEASONING FORTIFICATION COVERAGE			
N°	QUESTIONS	ANSWERS	SKIPS
bcf1	What is the brand of MAIN **<u>seasoning product</u>** used in most meals on most days in your household? *(CIRCLE ONLY **<u>ONE</u>** ANSWER.)*	Royco.....1 Maggi,Beef.....2 Maggi, Crevette (lobster) ……3 Knorr,beef .....4 Knorr, Chicken ……5 Knorr, unspecified ……..6 Don't use.....77 Don't know / Don't remember.....88 Other:_____.....99	If **77**, skip to **logo** module.
bcf2	The **<u>last time</u>** your household got bouillon cubes or seasoning powders how much did you get? *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*	A. Quantity ☐☐☐☐ B. Units of Quantity Kg.....1 Grams .....2 Number of Cubes……..…..3 Sachet 50 grams……4 Sachet 100 grams…….5 Sachet 200 grams…….6 Tin 500 grams ……..…..7 Tin 1 Kg……...8 Tin 2Kg ……9	
bcf3	How long does this amount usually last in your household? *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*	A. Duration ☐☐ B. Day(s).....1 month(s).....2	

FORTIFICATION LOGO KNOWLEDGE AND INFLUENCE			
	*(SHOW **UGANDA** FORTIFICATION LOGO.)*		
lk1	Have you ever seen this logo? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……1 No……..……..2	If "NO", skip to lk4
lk2	*(MULTIPLE RESONSES POSSIBLE - CIRCLE **ALL** RESPONSES THAT APPLY.)* What does this logo mean? *(DO NOT READ RESPONSES TO RESPONDENT.)*	Fortified / enriched / added micronutrients.....1 Good for health…….……..……2 Better quality ……3 Bad quality……..…..……4 More expensive……..…...5 No meaning …….…… ……..6 Don't know……...88 Other:…….....99	
lk3	Does this logo influence your decision to buy? *(DO NOT READ RESPONSES TO RESPONDENT.)* *(CIRCLE ONLY **ONE** ANSWER.)*	No, it does not influence my decision to buy..1 Yes, it motivates me to buy the product.....2 Yes, it discourages me to buy the product....3 Don't know….....88 Other: _____.....99	
	*(SHOW **KENYA** FORTIFICATION LOGO.)*		
lk4	Have you ever seen this logo? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……..……1 No……..2	If "NO", end interview and thank the respondent
lk5	What does this logo mean? *(DO NOT READ RESPONSES TO RESPONDENT.)* *(CIRCLE **ALL** RESPONSES THAT APPLY.)*	Fortified / enriched / added micronutrients.....1 Good for health…….……..……2 Better quality ……3 Bad quality……..…..……4 More expensive……..…...5 No meaning …….…… ……..6 Don't know……...88 Other:…….....99	

lk6	Does this logo influence your decision to buy? *(DO NOT READ RESPONSES TO RESPONDENT.)* *(CIRCLE ONLY **ONE**ANSWER.)*	No, it does not influence my decision to buy..1 Yes, it motivates me to buy the product.....2 Yes, it discourages me to buy the product....3 Don't know…....88 Other: _____.....99	

***** CHECK THE QUESTIONNAIRE & THANK THE RESPONDENT*****

WRA questionnaire

STICK WRA LABEL HERE

INTERVIEWER INFORMATION			
DATEINT	Date of interview	DD / MM / YY	☐☐/☐☐/1 5
TEAMID	Team number		☐☐
INTID	Enumerator name and code		☐☐
INTDUR	Start Time (HH:MM) ☐☐ : ☐☐	End Time (HH:MM) ☐☐ : ☐☐	

OUSEHOLD IDENTIFICATION			
	Residence Code	Urban ……..1 Rural ……..2	☐
Disid	District name and code		☐☐
subid	Sub-county name		
areaname	Parish name		
EA	Cluster (EA) name and code		☐☐
HH	Household Number		☐☐☐

RESPONDENT INFORMATION AND CONSENT			
WRAresp	Respondent Name		
lnr	Line number of respondent *Copy from household roster in household questionnaire 1.*		☐☐
READ CONSENT FORM IN ITS ENTIRETY TO RESPONDENT AND ASK THEM IF YOU SHOULD PROCEED WITH INTERVIEW			
Cons	Was ORAL consent obtained?	Yes ……1 No……..2	If “NO”, thank respondent and leave household

FINAL OUTCOME OF THE INTERVIEW Fill in ONLY after exhausting visits to the household		
visitno	Number of attempts to visit household (up to one return visit) *Record at the time of completing the interview or after second household visit*	☐
outhh	Interview completed.....1 Interview ONLY PARTIALLY completed……..….2 Refused/Consent NOT obtained.....3 No household member or No eligible respondent at home at all visits.....4 Eligible respondent incapacitated or intoxicated…….……....5 Dwelling vacant for extended period of time.....6 Household permanently moved out of EA or address is not a dwelling.....7 Dwelling destroyed.....8 Other: _____.....99	

LANGUAGE USED FOR THE INTERVIEW				
lang1	Language of the questionnaire	☐☐	Languages: 01 Alur 02 Ateso 03 Adhola 04 English 05 Kupsabiny 06 Luganda 07 Lugbara 08 Lugisu 09 Lugwere 10 Luo	11 Lusamia 12 Lusoga 13 Madi 14Ngakaramojong 15 Rukiga 16 Rukonzo 17 Runyankole 18 Runyoro 19 Rutoro 20 Swahili 21 Others specify
lang2	Language used in the interview	☐☐		
lang3	Native language of the respondent	☐☐		
trans	Use of translator	Not at all……..…1 Some of the time…….....2 All the time…….....3		

TEAM LEADERS CHECK AND COMMENTS *(Fill out after checking/editing the questionnaire)*			
TLID	Team Leader's name and code		☐☐
TLCK1	Did you accompany enumerator for this questionr		Yes …… No. ……
TLCK2	Did you back-check this questionnaire?		Yes …… No. ……
TLCK3	Did you review/Edit this questionnaire?		Yes …… No. ……
Comments			

HEALTH DATA			
N°	QUESTIONS	ANSWERS	SKIPS
hd1	Are you currently pregnant? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……..1 No……2 I don't know……3	
hd2	Are you currently breastfeeding? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……..1 No……2	

DIETARY DIVERSITY

"Now we are going to talk about the different foods you consumed yesterday f<u>rom the time you woke up, throughout the day, during the night until you finally went to sleep.</u> I am going to read to you a list of foods and I would like you to tell me if or not you consumed that food yeatserday. Please note that if foods were mixed with others such as maize porridge with added sugar or milk take all these foods as consumed (MAIZE, SUGAR AND MILK as consumed).

Please do not include any food used in a small amount for seasoning or condiments (like spices, herbs, or fish powder), I will ask you about those foods separately.

*(READ **<u>ALL</u>** QUESTIONS. CIRCLE ONLY **<u>ONE</u>** ANSWER FOR EACH EITHER YES OR NO.)*

N°	Food items	Response
dd01	Rice as a porridge or meal; maize as maize grain, maize on cob; maize posho, maize porridge, cornflakes; foods made from wheat flour such as wheat porridge or wheat ugali, bread, chapatti, pasta/macaroni, noodles, mandazi, doughnut, Weetabix; millet ugali or porridge; sorghum ugali or porridge; or other grains foods such as, pancakes, etc?	Yes....1 No….2
dd02	Any sweet potatoes with white flesh ***(SHOW SWEET POTATO FLESH COLOUR PICTURE);*** Irish potatoes, yams, manioc, cassava or any other foods made from roots or tubers?	Yes....1 No….2
dd03	Any sweet potatoes with yellow or orange flesh ***(SHOW SWEET POTATO FLESH COLOUR PICTURE);*** other food made from vegetables or root crops with yellow or orange flesh such as carrots, pumpkin,?	Yes....1 No….2
dd04	Any dark green leafy vegetables or dishes made with dark green leafy vegetables such as amaranth, cow peas leaves, cassava leaves, bean leaves, pumpkin leaves, spinach and other dark green leafy vegetables?	Yes....1 No….2
dd05	Any other vegetables, such as cabbage, egg-plant, tomatoes, cucumber?	Yes....1 No….2
dd06	Any ripe papaya, ripe mangoes, other yellow- or orange-fleshed fruits?	Yes....1 No….2
dd07	Any other fruits, such as matoke, plaintains, Ndiizi, Gonja, passion fruit, jack fruit, pineapples, oranges, sugarcanes, etc?	Yes....1 No….2
dd08	Any meats such as beef, pork, lamb, goat, rabbit wild game, chicken, duck, turkey, pigeons, or other birds, or meat products like sausage or kebabs?	Yes....1 No….2
dd09	Any liver, kidney, heart or other organ meats	Yes....1 No….2
dd10	Any eggs of chicken, duck or other birds?	Yes....1 No….2
dd11	Any fresh or dried fish or shellfish including mukene/omena/obufulu?	Yes....1 No….2

dd12	Any beans, cow peas, peas, soy beans, groundnuts, lentils, or other legumes, or any foods made from these foods?	Yes....1	No….2
dd13	Any cashew, walnut, pecan, shea nut, almond or other foods made from nuts?	Yes....1	No….2
dd14	Any cheese, yogurt, milk or other milk products?	Yes....1	No….2
dd15	Any foods made with oil, fat, margarine or butter?	Yes....1	No….2
dd16	Any sugar or honey or molasses?	Yes....1	No….2
dd17	Any condiments, coffee, tea or spices?	Yes....1	No….2
dd18	Any foods made with Red palm oil?	Yes....1	No….2

INDIVIDUAL WHEAT FLOUR CONSUMPTION

"Now we are going to talk about foods or products made with wheat flour that you might have consumed during the previous 7 days . I am going to read a list of different foods and ask you how many times you consumed that food in the 7 day period. Then I will ask about portion sizes.

