Report

Fortification Assessment Coverage Tool (FACT) Survey in Two South African Provinces: Gauteng and Eastern Cape, 2015

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Summary

In South Africa, national fortification of salt with iodine, and wheat bread flour (herein referred to as wheat flour) and maize meal with multiple micronutrients has been mandated by law since 1998 and 2003, respectively. Currently, there is a lack of current information available on how well these programs are performing, household coverage and intake of these fortified foods, and if vulnerable populations are being reached. The Fortification Assessment Coverage Tool (FACT) is a survey instrument that was developed by the Global Alliance for Improved Nutrition (GAIN) for carrying out coverage assessments of both population-based (staple food) and targeted (infant and young child) fortification programs. In 2015, GAIN, in collaboration with the United States Centers for Disease Control and Prevention (CDC) and the National Research Foundation / Department of Science and Technology (NRF/DST) Centre of Excellence in Food Security at the University of the Western Cape (UWC) conducted a FACT survey in two provinces: Gauteng and the Eastern Cape. The purpose of the survey was to assess the coverage and potential contribution of fortified foods to the micronutrient intake of the population.

A cross-sectional, two-stage, cluster household survey was conducted in Gauteng and in the Eastern Cape provinces from May-June 2015. The survey was designed to be representative at the province level. The study population consisted of households and women of reproductive age between 18-49 years. Based on sample size calculations and anticipated non-response, 920 households were to be invited to participate in Gauteng and 800 households in the Eastern Cape. 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;
- coverage and consumption of fortified wheat bread flour, maize meal, bread and salt ;
- coverage and consumption of oil and cake flour, which are not mandated to be fortified.

Food samples of wheat bread flour, maize meal, wheat bread, and salt were collected from participating households and analyzed quantitatively to determine fortification levels and adherence with national standards.

Three measures of coverage were assessed and expressed as the percentage of sampled households covered. The measures are: consumption of the food vehicle (i.e. households report preparing the food at home); consumption of the fortifiable food vehicle (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 vehicle (i.e. consumption of a food vehicle that is known to be fortified, confirmed by quantitative analyses of the household sample or, if no sample was available, analyses of samples from the reported brand used by the household). Two indicators of risk were used to assess the relationship between coverage and risk, which included poverty (defined by the multi-dimensional poverty index (MPI)) and lower women's dietary diversity (defined as less than the population median score 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 and maize meal an individual assessment of all women of reproductive age was used. This asked about frequency of consumption and portion size of wheat flour and maize meal 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 by taking into account this information in combination with a detailed household roster of all household members. For both methods, the corresponding daily nutrient intake was determined by multiplying the amount of fortifiable food consumed per day by a fortification level based on the quantitative laboratory analysis of food samples. The amount of nutrient consumed was then translated into a percentage of the daily recommended nutrient intake (RNI) for the women based on World Health Organization guidelines.

The survey response rates were 41% and 46%, in Gauteng and Eastern Cape, respectively, is likely biased towards poor and unemployed respondents. Wealthy gated communities would not grant access to the interviewers. For safety reasons the teams did not conduct interviews after dark and thus missed persons who worked outside the home. Thus, data are not representative of the two provinces as was originally planned are being treated as a convenience sample because of issues with high non-response.

Over 95% of households in the Gauteng and the Eastern Cape surveys reported consuming oil, maize meal, and salt. Cake flour was consumed by 43% of households in Gauteng and 72% of households in the Eastern Cape. Wheat flour was consumed by only 4% of households in Gauteng and 26% of households in the Eastern Cape. Approximately the same percentage of households reported consuming fortifiable foods. In Gauteng, the proportion of households that consumed a fortified food was 87% for wheat bread, 77% for maize meal, and 95% for salt. In the Eastern Cape, the proportions were: 52%, 87%, and 99%, respectively.

Using the individual assessment method, added iron from wheat flour was estimated to contribute 13% of the iron RNI among women of reproductive age in Gauteng and 8% in the Eastern Cape. The added iron in maize meal was estimated to contribute 12% of the iron RNI in Gauteng and 7% in the Eastern Cape. When households were separated by risk factors, women's iron RNI from wheat flour was lower among those from households with lower dietary diversity compared to those with higher dietary diversity in Gauteng. Women's iron RNI from maize meal was higher among those from households at risk of poverty compared to non-poor households in both Gauteng and the Eastern Cape. In Gauteng, from the household assessment using the AME method among women of reproductive age (among households that reported consuming the food),wheat bread and maize meal contributed 16% and 7%, respectively, to the iron RNI; salt contributed 68% to the iodine RNI. In the Eastern Cape, wheat bread and maize meal contributed 16% and 7%, respectively, to women's iron RNI; salt contributed 116% to the iodine RNI. In both provinces, women's nutrient RNI from all three foods was not different based on poverty status or dietary diversity.

The fortification quality compared to South Africa national standards varied greatly by food vehicle. Oil and cake flour are not mandatorily fortified therefore nutrient content was not analyzed. In Gauteng, among wheat bread samples, 4% were unfortified, 12% were inadequately fortified, 22% were adequately fortified and 62% were fortified above requirements. Among maize meal samples, 21% were unfortified, 62% were inadequately fortified, 11% were adequately fortified and 6% were fortified above requirements. Among salt samples, with regard to salt iodization, when the South African standards were used to measure adherence, 15% were unfortified; 18%, inadequately fortified; 52%, adequately fortified, and 16%, fortified above requirements, respectively. (When the UNICEF/WHO standards for salt were used, the percentages were: 15%, 4%, 20% and 61%, respectively). In the Eastern Cape, among wheat bread samples, 8% were unfortified, 33% were inadequately fortified, 24% were adequately fortified and 35% were fortified above requirements. Among maize meal samples, 12% were unfortified, 57% were under fortified, 17% were adequately

fortified and 13% were over fortified. Among salt samples, regard to salt iodization, when the South African standards were used to measure adherence, the percentages were: 12% were unfortified, 23% were under fortified, 48% were adequately fortified, and 16% were over fortified. (When the UNICEF/WHO standards for salt were used these percentages were the percentages were: 12%, 2%, 29% and 57%, respectively).

In conclusion, the potential for important contributions to nutrient intakes from consumption of fortified wheat bread, maize meal, and salt is high in both provinces; however, there are still improvements to be made to ensure the adequacy of fortification levels. Currently, in the Gauteng survey, 87% of the population is consuming fortified wheat bread; 77%, fortified maize meal and 80%, fortified salt. In the Eastern Cape survey, the percentages are 52%, 87%, and 84%, respectively. Moreover, although not currently fortified, cake flour is a promising vehicle for fortification with 43% and 72% of households in Gauteng and the Eastern Cape preparing foods at home containing cake flour. Fortification above requirements occurs in over half of wheat bread samples whereas fortification below requirements remains a concern for maize meal; further efforts are needed to improve quality and enforcement to better address under and over fortification to maximize impact.

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Abbreviations

CDC	United States Centers for Disease Control and Prevention
EA	Enumeration area
DOH	Department of Health
DST	Department of Science and Technology
GAIN	Global Alliance for Improved Nutrition
RNI	Recommended Nutrient Intake
RSA	Republic of South Africa
UWC	University of the Western Cape
WRA	Women of reproductive age

Background

Large scale fortification of widely distributed and consumed foods with micronutrients has the potential to improve the nutritional status of a large proportion of the population and neither requires changes in dietary patterns nor individual decision for compliance (WHO et al. 2009). South Africa implemented mandatory salt iodization in 1998 and a national fortification program of wheat bread flour and maize meal with multiple micronutrients in 2003 (Department of Health Government Gazette 2003; Department of Health Government Gazette 2008). Currently, the Department of Health has proposed revisions to the fortification program which would include mandatory fortification of cake flour and fortification with sodium iron ethylenediaminetetraacetic acid (NaFeEDTA) and B_{12} (Department of Health Government Gazette 2016). Currently in South Africa, wheat bread flour and maize meal is fortified with iron, zinc, folic acid, niacin, thiamin, riboflavin, pyridoxine, and vitamin A. Salt is fortified with iodine. Wheat flour is produced only by large commercial roller mills. Although maize meal is primarily produced by large commercial roller mills, there are also a large number of medium and small roller mills. In addition, hammer mills produce a small percentage of maize meal.

In 2015 the Global Alliance for Improved Nutrition (GAIN), with technical support from the United States Centers for Disease Control and Prevention (CDC) and the University of the Western Cape (UWC) conducted a sub-national fortification assessment survey in the provinces of Gauteng and the Eastern Cape in the Republic of South Africa (RSA). The survey assessed program coverage of fortified staple foods, as well as their contribution toward daily Recommended Nutrient Intakes (RNIs).

Gauteng and the Eastern Cape provinces represent two diverse provinces in South Africa. Gauteng is geographically the smallest province in the country with the highest population density (23.7% of the population) whilst the Eastern Cape is geographically the second largest province in the country with the 3rd largest population (12.7% of the population). The population in Gauteng is primarily urban while people in the Eastern Cape live in urban (large cities as well as smaller towns) or traditional (rural) environments. The languages most commonly spoken in Gauteng are Zulu (20%), English (12%), Afrikaans (12%), Sotho (10%) and Pedi (9%) while in Eastern Cape, the predominant languages are Xhosa (78%), Afrikaans (10%) and English (5%) (Statistics SA, 2012).

Project and Rationale

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 survey provides population-representative data on program coverage and performance in Gauteng and the Eastern Cape. The results are intended to further guide programming efforts and nutrition policy recommendations in RSA.