1. *BEGIN BY HELPING THE RESPONDENT TO UNDERSTAND THE PREVIOUS 7 DAY PERIOD*

2. GOING FOOD BY FOOD, ASK: **"In the last 7 days, how many times did you eat [FOOD ITEM]?"**

- *(IF THE FOOD WAS NOT CONSUMED, ENTER FREQUENCY = 00)*
- *(REPEAT QUESTION FOR EACH FOOD ITEM LISTED BELOW BEFORE ASKING ABOUT PORTION SIZE)*

3. *FOR BREAD (FC01-FC05),CHAPATI (FC06-FC07), SAMOSA (FC08-FC09),MANDAZI (FC11-FC15),CAKES (FC16-FC19) AND BISCUITS (FC20-FC23), SHOW THE FOOD TYPE PICTURE BEFORE ASKING :**In the last 7 days, how many times did you eat (food item] like this?***

4. NOW PROCEED TO ASK FOR PORTION SIZE BY ASKING **"Usually, how much of [FOOD ITEM] did you eat at one sitting?**

- *(SHOW PICTURES OF PORTIONS AND REPEAT QUESTION FOR EACH FOOD ITEM LISTED BELOW)*
- *(IF FREQUENCY = 00, SKIP THE PORTION SIZE QUESTION FOR THAT FOOD ITEM)*

N°	ITEMS	1. Frequency (# times)	2. Portion Size code
fc01	Bread sliced (500 g)	☐☐	☐☐
fc02	Bread sliced (1kg)	☐☐	☐☐
fc03	Bread bun (small)	☐☐	☐☐
fc04	Bread bun (big)	☐☐	☐☐
fc05	Bread bun (Long)	☐☐	☐☐

fc06	Chapatti –(Big)	☐☐	☐☐
fc07	Chapatti –(small)	☐☐	☐☐
Fc08	Samosas – Big	☐☐	☐☐
Fc09	Samosas – Small	☐☐	☐☐
Fc10	Rolex (stuffed rolled chapatti)	☐☐	☐☐
Fc11	Mandazi - Donut	☐☐	☐☐
fc12	Mandazi- half cake	☐☐	☐☐
Fc13	Mandazi- round	☐☐	☐☐
fc14	Mandazi – Long	☐☐	☐☐
fc15	Mandazi - Daddies	☐☐	☐☐
fc16	Queen cake, small	☐☐	☐☐
Fc17	Queen cake, large	☐☐	☐☐
Fc18	Sliced cake	☐☐	☐☐
Fc19	Block cake	☐☐	☐☐
fc20	Biscuits, rectangular (big)	☐☐	☐☐
fc21	Biscuits, rectangular (small)	☐☐	☐☐
fc22	Biscuits, round (Big)	☐☐	☐☐
fc23	Biscuits, Glucose pack	☐☐	☐☐
fc24	Spaghetti/ /macaroni - cooked	☐☐	☐☐

Fc25	Noodles - cooked	☐☐	☐☐
Fc26	Bagiya	☐☐	☐☐
Fc27	Wheat ugali	☐☐	☐☐
Fc28	porridge (Tumpeco cup)	☐☐	☐☐
Fc29	porridge (Nice Cup)	☐☐	☐☐
Fc30	Pizza (Large)	☐☐	☐☐
Fc31	Pizza (Medium)	☐☐	☐☐
Fc32	Pizza (Small)	☐☐	☐☐

***** CHECK THE QUESTIONNAIRE & THANK THE RESPONDENT *****

Annex B: Consent forms

FORTIFICATION ASSESSMENT COVERAGE TOOL (FACT) SURVEY IN UGANDA

INFORMED CONSENT DOCUMENT

Introduction

The Ministry of Health of Uganda, the Global Alliance for Improved Nutrition (GAIN), the United States Centers for Disease Control and Prevention (CDC) and Makerere University are conducting a national survey to assess the coverage of fortified staple foods and their contribution towards nutrient Intake among Ugandan households and specifically among women of reproductive age. The survey targets more than 1000 households spread across 51 districts of Uganda. Implementation of the survey is led by Professor Archileo Kaaya, Head of Department of Food Technology & Nutrition, School of Food Sciences, Nutrition and Bioengineering at Makerere University.

You and your household are requested to participate in the survey. Please listen carefully to the reading of this form and ask any questions that you may have before agreeing to participate in the survey.

What is the purpose of this survey?

The purpose of the survey is to determine the coverage and potential contribution of fortified foods to the micronutrient intake among urban and rural households in Uganda and women of reproductive age.

How was I selected to participate in this survey?

In July of this year, survey teams visited your village and moved door-to-door to list all households in the village. Your household and 15 others were selected by chance from the list of all households in the village to participate in the survey.

What do you want me to do if I decide to be in this survey?

If you agree to participate in this survey:

1. We will ask you some questions about your household including: composition of the household, assets owned by the household, access to water and availability of food in the household.
2. We will also request you to tell us about use of cooking oil, cooking fat, maize flour, wheat flour and salt in your household. We may ask you to give a small quantities of those foods (about 2 table spoonful) but we will replace them from our own supply.
3. We would also like to talk to all women 15-49 years who are members of this household about their food consumption.

How long will you need me?

We expect the interview about the household to take 45-60 minutes while interviewing each woman of child-bearing age (15-49 years) will take about 10-15 minutes. If we complete the interview successfully, we will not need to visit you again. However, we may need to comeback one more time if the interview is not completed.

Are there any risks to me or my family members if I decide to participate in this survey?

There are no risks at all to you or your household members due to participation in this survey. However, there is a small chance that some of the questions we ask may cause you some emotional discomfort or distress. If you find any questions we ask uncomfortable to you, you are free to refuse to answer those specific questions or say 'no' to any part of the interview.

Are there any benefits from being in this survey?
There may be no direct benefits to you or your households. However, the findings from this survey are very important and will guide the Ministry of Health, GAIN and other partner institutions to improve health and nutrition programs in your region, the whole of Uganda and other countries. Your participation is therefore very important.

Will my household or I receive anything for participating in your survey?
As a token of appreciation, your household will receive a bar of washing soap. You will also receive 500ml cooking oil and a packet of salt to replace or compensate you for food samples collected from your household.

What alternatives do I have if I don't want to be in your survey?
Your participation in this survey is voluntary. If you decide NOT to participate in the survey, we will thank you for your time and leave your household.

Will the information I give you be kept private?
We will keep your name and your household's information hidden from other people not involved in this survey. Your name or those of other household members will not appear in any reports for the survey. No one will be able to link you and your household to the answers you give. The report we shall write will be for the entire country as a whole and not for each household alone.

Who should I call if I have questions about this survey?
If you have a question about this survey please call the leader of this survey Professor Archileo Kaaya, School of Food Sciences, Nutrition and Bioengineering, Makerere University, Telephone Number 0414-533-865.

Who should I call if I have a question about my rights as a survey volunteer?
If you have questions about your rights as a volunteer in this survey, please contact the Chairperson of Makerere University School of Public health, Higher Degrees, Research and Ethics Committee, Dr. Kiwanuka Suzan, Telephone 0414-532-207

ENUMERATOR: CONFIRM CONSENT

I have read this consent form to the participant and answered their questions fully. The participant has understood what is needed from them and their household. The participant:

AGREES to participate in the survey (CIRCLE 'YES' OPTION ON QUESTIONNAIRE)

DECLINES participation in the survey (CIRCLE 'NO' OPTION ON THE QUESTIONNAIRE, END INTERVIEW)

Annex C: Example photo grid used with WRA questionnaire

Fc06	CHAPATI (BIG)		
1→		2→	
3→		4→	
5→		6→	
7→		8→	

Annex D: Food list methodology

HOW TO VALIDATE THE FOOD LISTS AND COLLECT RECIPES USING FOCUS GROUP DISCUSSIONS AND KEY INFORMANTS

The objectives of this exercise are to validate and thereafter generate a concrete list of maize and wheat based products in the EA as well as collect and compile recipes for some of the special foods on the generated list of foods.

Points to note:

1. The products for which we are collecting food lists and recipes are wheat based products and maize based products.
2. Carry out **two focus group discussions (FGDs) per district**, one at district level to represent urban and the other at village level to represent rural.
3. For the people in Kampala, all your EAs are urban

Procedure for validation of food lists and collection of recipes.

Step 1: During project introduction to the village chairperson, endeavor to inform him/ her that you would like to engage 5-7 people in a FGD regarding the kind of wheat and maize based products that people consume in that particular EA.

Step 2: Before or after the listing exercise (depending on what time is convenient for the team), inform the chairperson to select the 5-7 people that you had mentioned and gather them in a central location. **These are your key informants (KIs). They should be articulate and familiar with the topic of the purchase, preparation and consumption of wheat and maize based foods.**

Step 3: After introducing the topic to the KIs, list foods consumed in the area that are made from wheat.