1. OBJECTIVES

General objective

The main objective of the project was to determine the coverage and potential contribution of fortified foods to the micronutrient intake among households and women of reproductive age (18 to 49 years), respectively, in Gauteng and the Eastern Cape provinces in RSA.

Specific objectives

The specific objectives of the project were:

- To assess the coverage and consumption of fortified salt, wheat bread flour, wheat bread, and maize meal among households.
- To measure levels of select nutrients in samples of salt (iodine), wheat bread flour (iron), wheat bread (iron) and maize meal (iron).
- To estimate the consumption of wheat bread flour, cake flour, wheat bread, oil, and maize meal among households and women of reproductive age (18 to 49 years).
- To estimate the contribution of fortified salt, wheat bread and maize meal to the intake of select nutrients in the diet of women of reproductive age (18 to 49 years).
- To evaluate indicators for other health and nutrition conditions to determine their association with the consumption of fortified foods. Such indicators include:
    - Women's dietary diversity
    - Multi-dimensional poverty index.

Methodology

Ethical considerations

Participants were provided with an information sheet detailing the nature and process of the study and written consent was obtained (Annex A). The information sheet provided the contact details of the survey coordinator who was available to answer enquiries from concerned residents.

Prior to data collection, ethics approval was obtained from the Senate Research Committee of the University of the Western Cape. After finalization of the questionnaires, the final set of questionnaires were submitted as an amendment to the Senate Research Committee. The assessment was done with strict adherence to ethics standards during data collection, storage and analysis. Community leaders and participants who requested to see survey results were asked for their contact details so that a report of the findings could be forwarded to them. Only one such a request was received.

A. Study design

A cross-sectional two-stage cluster household survey was conducted in Gauteng and the Eastern Cape provinces. The surveys were initially designed to be representative at the provincial level. At the first stage of sampling, census enumeration areas (EAs) served as the primary sampling units (PSUs) and were selected within each province. At the second sampling stage, systematic random sampling was used to select households within the sampled EAs. However, because of the high non-response rate, a convenience, rather than a representative, sample was achieved.

B. Study population

The study population consisted of households and women of reproductive age (WRA) between 18-49 years residing in Gauteng and the Eastern Cape Province. A person $\geq$ 18 years of age who was familiar with foods purchased for and prepared in the household was asked to complete the household questionnaire. All WRA 18-49 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 questionnaires were completed.

C. Sampling

The target sample size was 632 completed households in each province. The target number of completed households was based on the following assumptions: 95% confidence interval, 50% prevalence rate, precision of 0.06, and a design effect of 2, yielding a base sample of 632 completed households for each province. The number of households selected to be invited to participate in the survey was increased according to the response rate obtained in the previous Demographic Health Survey (DHS) (Department of Health, 2007) conducted in 2003 i.e. 83% in Eastern Cape and 72% in Gauteng. Therefore 20 randomly selected households were approached in each EA in the Eastern Cape (total sample size = 800) and 23 households in Gauteng (total sample size = 920). Sampling was done without replacement. In other words, if a sampled EA proved to be invalid with no households the EA was not replaced. Similarly if a selected/invited household refused to participate and/or did not complete the survey, additional replacement households were not selected.

As described above, a sample of 40 EAs was selected from each of the two provinces (Eastern Cape and Gauteng). The sample of 40 EAs was allocated to the design strata using proportional allocation based on the population within each stratum defined by the geographic area type representing Urban, Traditional, and Farms areas.

Box 1: Sample Allocation of EAs by Province and Geographic Area Type

Province Name	Primary Stratum	Stratum EA sample size
Eastern Cape	Urban	20
Eastern Cape	Traditional	18
Eastern Cape	Farms	2
Gauteng	Urban	38
Gauteng	Traditional	1
Gauteng	Farms	1
Total		**80**

D. Development of data collection tools

Questionnaires

GAIN and CDC initially revised questionnaires developed from previous GAIN FACT surveys for this survey, and then UWC further revised and adapted them to the South African context. Questionnaires were revised through an iterative process. Where possible, questions were aligned with those of other GAIN FACT surveys, the Demographic and Health Surveys, National Food Consumption surveys and Living Standards Measure (LSM) instruments to allow for comparability of results. Modifications were reviewed by GAIN and CDC prior to survey implementation. The final English copies of these

questionnaires [Household listing; Household questionnaire 1 (HH1); Household questionnaire 2 (HH2); and Women of reproductive age questionnaire (WRA)] are provided in Annex B.

Translation and pretesting

Data collection for the FACT survey was conducted using paper forms. Questionnaires were translated by nutritionists, dietitians, or academics who spoke the most commonly spoken languages in these provinces (Afrikaans, Zulu, Tswana) as their mother tongue. After translation, the questionnaires were back translated by another mother tongue speaker of the language except for Tswana where the back translation was incomplete.

Questionnaires were checked for face validity by each of the provisionally selected fieldworkers in order to identify possible challenges in terms of understanding the terminology and coding. Comments received were incorporated into the final edited version. Questionnaires were also tested for ease of understanding by people similar to the sample population in three sites: urban formal housing area in the Western Cape, rural Eastern Cape and an informal area in Limpopo. Interviews were conducted with five (5) conveniently selected participants in each area. These interviews were conducted by three different provisionally selected fieldworkers. The only changes made after pre-testing were editorial.

Questionnaire supporting tools

Women's questionnaire: 7 day food frequency questionnaire for wheat bread flour and maize meal foods photo grid

Wheat flour and maize meal are staple food vehicles that are often purchased by households from markets in the form of already prepared products (e.g. bread is purchased from bakeries). In order to assess consumption of these staple foods, the FACT survey instrument includes an individual assessment of consumption of wheat flour and maize meal containing foods over a seven day recall period among WRA. A comprehensive list of all food items made with fortifiable wheat flour and maize meal and their recipes was developed. Only foods made from wheat flour that is mandated to be fortified were included, i.e. bread wheat flour and not cake wheat flour. Except for instant/quick cooking maize meal, all other types of maize were included as all are required to be fortified. Based on a protocol developed by GAIN, portion size photo grids were developed for foods made with wheat flour that are consumed in South Africa.

Fieldworkers assisted in the development of the food grids and measurement guides through individual interviews and focus group discussions. Standard recipes were determined for each of the foods included in the food picture grid. Portions of the foods made with wheat flour or maize meal were re-created from the largest portion (e.g. one large 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 of each food was weighed and recorded in grams after the photo was taken for each food. Examples of the photo grids are found in Annex C.

Household questionnaire: Food measurement guide

The food measurement guide was developed to help the respondent to estimate how much oil, wheat flour, maize meal, and salt they last bought for each of these commodities. The guide included photos of the common sizes for each food item and the corresponding amount in grams or milliliters. Some commodities were purchased and the amount was specified on the packet or bottle.

Study management and training

Recruitment and selection of field staff

Fieldworkers with a Nutrition / Dietetics qualification were recruited through advertisements in newsletters of the Association for Dietetics in South Africa (ADSA), the Nutrition Society of South Africa (NSSA), universities as well as by word of mouth. Based on curriculum vitaes submitted, 40 fieldworkers were provisionally selected out of the pool of 64 applicants and requested to attend the training session. Two registered dietitians were provisionally selected per team. Due to various reasons ranging from alternative employment opportunities to cancellation of special leave, only 32 of the provisionally selected fieldworkers arrived for training.

Team structure

Each team was composed of eight team members: one team leader, six FACT interviewers and one registered dietitian trained to perform 24 hour recall interviews and administer the infant feeding questionnaire (These dietary assessments were done as a secondary objective for this project but results are not reported in this document.. During training each team developed a plan for visiting EAs and households to maximize efficiency. Where it was possible, team leaders contacted authorities in the selected EA to inform them of the survey. Specific dedicated tasks responsibilities were assigned to team members. Team leaders were identified by the two PIs who conducted the training. Within each team the members also agreed to share some of the responsibilities and team leaders thus dedicated tasks to specific team members such as managing the finances, preparing materials for the team for the next day, mapping of dwelling units, double checking food samples and questionnaires returned after fieldwork, driving, etc.

The team leader answered any questions that the interviewers had on the questionnaire during the data collection and checked all the questionnaires for completeness before leaving the EA. Where necessary the team leader consulted telephonically with the UWC PI who served as the survey coordinator. The team leader collected all questionnaires and food samples when leaving an EA and in the evening checked for any other inconsistencies (e.g. recording errors, skips, etc.). Questionnaires were sent via courier to the survey coordinator who double checked that all questionnaires and food samples were received as per the accompanying household control sheet. The survey coordinator also coded the brand and producer names of oil, maize, wheat flour, bread and salt according to the code list before submitting the questionnaires for data capturing.

Training of interviewers and pilot testing

UWC, GAIN and CDC jointly prepared a training agenda and manual that was used by the field teams in training and the data collection itself. Training was planned to start on 27 April 2015, but due to a delay in finalization of questionnaires and training manuals, training took place from 11-16 May 2015. Training was conducted centrally (Pretoria) for fieldworkers of Gauteng and Eastern Cape teams. The training was conducted jointly by GAIN and UWC. Inadequate performance of fieldworkers during the first pilot practical exercise in the field resulted in the training being extended two days. Another full pilot was conducted where after fieldwork commenced on the 20 May 2015 for the two Gauteng teams and on 21 May 2015 for the two Eastern Cape teams.

Data collection

Field procedures

Fieldwork was completed in Gauteng from 20 May 2015 to 18 June 2015 (4½ weeks) and in Eastern Cape from 21 May 2015 to 26 June 2015 (5½ weeks). Field work was conducted six days a week (Monday through Saturday).