Step 4: Review the food lists that you carried with you to the field with them. Together with the KIs, find out whether some of the foods consumed in the EA have been omitted from the list or whether foods that are not consumed in that area have been added to the list.

Step 5: Add those that were left out and omit those that were added but are not consumed in that particular area.

Ensure that you explore a variety of different types of food items (e.g. main meat dishes, vegetable dishes, snacks etc). The goal is to develop as comprehensive a list of *commonly* consumed food items containing wheat.

Step 6: For each food listed, find out where it is purchased from, preparation methods, alternative or local names, whether it is consumed only in certain areas or population groups and any other useful information

Step 7: Repeat steps 3-6 for maize flour.

Step 8: After generating both lists and all the additional information, sort and refine the lists to include only those foods that are important to the study (to be determined by the supervisors and team leaders).

Step 9: Collect a recipe (only ingredients) for each of the foods that has been flagged as important to the study from the sources listed.

Obtain common recipes for each food item from each source mentioned in the food lists. Ensure that you collect at least three recipes from three different sources per food item.

Step 10: Move around neighborhood shops and kiosks to validate the lists.

Make additions to the lists if necessary based on what is available in these shops and kiosks.

Annex E: Pricelist of fortified foods, packaging, unit quantity and unit price

Name	Brand	Packaging	Unit quantity	Unit price
Maize flour	Maganjo fortified	Packet	1/4kg	1400
Maize flour	Maganjo fortified	Packet	1/2kg	2500
Maize flour	Maganjo fortified	Packet	1kg	4500
Maize flour	Maganjo fortified	Packet	2kg	8500
Maize flour	Maganjo fortified	Packet	5kg	22000
Maize flour	Maganjo fortified	Packet	10kg	40000
Maize flour	Maganjo ordinary	Packet	1/4kg	1000
Maize flour	Maganjo ordinary	Packet	1/2kg	2500
Maize flour	Maganjo ordinary	Packet	1kg	4000
Maize flour	Maganjo ordinary	Packet	2kg	7500
Maize flour	Maganjo ordinary	Packet	5kg	18000
Maize flour	Maganjo ordinary	Packet	10kg	39000
Maize flour	Pearl fortified	Packet	1/4kg	1800
Maize flour	Pearl fortified	Packet	1/2kg	3300
Maize flour	Pearl fortified	Packet	1kg	5500
Maize flour	Pearl fortified	Packet	2kg	10500
Maize flour	Pearl fortified	Packet	5kg	27000
Maize flour	Shibe	Packet	1/4kg	1800
Maize flour	Shibe	Packet	1/2kg	3600
Maize flour	Shibe	Packet	1kg	6000
Maize flour	Shibe	Packet	2kg	11500
Maize flour	Shibe	Packet	5kg	29500
Maize flour	Shibe	Packet	10kg	59000
Maize flour	Unbranded	Packet	1/4kg	400
Maize flour	Unbranded	Packet	1/2kg	800
Maize flour	Unbranded	Packet	1kg	1700
Maize flour	Unbranded	Packet	2kg	2100
Maize flour	Unbranded	Packet	5kg	4250
Maize flour	Unbranded	Packet	10kg	20000
Wheat flour	Azam	Packet	1/4kg	800
Wheat flour	Azam	Packet	1/2kg	1500
Wheat flour	Azam	Packet	1kg	3000
Wheat flour	Azam	Packet	2kg	7000
Wheat flour	Azam	Packet	5kg	13000
Wheat flour	Azam	Packet	10kg	69000
Wheat flour	Drum	Packet	1/4kg	800
Wheat flour	Drum	Packet	1/2kg	1500
Wheat flour	Drum	Packet	1kg	300
Wheat flour	Drum	Packet	2kg	6500
Wheat flour	Drum	Packet	5kg	12500
Wheat flour	Drum	Packet	10kg	124000
Wheat flour	Exe	Packet	1/4kg	800

Wheat flour	Exe	Packet	1/2kg	1500
Wheat flour	Exe	Packet	1kg	3000
Wheat flour	Exe	Packet	2kg	6000
Wheat flour	Exe	Packet	5kg	12000
Wheat flour	Exe	Packet	10kg	29500
Wheat flour	Pembe	Packet	1/4kg	800
Wheat flour	Pembe	Packet	1/2kg	1500
Wheat flour	Pembe	Packet	1kg	3000
Wheat flour	Pembe	Packet	2kg	6000
Wheat flour	Pembe	Packet	5kg	12000
Wheat flour	Pembe	Packet	10kg	29500
Cooking oil	Fortune	Kendo	Small	200
Cooking oil	Fortune	Kendo	Medium	300
Cooking oil	Fortune	Kendo	Large	400
Cooking oil	Fortune	Sachet	500ml	2500
Cooking oil	Fortune	Sachet	1000ml	5000
Cooking oil	Fortune	Jerrycan	500ml	3300
Cooking oil	Fortune	Jerrycan	1000ml	6500
Cooking oil	Fortune butto	Kendo	Small	200
Cooking oil	Fortune butto	Kendo	Medium	300
Cooking oil	Fortune butto	Kendo	Large	400
Cooking oil	Fortune butto	Sachet	500ml	2500
Cooking oil	Fortune butto	Sachet	1000ml	5000
Cooking oil	Fortune butto	Jerrycan	500ml	3300
Cooking oil	Fortune butto	Jerrycan	1000ml	6500
Cooking oil	Golden fry	Kendo	Small	200
Cooking oil	Golden fry	Kendo	Medium	300
Cooking oil	Golden fry	Kendo	Large	400
Cooking oil	Golden fry	Sachet	500ml	2500
Cooking oil	Golden fry	Sachet	1000ml	5000
Cooking oil	Golden fry	Jerrycan	500ml	3300
Cooking oil	Golden fry	Jerrycan	1000ml	6500
Cooking oil	Ufuta	Kendo	Small	200
Cooking oil	Ufuta	Kendo	Medium	300
Cooking oil	Ufuta	Kendo	Large	400
Cooking oil	Ufuta	Jerrycan	500ml	3500
Cooking oil	Ufuta	Jerrycan	1000ml	7000
Seasoning	Knorr beef	Packet	4g	100
Seasoning	Knorr beef	Packet	160g	2500
Seasoning	Knorr chicken	Packet	4g	100
Seasoning	Knorr chicken	Packet	160g	2500
Seasoning	Royco	Packet	5g	100
Seasoning	Royco	Packet	10g	200
Seasoning	Royco	Packet	50g	1500

Seasoning	Royco	Packet	100g	2800
Seasoning	Royco	Packet	200g	3300
Seasoning	Royco	Packet	500g	4500
Seasoning	Royco	Packet	1kg	7000
Seasoning	Harambe	Packet	5g	100
Seasoning	Harambe	Packet	10g	200
Cooking fat	Chipsy	Tub	500g	3800
Cooking fat	Chipsy	Tub	1kg	7300
Cooking fat	Cowboy	Tub	500g	4000
Cooking fat	Cowboy	Tub	1kg	7500
Cooking fat	Kasuku	Tub	500g	3800
Cooking fat	Kasuku	Tub	1kg	7300
Cooking fat	Kimbo	Tub	500g	4000
Cooking fat	Kimbo	Tub	1kg	7500
Margarine	Blue band	Tub	50g	600
Margarine	Blue band	Tub	100g	1200
Margarine	Blue band	Tub	250g	2700
Margarine	Blue band	Tub	500g	5500
Margarine	Blue band	Tub	1kg	9500
Margarine	Blue band	Tub	2kg	29500
Margarine	Blue band	Tub	4 kg	38500
Margarine	Prestige	Tub	250g	2500
Margarine	Prestige	Tub	500g	4800
Salt	Habari	Packet	150g	200
Salt	Habari	Packet	200g	300
Salt	Habari	Packet	500g	500
Salt	Habari	Packet	1kg	900
Salt	Habari	Packet	2kg	1800
Salt	Kay	Packet	150g	200
Salt	Kay	Packet	200g	300
Salt	Kay	Packet	500g	500
Salt	Kay	Packet	1kg	900
Salt	Kay	Packet	2kg	1800