Team members were each given a letter from the implementing agency stating the team's scope of work. Immediately prior to starting the field work, the team leader or a team member visited an EA to determine which relevant authorities should be informed / contacted to obtain permission.

As a safety precaution, fieldworkers moved around and performed interviews in pairs. In both provinces the mapping took at least half a day, with a full day required for interviews. In Gauteng teams took on average 1½ days to complete interviews in each EA. Due to the distances required to travel between selected EAs, the teams in the Eastern Cape completed one EA in two days. The safety situation in the country combined with the winter season precluded fieldworkers from performing interviews after dark (around 17:00). Residents, especially WRA, were often not present during the day as they were often at work and arrived home only around 19:00.

In traditional areas in the Eastern Cape obtaining permission from traditional leaders was a difficult process. In some cases, traditional leaders gave immediate permission, but in other cases the traditional leaders indicated that they first needed to arrange for an imbizo (community meeting) to discuss this with community members. Where possible, this was facilitated by the changing around of visit dates to EAs, but for some EAs the time period required for the imbizo (a minimum of two weeks) made it impossible to do fieldwork in a selected EA. Another difficulty that arose was that the vehicles rented for this project were too low for the terrain in parts of the Eastern Cape where roads are much neglected. This resulted in fieldworkers spending significant time walking long distances to locate households.

In urban settings there were no challenges accessing the areas, but participation by households was a challenge. Specifically, in higher socio-economic settings, houses were often located in security complexes. In EAs where households were located within security complexes with access control, the survey coordinator provided a letter soliciting participation from inhabitants which were either placed (with the information sheet) in the post-box of each selected household or given to the residents' association. In most cases the survey coordinator also phoned the chairperson of the residents' association to request permission to enter the security complex.

After having obtained written consent, the interviewers administered the questionnaire to the participant(s) in the selected household. He/she read the instructions to the participant(s) and then read each question along with all possible responses, where appropriate. Each fieldworker was provided with a pack of questionnaires translated in the most commonly spoken languages in these two provinces. Fieldworkers could speak at least two or three of the most commonly spoken languages in their survey provinces. Where the fieldworker could not speak the language of the participant, fieldworkers made arrangements for another fieldworker fluent in the spoken language to perform the interview or to act as interpreter in the case of 24hr recalls. The fieldworker used the translated questionnaire to read the instructions to the participants. Responses were recorded on the English questionnaire.

Where an interview was interrupted or terminated prematurely, interviewers arranged to make one call back to complete the questionnaire. Where a respondent was not available at the time the interviewer visited, one call back was made at a different time and on a separate day. Any household that could not be reached after the second day in the EA was classified as missing or incomplete and was not replaced.

Food sample collection

Participants were asked to provide a sample of oil (25 ml), maize flour (4 tablespoons), wheat bread flour (4 tablespoons), bread (two slices) and salt (2 tablespoons), if available. In cases where insufficient food was available in the household participants were asked for at least half of the amounts required or no food sample was taken. The oil sample was collected in a plastic tube, while other food samples were placed in small zip-lock plastic bags. Each sample was marked with a label indicating the food sample as well as the unique household identifier number. Each tube/small plastic bag was placed in a larger zip-lock plastic bag and sealed. A 5 g desiccant was placed in the small bag with each bread sample. At regular intervals the fieldworkers handed the completed questionnaires as well as the food samples to the team leader. Food samples were then placed in an insulated cooler bag. Food samples collected in an EA were either kept in the cooler bag or transferred to a cardboard box and stored in a cool place. Food samples were packed by type and EA number and shipped to the BioAnalyt laboratory for analysis in Germany in mid July 2015. Salt samples were analyzed for iodine content; wheat bread, wheat bread flour and maize meal were analyzed for iron content (Annex D),

Supervision/oversight

UWC and GAIN composed the team of supervisors. CDC provided technical assistance. The UWC survey coordinator provided overall survey supervision. Suggestions made to a team by a supervisor were also given to each of the other teams via the survey coordinator to ensure consistency. The purpose of the visits was to rule out remaining flaws in the procedures and approaches taken. One example of change was to accept containers displaying the term “iodized” as the logo present for salt. The decision to invite all eligible women to a 24hr recall interview and infant feeding questionnaire (if relevant) was also taken as a result of the supervision visits indicating that very few women were available for interview. Subsequently, the survey coordinator spent at least one day every two weeks with each fieldwork team as a continued quality assurance measure. Team leaders reported telephonically to the survey coordinator on a daily basis and they provided weekly written updates (using the cluster control form) on progress and challenges in each EA.

After data collection, each questionnaire was checked by the team leader for correctness. If missing information or discrepancies were identified the fieldworker (identifiable by fieldworker code) was asked to clarify and provide additional information. The team leader completed the household control form before the complete set of questionnaires for each EA as well as the respective food samples were packaged for delivery to the survey coordinator by courier service.