Annex F: List of key variables in analyses and how they were calculated

Variable	Calculation
Household dependency ratio	The "number of household members below 15 years of age and above 64 years of age" divided by the "number of household members between 15 and 64 years of age".
Dietary diversity score	Women were asked about their consumption of 18 food groups. Multiple foods on the questionnaire counted toward similar food categories when they were re-categorized based on the DDS definitions These were distilled into 10 food groups: 1. All starchy staple foods, 2. Beans and peas, 3.Nuts and seeds, 4.Dairy, 5. Flesh foods, 6.Eggs, 7. Vitamin-A rich dark green leafy vegetables, 8. Other vitamin-A rich vegetables and fruits, 9.Other vegetables, and 10. Other fruits. If a woman consumed a food from a food group, she received a score of 1 for the food group and a maximum of 10 if she ate from all of the food groups. This summary score (0-10) was the woman's dietary diversity score. A woman's dietary diversity score less than the population median in each stratum was classified as "lower dietary diversity (below the median)" and otherwise, it was termed "higher dietary diversity (at or above the median)".
Multidimensional Poverty Index (MPI)	The MPI is derived from three domains: living standards (mpiLS), household education (mpiED), and health and nutrition (mpiHN). The household living standard score was based on 6 variables: no electricity, dirt floor, use of dirty cooking fuel, < 2 key assets owned, unsafe drinking water, and unimproved / shared latrine). If affirmative, each LS variable got a score of 1/18. The household ED dimension was based on 2 variables: household head had less than five years of education and any school age child was not attending school. If affirmative, each ED variable was scored 1/6. For health and nutrition, the domain was based on the 3 variables: hunger, recently born child dead, and poor access to preventative services. All affirmative responses were given a score of 1/9. Next the scores from each domain were summed (i.e. mpiLS + mpiED + mpiHN) to obtain a maximum score of 1. Households with an MPI score greater than or equal to 0.33 were defined as a "poor" while households with an MPI less than 0.33 were classified as "non-poor".
Household hunger	Hunger score was calculated as a household cumulative sum of responses to 3 questions on "lack of food", "insufficient food over the past month", and "insufficient food (day and night)". The maximum household score was 6. Scores between 0-1 were classified as "little or no hunger", 2-3 as "moderate hunger", and 4-6 as "severe hunger".
Food groupings for food frequency questions	1. All starchy staple foods (rice, cereals and tubers [questions 1 & 2]), group 2. Beans and peas (legumes [question 12]), group 3. Nuts and seeds (cashew, walnuts, almonds, pecan nuts and other seeds [question 13]), group 4. Dairy (cheese, milk, milk products [question 14]), group 5. Flesh foods (meats, fish, organ meats [questions 8, 9,

Variable	Calculation
	11]), group 6. Eggs (eggs [question 10]), group 7. Vitamin A rich dark green leafy vegetables (kale, spinach, etc. [question 4]), group 8. other vitamin A-rich fruits and vegetables (yellow or orange flesh vegetables /root crops – carrots; fruit/vegetables such as mangoes, papaya, pawpaw, squash or melon [questions 3 and 6), group 9. other vegetables (other vegetables [question 5]), group 10 (other fruits (other fruits [question 7]).
Fortifiable food consumed	Fortifiable refers to any food that was not made at home and is assumed to be industrially processed.
Fortified food consumed	"Fortified food" refers to analyzed foods confirmed to meet fortification criteria, as follows. (A) In households where a food sample was taken and analyzed, if the sample met the fortified criteria then the household was classified as consuming fortified food. (B) In households where a food sample was not taken and the brand name was available, the median nutrient value in the branded samples analyzed from other households was used. If the value met the fortified criteria then the household was classified as consuming fortified food. (C) In households where a food sample was not taken and the brand name was not available, the median nutrient value in the unbranded samples analyzed from other households was used. If the value met the fortified criteria then the household was classified as consuming fortified food. Foods were classified as: "Consumes fortified food" if the household reported to consume a food that was confirmed to be fortified by quantitative analyses (i.e. if the sample or brand provided met or exceeded the following nutrient content cut-off criteria: oil with ≥3.0 IU/kg vitamin A, wheat flour ≥35.0 mg/kg iron, maize flour ≥15.0 mg/kg iron, or salt ≥7.6 mg/kg iodine. Red palm oil was not included in these analyses because it is not required to be fortified in Uganda and was considered not fortifiable.
Unfortified food sample	Unfortified foods were those that, upon analysis, had less than the criteria for "fortified". Fortification quality of oil, wheat flour, maize flour and salt were assessed by laboratory analysis of nutrients in food specimens collected from the households using cut-offs based on the 2012 and the 2006 Uganda National Standards (UNBS 2012, UNBS 2006a; UNBS 2006b; & UNBS 2006c). "Unfortified" was defined as <3.0 mg RE/kg vitamin A, <35.0 mg/kg iron (including intrinsic iron), <15.0 mg/kg iron (including intrinsic iron), and <7.6 ppm iodine for oil, wheat flour maize flour, and salt respectively.
Reported positive attributes to logo	Reported that the logo means "fortified / enriched / added micronutrients", "good for health" or "better quality".
Percent Recommended Nutrient Intake	Recommended Nutrient Intakes (RNI) from the World Health Organization were used, to compare women's nutrient intake from

Variable	Calculation
	fortifiable food. The iron RNI for women, assuming 12% bioavailability, is as follows: 25.8 mg/day (15-18 years), 24.5 mg/day (19-50 years), 24.5 mg/day (pregnant women), 12.5 mg/day (lactating women). The vitamin A RNI for women is as follows: 600 micrograms retinol equivalents (mcg RE)/day (15-18 years), 500 mcg RE/day (19-50 years), 800 mcg RE/day (pregnant women), and 850 mcg RE/day (lactating women). The iodine RNI for women is as follows: 150 mcg/day (15-18 years), 150 mcg/day (19-50 years), 200 mcg/day (pregnant women), and 200 mcg/day (lactating women). For women who were both pregnant and lactating, the pregnancy RNI was used for all nutrients. The percent of RNI met was calculated as follows: "amount of nutrient consumed from food" divided by "nutrient RNI" multiplied by 100%.
Apparent food consumption	Apparent food consumption is the product of "amount of food consumed per day" and "adult male equivalent (AME) ratio" of an individual based on their sex and age. As a point of reference, males age 18-30 y are assigned an AME ratio of 1.0.

Annex G. In-depth description of analytical methods applied to food samples

Dr. Anna Zhenchuk and Dipl. BioChem. Katrin Steinbrenner, BioAnalyt GmbH

1. Introduction

GAIN has collected samples of staple foods from markets and households in Uganda to assess the coverage of fortified foods and the levels of micronutrients in these foods. The samples of salt, oil, wheat and maize flour were sent to BioAnalyt for the measurement of iodine, vitamin A and iron levels. The samples were analyzed for added micronutrient content using the iCheck technology. Students from the University of Potsdam were trained in the use of the iCheck and performed the analysis under supervision from BioAnalyt.

2. Technology

iCheck is a test kit for the quantitative determination of micronutrients. It consists of two units, a portable photometer or fluorimeter (iCheck) and the disposable reagent vials in which the reaction is performed.

The validation protocol for each iCheck and matrix combines assessment of precision, trueness and a comparison to a reference method[2]. iCheck and iCheck reagent vials are produced according to quality management system (DIN EN ISO 9001:2008) certified by TÜV Nord in Germany.

3. Methodology

For the hands on training for each iCheck analysis method, the student analysts read the user manuals and received a demonstration of the entire analysis procedure. Finally, they independently analyzed a sample 10 times to assess precision and repeatability. The analyst with the most consistent results was then selected to perform the analysis.

3.1 Analysis of Vitamin A in Edible Oil

iCheck Chroma 3 was used for the determination of vitamin A in cooking oil. The determination of vitamin A is based on a color reaction in which the reagents in the vial turn a brilliant blue (Carr-Price reaction), the intensity of which is dependent on retinol concentration. The device measures the absorption of the color in the reagent vial at 3 different wavelengths, over the course of 30 seconds. The device then calculates the vitamin A content through a sophisticated algorithm and displays the result in mg Retinol equivalents/kg. The linear range of the

[2] Precision is the extent to which a measurement procedure gives the same results each time it is repeated under identical conditions and variable conditions (repeatability) and variable conditions (reproducibility).

Trueness refers to the closeness of agreement between the arithmetic mean of a large number of test results and the true or accepted reference value.

device is 3–30 mg retinol equivalents (RE)/kg of oil. This method has been validated against the reference method of HPLC (1, 2).

Liquid oil samples were directly injected into the reagent vial and measured with iCheck Chroma 3 according to the user manual. Solidified oil samples were warmed to 40°C in an incubator and shaken for 5 minutes to ensure that they were homogeneous, before analysis. Every 10th sample was analyzed in duplicate to assess precision.

As a quality control, the emitter and receptor of the iCheck Chroma 3 device were controlled by using a standard density glass filter (Chroma 3 Standard) at the beginning of each set of measurements. Additionally, a standard oil sample spiked with a known concentration of retinol palmitate was run every ten measurements as a control.

3.2 Analysis of Iodine in Salt

iCheck Iodine was used for the measurement of iodine in salt. The principle of this colorimetric method is based on the reaction of potassium iodate from a salt sample with potassium iodide in the reagent vial added in excess. Chemically, iodide (I–) forms iodine (I2) and triiodide (I3–), resulting in a blue-purple complex in a starch solution. The absorption of the blue color is dependent on the concentration of the solution and is measured at 565 nm in the iCheck device. The method has been validated against the reference method of iodometric titration (3).

The salt samples were analyzed individually. The samples were diluted 1:10 with water to ensure that the iodine concentration of the final solution was within the linear range of iCheck Iodine (1.0 - 13.0 mg/L). Before weighing in, the salt samples were mixed thoroughly to ensure homogeneity. Exactly 4 g of salt was dissolved completely in 36 mL of water. The salt solutions were injected and analyzed according to iCheck Iodine user manual. Salt samples with concentration of iodine above iCheck Iodine linear range (>13.0 mg/L) were reanalyzed with higher dilution factor of 1:20. Every 10th sample was analyzed in duplicate to assess precision.

As a quality control, a standard density glass filter (Iodine Standard) was measured to control emitter and receptor before each set of measurements. Additionally, a standard iodized salt sample was analyzed to control the measurement process at regular intervals.