The survey coordinator double checked that all food samples were received. Missing food samples were recorded but could not be taken again as the team has moved on to another EA by that time. The survey coordinator then checked the questionnaires for face value errors and coded the brand and manufacturer for oil, maize meal, bread flour, bread and salt if it was recorded on the questionnaire.

Development of other data collection tools

A series of supporting instruments were developed to facilitate field work and ensure high quality of the field work:

- Training manual: This guide details the steps in data collection (approaching a PSU, conducting the mini-census, administering the interview, and activities prior to leaving a PSU);
- Cluster control form: The team supervisor kept an updated version of this tool that lists those households selected for data collection and the results of recruitment at each of these households;
- Household control form: The team leader completed this form as an inventory and quick check tool to ensure all questionnaires and samples were forwarded to the survey coordinator. This form also served as a valuable resource during data cleaning.

2. DATA ENTRY AND MANAGEMENT

Data entry and data cleaning

Data were electronically captured by the South African Medical Research Council (MRC) using EpiData. Within EpiData each questionnaire was captured separately and then one data set was created by merging the Household 1 and Household 2 data on the computer printed ID variable. Data sets were saved in STATA version 12. The data of each female was merged with the respective Household 1 and Household 2 questionnaire to create a combined female data set for women who consented and those who did not consent.

The original protocol provided for double data entry by dedicated but not specialized data entry clerks. Subsequently, the data capturing was performed by the professional capturer of the MRC under supervision of a statistician. Double data entry was not performed as per the MRC policy based on years of experience and sporadic cross checking which indicated that the error rate by the data capturer is close to zero.

The merged household data set was checked for incorrect values by a statistician of the MRC and the survey coordinator. Where errors or inconsistencies were identified, the original questionnaire was found and the information checked and corrected, where possible.

Data storage

All hard copies of data collected from the survey are stored in a locked cabinet in the office of the survey coordinator. The electronic captured data are stored on the desktop computer of the survey coordinator and a copy was shared with GAIN/CDC. Respondents' names were not captured to ensure data confidentiality. The timeline for the field activities carried out in South Africa (items A-F) can be found in Annex E.

Data analyses

Data analyses were completed using SAS (SAS Institute, Cary, USA) statistical analysis software and R (The R Foundation for Statistical Computing, Vienna, Austria). Statistical significance was set at $p < 0.05$. Descriptive statistics were applied to assess the structure of the variables and indicators within each province are presented as mean (95% Confidence Interval (CI)), median (25^{th} percentile, 75^{th} percentile) or percentage (95% CI). For stratified analyses, the statistical significance of associations between categorical variables and coverage of fortified foods was assessed using chi-square or test of independent proportions, as appropriate. The Wilcoxon rank sum test was used to compare median differences across categories. Because of the high non-response, the data were not weighted and non-complex design statistical methods were used.

3. DEFINITION AND CALCULATION OF KEY VARIABLES

Key outcome variables were fortification coverage followed by nutrient intakes from fortified food (Annex F). Nutrient intakes were estimated for WRA using two different methods: a photo grid method was applied to flour-containing foods for interviewed WRA (only) in the household and the adult male equivalent method (AME) was applied to foods purchased in the household for all WRA in the household. Additionally, two stratifying variables were constructed: poverty risk and women's dietary diversity score.

A. Fortification coverage

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

- **Consumes food**: Households report preparing the food (except wheat bread) at home, regardless of whether or not it is fortified. In the case of wheat bread, households report eating the food at home (whether or not it was prepared at home). (All "don't know" or missing responses were recoded to "no");
- **Consumes fortifiable food:** consumption of a food vehicle that was not made at home and is assumed to be industrially processed. All wheat bread was considered fortifiable even if it was made at home (as the wheat flour used to bake the bread would have been fortifiable). (All "don't know" or missing responses were recoded to "no");
- **Consumes fortified food:** consumption of a fortifiable food vehicle that is known to be fortified as confirmed by quantitative testing of nutrient levels in 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 nutrient levels were analyzed in the laboratory, if the sample was above the intrinsic level for iron (Department of Health, 2003; i.e. in wheat flour > 18 mg/kg iron, wheat bread >15.25 mg/kg, super and coarse/Braaipap maize meal >6.5 mg/kg, and sifted maize meal >14.2 mg/kg) or the lowest level of detection for iodine (i.e. salt > 10 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. All instant/quick cooking maize meal were classified as not fortified.
    - 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 both provinces 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.

B. Daily flour consumption (Photo-Grid Method) and micronutrient contribution to Recommended Nutrient Intake (RNI)

WRA were asked to report whether they consumed any of 15 wheat flour or maize meal-containing foods in the last seven days (see female questionnaire in Annex B). For foods 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 wheat flour and maize meal in the portion sizes was estimated from recipes. To estimate the daily micronutrient contribution (% RNI) of added iron (ppm) in commercial wheat bread the grand median nutrient value (added iron) in all commercial wheat bread samples analyzed in both provinces was multiplied by women's daily consumption of wheat bread. To estimate the daily micronutrient contribution (% RNI) of added iron (ppm) in other wheat flour products (i.e. non-commercial bread), the grand median nutrient value (added iron) in all wheat flour samples analyzed in both provinces was multiplied by women's daily consumption. (Because only four samples of flour were collected from Gauteng and 39 samples were collected from the Eastern Cape, the median nutrient value of both provinces were combined.) To estimate daily micronutrient contribution (% RNI) of added iron (ppm) in maize meal products, the province-specific median nutrient value (added iron) was multiplied by women's daily consumption of maize meal. In this way, iron intake in milligrams per day was estimated for wheat bread/wheat flour and maize meal. The grams of fortified food (wheat bread, wheat flour or maize meal) in each portion size were multiplied by the frequency consumed to estimate the amount consumed per week, and then divided by 7 to calculate intake/day. A cumulative total intake in grams per day was obtained by summing all food items containing wheat bread/wheat flour or maize meal. For any of the 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.

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 (WHO/FAO 2004): 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).

C. Daily apparent food consumption (using the AME method) and micronutrient contribution to RNI

The daily apparent food consumption (using the AME approach) was used to calculate the RNI from fortified foods among women from households that consumed the food vehicles (i.e. salt, wheat flour, wheat bread, and maize meal) based on amounts consumed in the household. 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. Household food were converted into metric units and duration into days as needed, and then were used to derive the apparent daily consumption (i.e. grams/day). With the exception of bread which was accessed in loaves (1 loaf=700 grams) all other food items were measured in metric units. The AME food amount apparently consumed/day for WRA was estimated as the product of the amount of household food apparently consumed/day and household AME fraction for WRA (i.e. household consumption g/day x WRA individual AME).

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).

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:

- 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).
- 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.
- 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 iodine RNI for women employed was 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 WRA questionnaire. Thus, all non-surveyed women (who were listed on the household roster) were assumed to be non-pregnant and non-lactating.

D. 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)".

E. Women's dietary diversity score (DDS)

The dietary diversity instruments 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 (see questionnaire in Annex C.3) These responses were distilled into a 10 point scoring system based on the following 10 food groups: group 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 8,9,11]), 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]). 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)" and otherwise, it was termed "higher dietary diversity (at or above the median)". The median was 5 for Gauteng and was 4 for the Eastern Cape.

To obtain the proportion of women that consumed plant sources of vitamin A she 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 5 or 6; for iron rich or / zinc rich foods groups 5

Limitations

Although the maize and wheat flour fortification program in South Africa includes fortificants other than iron (vitamin A, folic acid, etc.), iron alone was assessed and served as a "marker" to reflect fortification of other micronutrients including vitamin A which may have stability issues.

Laboratory testing was conducted on all food samples collected in the households, but the small number of samples collected for many brands, limits the reliability of brand specific information especially because previous reports have found variation or inconsistent addition of the fortification premix (Yusufali 2012, van Jaarsveld 2015). The definition of 'fortified' food for a household was based on imputation of brand median nutrient when food samples were not taken/provided but respondents reported the brand they consumed. This is subject to recall bias as more popular brands are more likely dominate responses.

Households that report preparing the food at home were considered to "consume" the food. Because neither regularly nor sometimes was defined in the questionnaire, it cannot be determined to what extent or how consistently households were consuming the food. Households that reported consuming foods were asked whether or not the food was made at home. Foods not made at home were assumed to be industrially processed and defined as fortifiable. In South Africa this may largely be the case for oil and wheat flour, but it is less true for maize meal which can be produced by small scale producers that may not fall under the mandatory fortification legislation depending on the scale of their production.

Because white and brown wheat flour could not be distinguished, fortification standards were averaged across white and brown wheat flour to arrive at cut points (not fortified; under fortified, adequately fortified and fortified above requirements, see Annex F). White and brown wheat bread also could not be distinguished and fortification standards were averaged across white and brown wheat bread. Because fortification levels are higher for brown wheat flour/bread than for white flour/bread, it is possible that the number of samples that are fortified may have been either under/over-estimated (to the extent that more or less white flour/bread was consumed and samples taken). In regard to maize meal, questions were asked about consumption of sifted maize meal but not about special maize meal. By using the sifted category only (as has been done in the current analyses), it is possible that the number of samples that are fortified may have been underestimated if some of these samples were special maize meal because the fortified cutoff for sifted maize meal is higher than that for special maize meal. However, it should be noted that no respondent reported consuming maize meal from an "other" category thus consumption of special maize meal might have been unusual or the interviewers may have recoded.