3.3 Analysis of Iron in Wheat and Maize Flour

iCheck Iron was used for the measurement of Iron in Flour. The principle of the method is colorimetric, in which reagents react with the iron to form a bright reddish-pink color. The disposable reagent vials contain 2 mL of reagents and when the sample solution is injected, a water phase and an organic solvent phase are formed. By shaking the vial, Fe2+ is extracted into the organic phase, where it forms a chelate with Bathophenanthroline (bphen), forming the pinkish red color complex:

$$3\ \text{bphen} + Fe^{2+} \rightarrow [Fe(\text{bphen})_3]^{2+}$$

When the reaction is complete, the vial is placed in the portable device, the absorption is measured at 525 nm and the concentration is displayed in mg Fe/L. The total iron content, both the intrinsic iron from the food matrix and added iron from fortification of the sample is determined. The reference method used for validation is Atomic absorption spectroscopy (AAS).

The samples were diluted 1:10 with water to ensure that the iron concentration of the final solution was within the linear range of iCheck Iron, 1.5 - 12.0 mg Fe/L. Before weighing in, the flour samples were mixed thoroughly to ensure homogeneity. Exactly 5 g of flour was mixed with water to a final volume of 50 mL. The flour slurry was injected and analyzed according to iCheck Iron user manual. All samples were injected and measured individually and every 10^{th} sample was analyzed in duplicate to assess precision. The iron type used in flour fortification program in Uganda in NaFeEDTA, therefore the injected samples were incubated in the vials overnight and then measured with iCheck Iron.

A wheat and maize spiked flour sample was used to control the accuracy of the analyst measurement. The spiked flour was measured at the beginning of each set of measurements and every 10-20 measurements. Balances were controlled with a calibration weight before each sample was weighed in and calibrated if necessary.

Unfortified samples were also measured to assess the level of intrinsic iron, since the methodology does not allow for differentiation of added and natural (intrinsic) iron.

4. **Results**

All the measurement results were put into excel files and delivered to the customer.

Oil:

A total of 294 oil samples were analyzed. 16 oils had intense red or orange coloration, indicative of unrefined oils and may not be reliably measured with iCheck technology. iCheck Chroma 3 has been validated for RBD (refined bleached deodorized oils).

Samples with a measured vitamin A concentration of less than 10 000 IU/kg (<3.0 mg RE/kg) were classified as non-fortified. The precision, as assessed by duplicate measurement of 21 oil samples, is 96%±3%. The trueness, as assessed by the recovery with spiked control oil sample, is 105%±10%.

Salt:

A total of 820 salt samples were analyzed individually for iodine content. Samples with measured iodine concentration below 10 ppm were classified as non-iodized. The average precision, as assessed by the duplicate measurement of 82 salt samples, is 99%. The trueness, as assessed by the recovery with iodized salt control sample, is 93%±2%.

Wheat Flour:

A total of 47 wheat flour samples were analyzed for total iron content. The average measured intrinsic iron content of the flour is 35 ppm (mg Fe/kg). This value was obtained by taking the average tested value of 4 different unfortified flours. The average precision, as assessed by measuring 4 wheat flour samples in duplicates is 94%±5%. The trueness for iron analysis, as assessed by the recovery with spiked wheat flour sample, is 105%±4%. The average measured added iron content in the wheat flour is 19 ppm.

Maize Flour:

A total of 238 maize flour samples were analyzed for total iron content. The intrinsic iron content of the maize flour was below iCheck Iron linear range (<14 mg Fe/kg). The precision, as assessed by measuring 9 maize flour samples in duplicates, is 84%±8%. The trueness for iron analysis, as assessed by the recovery with spiked maize flour sample, is 99%±6%. The average measured total iron content in maize flour is 21 ppm.

5. Summary

In interpreting the fortification levels of the food samples, it is recommended to express the result as a range instead of an absolute value, thus taking into consideration uncertainty of the method and also the distribution of the target analyte in the sample.

The analysis of 1400 food samples was rapidly and successfully accomplished. Such a coverage study could easily be replicated using iCheck equipment, with the right control parameters, in country by local analysts upon proper training and close supervision by BioAnalyt approved trainer.

References

1. Renaud et al. "Quantification of vitamin A in fortified rapeseed, groundnut and soya oils using a simple portable device: comparison to high performance liquid chromatography." International Journal for Vitamin and Nutrition Research, vol. 83, no. 2, 2013.
2. Rohner et al. "Quantification of Vitamin A in Palm Oil Using a Fast and Simple Portable Device: Method Validation and Comparison to High-Performance Liquid Chromatography." International Journal for Vitamin and Nutrition Research, vol. 81, no. 5, 2011.
3. Rohner et al. "Validation of a user-friendly and rapid method for quantifying iodine content of salt." Food and Nutrition Bulletin, vol. 33, no. 4 (suppl.), 2012.

Annex H: Results from Figures 1-4 in table format

Results from Figure 1: household coverage of foods.[1]

Coverage[2]	National N=949 % (95% CI)	Rural N=509 % (95% CI)	Urban N=440 % (95% CI)	p-value[3]
Consumes oil	89.9 (85.9, 94.0)	89.4 (86.7, 92.1)	92.7 (90.3, 95.2)	0.0742
Consumes fortifiable oil	89.0 (84.7, 93.2)	88.2 (85.4, 91.0)	92.7 (90.3, 95.2)	0.0191
Consumes fortified oil				
Yes	54.4 (48.3, 60.4)	51.3 (46.9, 55.6)	70.0 (65.7, 74.3)	<0.0001
No	4.6 (2.3, 6.9)	4.3 (2.5, 6.1)	5.9 (3.7, 8.1)	
Don't know	30.0 (23.5, 36.5)	32.6 (28.5, 36.7)	16.8 (13.3, 20.3)	
Does not consume fortifiable oil	11.0 (6.8, 15.3)	11.8 (9, 14.6)	7.3 (4.8, 9.7)	
Consumes wheat flour	11.2 (7.7, 14.7)	8.3 (5.9, 10.6)	26.4 (22.2, 30.5)	<0.0001
Consumes fortifiable wheat flour	10.6 (7.6, 13.6)	7.5 (5.2, 9.8)	26.4 (22.2, 30.5)	<0.0001
Consumes fortified wheat flour				
Yes	8.5 (5.7, 11.4)	6.3 (4.2, 8.4)	20.0 (16.2, 23.8)	NA
No	0.7 (0.4, 1.0)	0.0 (0.0, 0.0)	4.1 (2.2, 5.9)	
Don't know	1.4 (0.6, 2.1)	1.2 (0.2, 2.1)	2.3 (0.9, 3.7)	
Does not consume fortifiable wheat flour	89.4 (86.4, 92.4)	92.5 (90.2, 94.8)	73.6 (69.5, 77.8)	
Consumes maize flour	91.8 (87.7, 96.0)	91.2 (88.7, 93.6)	95.2 (93.2, 97.2)	0.0140
Consumes fortifiable maize flour	42.4 (32.7, 52.1)	36.3 (32.2, 40.5)	73.0 (68.8, 77.1)	<0.0001
Consumes fortified maize flour				
Yes	6.5 (3.3, 9.7)	6.1 (4.0, 8.2)	8.6 (6.0, 11.3)	<0.0001
No	19.4 (14.3,24.4)	15.5 (12.4,18.7)	38.9 (34.3,43.4)	
Don't know	16.5 (11.7,21.3)	14.7 (11.6,17.8)	25.5 (21.4, 29.5)	
Does not consume fortifiable maize flour	57.6 (47.9, 67.3)	63.7 (59.5, 67.8)	27.0 (22.9, 31.2)	
Consumes salt	99.5 (99.0, 100.0)	99.6 (99.1, 100.0)	99.1 (98.2, 100.0)	0.3171
Consumes fortifiable salt	99.4 (98.8, 99.9)	99.4 (98.7, 100.0)	99.1 (98.2, 100.0)	0.5660
Consumes fortified salt				
Yes	93.3 (88.8, 97.7)	92.7 (90.5, 95.0)	95.9 (94.1, 97.8)	0.0703

No	0.4 (0.0, 0.9)	0.4 (0.0, 0.9)	0.5 (0.0, 1.1)	
Don't know	5.7 (1.6, 9.8)	6.3 (4.2, 8.4)	2.7 (1.2, 4.3)	
Does not consume fortifiable salt	0.6 (0.1,1.2)	0.6 (0.0,1.3)	0.9 (0.0,1.8)	
Consumes cooking fat	32.2 (24.1, 40.4)	29.3 (25.3, 33.2)	47.0 (42.4, 51.7)	<0.0001
Consumes fortifiable cooking fat	29.0 (21.7, 36.3)	26.1 (22.3, 30.0)	43.4 (38.8, 48.1)	<0.0001
Consumes fortified cooking fat	NA	NA	NA	
Consumes bouillon cubes	34.7 (28.7, 40.7)	28.9 (24.9, 32.8)	64.1 (59.6, 68.6)	<.0001
Consumes fortifiable bouillon cubes	34.7 (28.7, 40.7)	28.9 (24.9, 32.8)	64.1 (59.6, 68.6)	<.0001
Consumes fortified bouillon cubes	NA	NA	NA	NA

Abbreviations: CI, confidence interval; NA, not applicable

[1] All values are percent as indicated, and are weighted to correct for unequal probability of selection.

[2] "Consumes food" refers to households that report preparing this food at home. "Consumes fortifiable food" refers to households that reported consuming a food that was not made at home and is assumed to be industrially processed. "Consumes Fortified food" refers to households that consumed a food that was confirmed to be fortified by quantitative analyses (i.e. if the sample or brand provided met or exceeded the following nutrient content cut-off criteria: oil with ≥3.0 IU/kg vitamin A, wheat flour ≥35.0 mg/kg iron,, maize flour ≥15.0 mg/kg iron, salt ≥7.6 mg/kg iodine. "Consumes fortified food" was determined as follows:

(A) In households where a food sample was collected and analyzed, if the sample met the fortified criteria (laboratory nutrient content cut-off) then the household was classified as consuming fortified food. If the sample did not meet the fortified criteria, then the household was classified as "not consuming fortified food".

(B) In households where a food sample was not taken and the brand name was available, the median nutrient value in the branded samples analyzed from other households was used. If the value met the fortified criteria then the household was classified as consuming fortified food. If the value did not meet the fortified criteria then the household was classified as "not consuming fortified food".

(C) In households where a food sample was not collected and the brand name was not available, the household was classified as "don't know" for consumes fortified food.

(D) Households that did not consume a fortifiable food were classified as "Does not consume fortifiable food".

[3] Comparing rural versus urban. Chi-square test was used to compare percentages.

[4] All bouillon cubes are assumed to be fortifiable because they are industrially made outside of the household

NA = Not Applicable

Results from Figure 2: household coverage of foods by poverty risk.[1]

Coverage[2]	Poor % (95% CI)[3]	Non-poor % (95% CI)[3]	p-value[4]
National	**N=500**	**N=449**	
Consumes oil	88.3 (83.7, 92.9)	92.8 (88.4, 97.2)	0.0602
Consumes fortifiable oil	86.8 (81.7, 91.8)	92.8 (88.4, 97.2)	0.0202
Consumes fortified oil			
Yes	48.4 (40.7, 56.1)	64.7 (59.1, 70.4)	<0.0001
No	2.8 (1.2, 4.5)	7.6 (3.5, 11.7)	
Don't know	35.5 (28.2, 42.9)	20.4 (13.5, 27.3)	
Does not consume fortifiable oil	13.2 (8.2, 18.3)	7.2 (2.8, 11.6)	
Consumes wheat flour	7.2 (2.8, 11.6)	18.3 (13.7, 22.8)	0.0015
Consumes fortifiable wheat flour	6.2 (3.0, 9.3)	18.3 (13.7, 22.8)	<0.0001
Consumes fortified wheat flour			
Yes	4.4 (1.5, 7.4)	15.7 (11.3, 20.1)	<0.0001
No	0.2 (0.0, 0.5)	1.4 (0.7, 2.1)	
Don't know	1.5 (0.4, 2.6)	1.2 (0.1, 2.2)	
Does not consume fortifiable wheat flour	93.8 (90.7, 97.0)	81.7 (77.2, 86.3)	
Consumes maize flour	89.7 (84.1, 95.3)	95.5 (92.2, 98.9)	0.0213
Consumes fortifiable maize flour	35.5 (24.8, 46.2)	54.3 (43.1, 65.5)	0.0009
Consumes fortified maize flour			
Yes	5.9 (2.7, 9.1)	7.6 (2.3, 12.9)	<0.0001
No	13.1 (8.5, 17.7)	30.2 (22.2, 38.1)	
Don't know	16.5 (10.0, 22.9)	16.5 (11.8, 21.2)	
Does not consume fortifiable maize flour	64.5 (53.8, 75.2)	45.7 (34.5,56.9)	
Consumes salt	99.3 (98.5, 100.0)	99.9 (99.7, 100.0)	0.0644
Consumes fortifiable salt	99.0 (98.2, 99.9)	99.9 (99.7, 100.0)	0.0154
Consumes fortified salt			
Yes	91.8 (85.0, 98.5)	95.8 (93.4, 98.3)	0.1399
No	0.3 (0.0, 0.8)	0.7 (0.0, 1.6)	
Don't know	7.0 (0.8, 13.2)	3.4 (1.1, 5.7)	
Does not consume fortifiable salt	1.0 (0.1, 1.8)	0.1 (0.0, 0.3)	
Consumes cooking fat	24.7 (16.4, 33.0)	45.2 (34.7, 55.6)	<0.0001
Consumes fortifiable cooking fat	21.8 (14.1, 29.5)	41.4 (32.1, 50.7)	<0.0001
Consumes fortified cooking fat	NA	NA	NA
Consumes cooking bouillon cubes	24.6 (18.9, 30.3)	52.1 (45.7, 58.5)	<0.0001
Consumes fortifiable bouillon cubes	24.6 (18.9, 30.3)	52.1 (45.7, 58.5)	<0.0001
Consumes fortified bouillon cubes	NA	NA	NA

Rural	**N=353**	**N=156**	
Consumes oil	88.1 (84.7, 91.5)	92.3 (88.1, 96.5)	0.1555
Consumes fortifiable oil	86.4 (82.8, 90.0)	92.3 (88.1, 96.5)	0.0568
Consumes fortified oil			
Yes	47.9 (42.6, 53.1)	59 (51.2, 66.7)	<0.0001
No	2.3 (0.7, 3.8)	9 (4.5, 13.5)	
Don't know	36.3 (31.2, 41.3)	24.4 (17.6, 31.1)	
Does not consume fortifiable oil	13.6 (10.0, 17.2)	7.7 (3.5, 11.9)	
Consumes wheat flour	6.5 (3.9, 9.1)	12.2 (7.0,17.3)	0.0323
Consumes fortifiable wheat flour	5.4 (3.0, 7.7)	12.2 (7.0, 17.3)	0.0071
Consumes fortified wheat flour			
Yes	4.0 (1.9, 6.0)	11.5 (6.5, 16.6)	0.0042
No	10.8 (7.5, 14.0)	4.5 (1.2, 7.7)	
Don't know	1.4 (0.2, 2.7)	0.6 (0,1.9)	
Does not consume fortifiable wheat flour	94.6 (92.3, 9.0)	87.8 (82.7, 93.0)	
Consumes maize flour	89.2 (86.0, 92.5)	95.5 (92.3, 98.8)	0.0214
Consumes fortifiable maize flour	33.7 (28.8, 38.7)	42.3 (34.5, 50.1)	0.0630
Consumes fortified maize flour			
Yes	5.7 (3.2, 8.1)	7.1 (3.0, 11.1)	0.0125
No	12.2 (8.8, 15.6)	23.1 (16.4, 29.7)	
Don't know	15.9 (12.0, 19.7)	12.2 (7.0, 17.3)	
Does not consume fortifiable maize flour	66.3 (61.3, 71.2)	57.7 (49.9,65.5)	
Consumes salt	99.4 (98.6, 100.0)	100.0 (100.0, 100.0)	
Consumes fortifiable salt	99.2 (98.2, 100.0)	100.0 (100.0, 100.0)	
Consumes fortified salt			
Yes	91.5 (88.6, 94.4)	95.5 (92.3, 98.8)	
No	0.3 (0.0, 0.8)	0.6 (0.0,1.9)	
Don't know	7.4 (4.6, 10.1)	3.8 (0.8, 6.9)	
Does not consume fortifiable salt	0.8 (0.0, 1.8)	0.0 (0.0, 0.0)	
Consumes cooking fat	24.4 (19.9, 28.9)	40.4 (32.7 ,48.1)	0.0002
Consumes fortifiable cooking fat	21.2 (17.0, 25.5)	37.2 (29.6, 44.8)	0.0002
Consumes fortified cooking fat	NA	NA	NA
Consumes bouillon cubes	22.4 (18.0, 26.7)	43.6 (35.8,51.4)	<0.0001
Consumes fortifiable bouillon cubes	22.4 (18.0, 26.7)	43.6 (35.8,51.4)	<0.0001
Consumes fortified bouillon cubes	NA	NA	NA

Urban	**N=147**	**N=293**	
Consumes oil	90.5 (85.7, 95.2)	93.9 (91.1, 96.6)	0.1978
Consumes fortifiable oil	90.5 (85.7, 95.2)	93.9 (91.1, 96.6)	0.1026
Consumes fortified oil			
Yes	53.7 (45.6, 61.8)	78.2 (73.4, 82.9)	<0.0001
No	8.8 (4.2, 13.5)	4.4 (2.1, 6.8)	
Don't know	27.9 (20.6, 35.2)	11.3 (7.6, 14.9)	
Does not consume fortifiable oil	9.5 (4.8, 14.3)	6.1 (3.4, 8.9)	
Consumes wheat flour	14.3 (8.6, 20.0)	32.4 (27.0, 37.8)	<0.0001
Consumes fortifiable wheat flour	14.3 (8.6, 20.0)	32.4 (27.0, 37.8)	<0.0001
Consumes fortified wheat flour			
Yes	9.5 (4.8, 14.3)	25.3 (20.3, 30.3)	0.0005
No	2.7 (0.1, 5.4)	4.8 (2.3, 7.2)	
Don't know	2.0 (0.0, 4.3)	2.4 (0.6, 4.1)	
Does not consume fortifiable wheat flour	85.7 (80.0, 91.4)	67.6 (62.2, 73.0)	
Consumes maize flour	94.6 (90.9, 98.2)	95.6 (93.2, 97.9)	0.6408
Consumes fortifiable maize flour	54.4 (46.3, 62.5)	82.3 (77.9, 86.6)	<0.0001
Consumes fortified maize flour			
Yes	8.2 (3.7, 12.6)	8.9 (5.6, 12.1)	<0.0001
No	23.1 (16.3, 30.0)	46.8 (41.0, 52.5)	
Don't know	23.1 (16.3, 30.0)	26.6 (21.5, 31.7)	
Does not consume fortifiable maize flour	45.6 (37.5, 53.7)	17.7 (13.4,22.1)	
Consumes salt	98.0 (95.7, 100.0)	99.7 (99.0, 100.0)	0.0765
Consumes fortifiable salt	98.0 (95.7, 100.0)	99.7 (99.0, 100.0)	0.0765
Consumes fortified salt			
Yes	94.6 (90.9, 98.2)	96.6 (94.5, 98.7)	0.4189
No	0.0 (0.0, 0.0)	0.7 (0.0, 1.6)	
Don't know	3.4 (0.5, 6.3)	2.4 (0.6, 4.1)	
Does not consume fortifiable salt	2.0 (0.0, 4.3)	0.3 (0.0, 1.0)	
Consumes cooking fat	28.6 (21.2, 35.9)	56.3 (50.6, 62.0)	<0.0001
Consumes fortifiable cooking fat	27.9 (20.6, 35.2)	51.2 (45.4, 56.9)	<0.0001
Consumes fortified cooking fat	NA	NA	NA
Consumes bouillon cubes	48.3 (40.2, 56.4)	72.0 (66.9, 77.2)	<.0001
Consumes fortifiable bouillon cubes	48.3 (40.2, 56.4)	72.0 (66.9, 77.2)	<.0001
Consumes fortified bouillon cubes	NA	NA	NA

Abbreviations: CI, confidence interval; NA, not applicable

[1] All values are percent as indicated, and are weighted to correct for unequal probability of selection.

[2] "Consumes food" refers to households that report preparing this food at home. "Consumes fortifiable food" refers to households that reported consuming a food that was not made at home and is assumed to be industrially processed. "Consumes Fortified food" refers to households that consumed a food that was confirmed to be fortified by quantitative analyses (i.e. if the sample or brand provided met or exceeded the following nutrient content cut-off criteria: oil with ≥3.0 IU/kg vitamin A, wheat flour ≥35.0 mg/kg iron, mg/kg iron, maize flour ≥15.0 mg/kg iron, salt ≥7.6 mg/kg iodine. "Consumes fortified food" was determined as follows:

(A) In households where a food sample was collected and analyzed, if the sample met the fortified criteria (laboratory nutrient content cut-off) then the household was classified as consuming fortified food. If the sample did not meet the fortified criteria, then the household was classified as "not consuming fortified food".

(B) In households where a food sample was not taken and the brand name was available, the median nutrient value in the branded samples analyzed from other households was used. If the value met the fortified criteria then the household was classified as consuming fortified food. If the value did not meet the fortified criteria then the household was classified as "not consuming fortified food".

(C) In households where a food sample was not collected and the brand name was not available, the household was classified as "don't know" for consumes fortified food.

(D) Households that did not consume a fortifiable food were classified as "Does not consume fortifiable food".

[3] Multidimensional Poverty Index (MPI) greater than or equal to 0.33 is defined as "poor" and MPI less than 0.33 is defined as "non-poor".

[4] Comparing poor versus non-poor. Chi-square test was used to compare percentages.

[5] All bouillon cubes are assumed to be fortifiable because they are industrially made outside of the household

NA = Not Applicable

Results from Figure 3: household coverage of foods by women's dietary diversity score.[1]

Coverage[2]	Lower dietary diversity % (95% CI)[3]	Higher dietary diversity % (95% CI)[3]	p-value[4]
National	**N=280**	**N=474**	
Consumes oil	89.5 (84.8, 94.2)	92.6 (86.8, 98.4)	0.3822
Consumes fortifiable oil	87.7 (81.0, 94.3)	91.9 (86.1, 97.7)	0.3006
Consumes fortified oil			
Yes	52.4 (41.1, 63.8)	60.4 (52.4, 68.3)	0.4626
No	5.3 (1.8,8.8)	4.5 (2.2,6.8)	
Don't know	29.9 (20.8,39)	27.1 (18.3,35.9)	
Does not consume fortifiable oil	12.3 (5.7,19)	8.1 (2.3,13.9)	
Consumes wheat flour	11.0 (5.9, 16.0)	12.6 (8.4, 16.9)	0.5808
Consumes fortifiable wheat flour	10.4 (5.3, 15.4)	12.0 (8.7, 15.4)	0.5475
Consumes fortified wheat flour			
Yes	8.1 (3.1, 13.0)	10.0 (6.6, 13.3)	0.7126
No	0.4 (0,0.9)	0.7 (0.3,1.1)	
Don't know	1.9 (0.2,3.6)	1.3 (0.2,2.4)	
Does not consume fortifiable wheat flour	89.6 (84.6,94.7)	88 (84.6,91.3)	
Consumes maize flour	86.7 (75.9, 97.6)	95.1 (92.1, 98.1)	0.0171
Consumes fortifiable maize flour	39.0 (26.5, 51.6)	45.9 (34.8, 57.1)	0.2596
Consumes fortified maize flour			
Yes	5.8 (1.5, 10.1)	6.9 (3.6, 10.2)	0.3277
No	15.4 (9.1,21.7)	22.3 (15.5,29.2)	
Don't know	17.8 (11.5,24.2)	16.7 (10.6,22.8)	
Does not consume fortifiable maize flour	61 (48.4,73.5)	54.1 (42.9,65.2)	
Consumes salt	100.0 (100.0, 100.0)	99.9 (99.8, 100.0)	NA
Consumes fortifiable salt	99.4 (98.3, 100.0)	99.9 (99.8, 100.0)	0.0331
Consumes fortified salt			
Yes	89.1 (74.8,100)	96.7 (94.8,98.6)	0.0038
No	0.1 (0,0.4)	0.7 (0,1.6)	
Don't know	10.1 (0,23.3)	2.5 (0.8,4.3)	
Does not consume fortifiable salt	0.6 (0,1.7)	0.1 (0,0.2)	
Consumes cooking fat	24.4 (17.3, 31.5)	37.6 (27.6, 47.6)	0.0006
Consumes fortifiable cooking fat	21.6 (14.5, 28.8)	33.8 (25.3, 42.3)	0.0007
Consumes fortified cooking fat	NA	NA	NA

Consumes bouillon cubes	28.1 (21.8,34.4)	40.1 (32.6,47.7)	0.0004
Consumes fortifiable bouillon cubes	28.1 (21.8,34.4)	40.1 (32.6,47.7)	0.0004
Consumes fortified bouillon cubes	NA	NA	NA
Rural	**N=130**	**N=269**	
Consumes oil	88.6 (83.2,94.1)	92.1 (88.9,95.4)	0.2511
Consumes fortifiable oil	86.4 (80.5,92.2)	91.4 (88,94.8)	0.1201
Consumes fortified oil			
Yes	51.5 (43,60.1)	56.6 (50.6,62.5)	0.4168
No	3.8 (0.5,7.1)	4.9 (2.3,7.5)	
Don’t know	31.1 (23.1,39)	30 (24.4,35.5)	
Does not consume fortifiable oil	13.6 (7.8,19.5)	8.6 (5.2,12)	
Consumes wheat flour	8.3 (3.6,13.1)	9.4 (5.9,12.9)	0.7355
Consumes fortifiable wheat flour	7.6 (3,12.1)	8.6 (5.2,12)	0.7231
Consumes fortified wheat flour			
Yes	6.1 (2,10.1)	7.5 (4.3,10.7)	0.8287
No	0.0	0.0	
Don’t know	1.5 (0,3.6)	1.1 (0,2.4)	
Does not consume fortifiable wheat flour	92.4 (87.9,97)	91.4 (88,94.8)	
Consumes maize flour	84.1 (77.8,90.4)	94.8 (92.1,97.4)	0.0004
Consumes fortifiable maize flour	31.8 (23.8,39.8)	39.7 (33.8,45.6)	0.1251
Consumes fortified maize flour			
Yes	4.5 (1,8.1)	6.7 (3.7,9.8)	0.4331
No	12.9 (7.1,18.6)	17.2 (12.7,21.8)	
Don’t know	14.4 (8.4,20.4)	15.7 (11.3,20.1)	
Does not consume fortifiable maize flour	68.2 (60.2,76.2)	60.3 (54.4,66.2)	
Consumes salt	100.0 (100.0, 100.0)	100.0 (100.0, 100.0)	NA
Consumes fortifiable salt	99.2 (97.7, 100.0)	100.0 (100.0, 100.0)	NA
Consumes fortified salt			
Yes	87.1 (81.4,92.9)	96.6 (94.5,98.8)	NA
No	0	0.7 (0,1.8)	NA
Don’t know	12.1 (6.5,17.7)	2.6 (0.7,4.5)	NA
Does not consume fortifiable salt	0.8 (0,2.2)	0	NA
Consumes cooking fat	20.5 (13.5,27.4)	34.5 (28.7,40.2)	0.0040
Consumes fortifiable cooking fat	17.4 (10.9,23.9)	31.1 (25.5,36.7)	0.0036
Consumes fortified cooking fat	NA	NA	NA

Consumes bouillon cubes	19.7 (12.9,26.5)	34.1 (28.4,39.8)	<0.0001
Consumes fortifiable bouillon cubes	19.7 (12.9,26.5)	34.1 (28.4,39.8)	<0.0001
Consumes fortified bouillon cubes	NA	NA	NA
Urban	**N=150**	**N=205**	
Consumes oil	92.8 (88.6,96.9)	95.1 (92.1,98.1)	0.3612
Consumes fortifiable oil	92.8 (88.6,96.9)	95.1 (92.1,98.1)	0.3612
Consumes fortified oil			
Yes	55.9 (48,63.9)	82.3 (77,87.5)	<0.0001
No	11.2 (6.1,16.2)	2.5 (0.3,4.6)	
Don’t know	25.7 (18.7,32.6)	10.3 (6.1,14.6)	
Does not consume fortifiable oil	7.2 (3.1,11.4)	4.9 (1.9,7.9)	
Consumes wheat flour	21.1 (14.5,27.6)	31.5 (25.1,37.9)	0.0279
Consumes fortifiable wheat flour	21.1 (14.5,27.6)	31.5 (25.1,37.9)	0.0279
Consumes fortified wheat flour			
Yes	15.8 (10,21.6)	24.1 (18.2,30.1)	0.0884
No	2.0 (0,4.2)	4.9 (1.9,7.9)	
Don’t know	3.3 (0.4,6.1)	2.5 (0.3,4.6)	
Does not consume fortifiable wheat flour	78.9 (72.4,85.5)	68.5 (62.1,74.9)	
Consumes maize flour	96.7 (93.9,99.6)	97.0 (94.7,99.4)	0.8575
Consumes fortifiable maize flour	66.4 (58.9,74)	81.8 (76.4,87.1)	0.0009
Consumes fortified maize flour			
Yes	10.5 (5.6,15.4)	7.9 (4.2,11.6)	<.0001
No	25.0 (18.1,31.9)	51.7 (44.8,58.6)	
Don’t know	30.9 (23.5,38.3)	22.2 (16.4,27.9)	
Does not consume fortifiable maize flour	33.6 (26,41.1)	18.2 (12.9,23.6)	
Consumes salt	100.0 (100.0, 100.0)	99.5 (98.5, 100.0)	NA
Consumes fortifiable salt	100.0 (100.0, 100.0)	99.5 (98.5, 100.0)	NA
Consumes fortified salt			
Yes	96.7 (93.9,99.6)	97.0 (94.7,99.4)	
No	0.7 (0,1.9)	0.5 (0,1.5)	
Don’t know	2.6 (0.1,5.2)	2.0 (0,3.9)	
Does not consume fortifiable salt	0.0	0.5 (0,1.5)	
Consumes cooking fat	39.5 (31.7,47.3)	55.7 (48.8,62.5)	0.0025
Consumes fortifiable cooking fat	37.5 (29.8,45.2)	49.3 (42.4,56.2)	0.0273
Consumes fortified cooking fat	NA	NA	NA
Consumes bouillon cubes	59.9 (52,67.7)	74.9 (68.9,80.9)	0.0026

Consumes fortifiable bouillon cubes	59.9 (52,67.7)	74.9 (68.9,80.9)	0.0026
Consumes fortified bouillon cubes	NA	NA	NA

Abbreviations: CI, confidence interval; NA, not applicable

[1] All values are percent as indicated, and are weighted to correct for unequal probability of selection.

[2] "Consumes food" refers to households that report preparing this food at home. "Consumes fortifiable food" refers to households that reported consuming a food that was not made at home and is assumed to be industrially processed. "Consumes Fortified food" refers to households that consumed a food that was confirmed to be fortified by quantitative analyses (i.e. if the sample or brand provided met or exceeded the following nutrient content cut-off criteria: oil with ≥3.0 IU/kg vitamin A, wheat flour ≥35.0 mg/kg iron, maize flour ≥15.0 mg/kg iron, salt ≥7.6 mg/kg iodine. "Consumes fortified food" was determined as follows:

(A) In households where a food sample was collected and analyzed, if the sample met the fortified criteria (laboratory nutrient content cut-off) then the household was classified as consuming fortified food. If the sample did not meet the fortified criteria, then the household was classified as "not consuming fortified food".

(B) In households where a food sample was not taken and the brand name was available, the median nutrient value in the branded samples analyzed from other households was used. If the value met the fortified criteria then the household was classified as consuming fortified food. If the value did not meet the fortified criteria then the household was classified as "not consuming fortified food".

(C) In households where a food sample was not collected and the brand name was not available, the household was classified as "don't know" for consumes fortified food.

(D) Households that did not consume a fortifiable food were classified as "Does not consume fortifiable food".

[3] Lower dietary diversity refers to a dietary diversity score lower than the population median in each stratum (i.e. rural or urban residence). Higher dietary diversity refers to a dietary diversity score greater than or equal to the population median in each stratum (i.e. rural or urban residence). The population median is 4 in rural areas and 5 in urban areas. When more than one woman of reproductive age answered the dietary diversity information per household, the dietary diversity score of one woman was randomly selected and applied to the household.

[4] Comparing poor versus adequate. Chi-square test was used to compare percentages.

[5] All bouillon cubes are assumed to be fortifiable because they are industrially made outside of the household.

NA = Not Applicable

Results from Figure 4: Fortification quality of household food samples compared to national or international standards.

Food*	Sample size N	Unfortified n (%)	Inadequately fortified n (%)	Adequately fortified n (%)	Above standard n (%)
National					
Oil[1]	278	40 (14.4)	77 (27.7)	161 (57.9)	0
Wheat flour[2]	47	11 (23.4)	7 (14.9)	25 (53.2)	4 (8.5)
Maize flour[3]	238	168 (70.6)	61 (25.6)	8 (3.4)	1 (0.4)
Salt[4]	820	4 (0.5)	152 (18.5)	661 (80.6)	3 (0.4)
Salt[5]	820	4 (0.5)	19 (2.3)	552 (67.3)	245 (29.9)
Rural					
Oil[1]	107	16 (15.0)	25 (23.4)	66 (61.7)	0
Wheat flour[2]	7	0	1 (14.3)	5 (71.4)	1 (14.3)
Maize flour[3]	76	45 (59.2)	29 (38.2)	2 (2.6)	0
Salt[4]	429	2 (0.5)	91 (21.2)	335 (78.1)	1 (0.2)
Salt[5]	429	2 (0.5)	11 (2.6)	303 (70.6)	113 (26.3)
Urban					
Oil[1]	169	24 (14.2)	52 (30.8)	93 (55.0)	0
Wheat flour[2]	40	11 (27.5)	6 (15.0)	20 (50.0)	3 (7.5)
Maize flour[3]	162	123 (75.9)	32 (19.8)	6 (3.7)	1 (0.6)
Salt[4]	389	2 (0.5)	61 (15.7)	324 (83.3)	2 (0.5)
Salt[5]	389	2 (0.5)	8 (2.1)	248 (63.8)	131 (33.7)

[1] Fortification quality for oil was determined by analyzing the vitamin A levels in samples collected from households. "Unfortified" had <3.0 mg RE/kg vitamin A, "inadequately fortified" had 3.0 to <20.0 mg RE/kg vitamin A, "adequately fortified" had 20.0 to <40.0 mg RE/kg vitamin A and "above standard" had ≥40.0 mg RE/kg vitamin A. Red palm oil was not included in these analyses because it is not required to be fortified in Uganda and was considered not fortifiable.

[2] Fortification quality for wheat flour was determined by analyzing the iron levels in samples collected from households. "Unfortified" had <35.0 mg/kg iron, "inadequately fortified" had 35.0 to <50.0 mg/kg iron, "adequately fortified" had 50.0 to <80.0 mg/kg iron and "above standard" had ≥80.0 mg/kg iron.

[3] Fortification quality for maize flour was determined by analyzing the iron levels in samples collected from households. "Unfortified" had <15.0 mg/kg iron, "inadequately fortified" had 15.0 to <30.0 mg/kg iron, "adequately fortified" had 30.0 to <45.0 mg/kg iron and "above standard" had ≥45.0 mg/kg iron.

[4] Fortification quality for salt according to national standards was determined by analyzing the iodine levels in samples taken from households. "Unfortified" had <7.6 ppm iodine, "inadequately fortified (below standard)" had 7.6 to <30.0 ppm iodine, "adequately fortified (at standard)" had 30.0 to <80.0 ppm iodine, and "above standard" had ≥80.0 ppm iodine.

[5] Fortification quality for salt according to international (WHO) standards was determined by analyzing the iodine levels in samples taken from households. "Unfortified" had <7.6 ppm iodine, "inadequately fortified (below standard)" had 7.6 to <15 ppm iodine, "adequately fortified (at standard)" had 15 to <40 ppm iodine, and "above standard" had ≥40 ppm iodine.

**Some oil and salt samples were missing rural/urban labels and were only analyzed at the national level; aggregating the number of rural and urban samples that were missing labels will not add up to the total number of national samples analyzed.*

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