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 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 2012). The photo grid methodology uses a short food frequency questionnaire and is subject to the limitations of that method such as ascertainment of absolute intake (Thompson 2015). It should be noted that neither the FACT survey tool nor the AME methods has not been compared with other methods of dietary intake. The photo grids and recipes used to estimate the intake of flour-based foods were not validated.

Using the grand median added iron levels from household food 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 and maize meal types used in wheat flour and maize meal products purchased and consumed away from the home. Moreover, due to the small number of wheat samples collected and analyzed 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.

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. One woman's dietary diversity may not reflect the pattern of multiple family members.

The response rate was low (41 to 46%) and is likely biased towards poor and unemployed respondents. Wealthy gated communities would not grant access to the interviewers. For safety reasons the teams did not conduct interviews after dark and thus missed persons who worked outside the home. The data are specific to Gauteng and the Eastern Cape and thus not provincially representative.

Results

In Gauteng, the response rate for household survey 1 was 40.8% (**Table 1**). Response rates for household survey 2 were similar to those for Survey 1. Because of the household nonresponse, we did not know how many women of reproductive age were eligible and thus could not calculate response rates for the female questionnaire (women of reproductive age). Interviewers were not able to complete any interviews in 8 of the 40 EAs. Reasons given were: access refused (security complex [2 EA], gold estate [1 EA] and small holdings company [1 EA]); industrial area with no residents [1 EA]; all residents working during the day [2 EA]; and residents removed for housing construction [1 EA]). Among the 361 non-responding households for Gauteng, reasons for non-response included: refused (N=148; 41.0%), no one at home (n=191, 52.9%), other-not specified by interviewer (n= 9, 2.5%) and dwelling vacant or household member intoxicated/incapacitated (n=13, 3.6%). In the Eastern Cape, the response rate for household survey 1 was 45.6% (**Table 1**). Response rates for household survey 2 were similar to those for Survey 1. Response rates for the female questionnaire (women of reproductive age) survey were not available. Interviewers were not able to complete any interviews in 5 of the 40 EA's. Reasons given were: access refused (hospital community [1 EA] and housing community board [2 EA]), farm community with difficult access (1 EA), and aggressive community (1 EA). Among the 325 nonresponding households, reasons for non-response included: refused (n=86; 26.5%), no one at home (n=175; 53.8%), other- not specified by interviewer (n=26, 8.0%) and dwelling vacant or household member intoxicated/incapacitated (n=38; 11.7%).

Table 1. Response rate for different components of the survey, Gauteng and the Eastern Cape, South Africa, 2015.

Component	Sample size					
	GAUTENG			EASTERN CAPE		
	Planned[1]	Interviewed	Response rate (%)	Planned[1]	Interviewed	Response rate (%)
Household survey 1[2]	920	375	40.8	800	365	45.6
Household survey 2[3]	920	372	40.4	800	361	45.2

[1] These are the number that were planned to be visited, based on sample size calculations.
[2] This survey asked about the household roster; birth history of women in household; household characteristics; water, sanitation and hygiene; and health services access.
[3] This survey asked about consumption of fortifiable foods. Response information for the female survey was not available.

The median household size was three in Gauteng and four in the Eastern Cape (**Table 2**). The dependency rate was 0.6 in Gauteng and 0.8 in the Eastern Cape. (The dependency rate was defined as follows: numeric sum of household members below 15 years and those above 64 years of age divided by the numeric sum of all household members between 15 and 64 years of age). Female-headed households were common in both provinces: 52.3% in Gauteng and 54.8% in the Eastern Cape. The mean age of the household head was 46.4 years in Gauteng and 54.6 years in the Eastern Cape.

Table 2. Summary of household characteristics, Gauteng and the Eastern Cape, South Africa, 2015.[1]

Characteristic	GAUTENG		EASTERN CAPE	
	n	Median (25%, 75%), % (95% CI) or mean (95% CI)	n	Median (25%, 75%), % (95% CI) or mean (95% CI)
Household size[2]	372	3 (2, 5)	361	4 (3, 6)
Household dependency ratio[2,3]	372	0.6 (0.3, 1.0)	361	0.8 (0.5, 1.0)
Female-headed household[4]	372	52.3 (47.2, 57.4)	361	54.8 (49.7, 60.0)
Age of head of household[5]	372	46.4 (44.9, 47.9)	361	54.6 (53.0, 56.3)

Abbreviation: CI, confidence interval
[1] All values are median, percent or mean as indicated.
[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).

Women who participated in the female questionnaire were, on average, 32.7 years in Gauteng and 30.0 years in the Eastern Cape (**Table 3**). Nearly 8% in Gauteng were pregnant compared with 6.5% in the Eastern Cape. The percentage lactating was 9.9% in Gauteng and 9.0% in the Eastern Cape.

Table 3. Summary characteristics of women of reproductive age who participated in the female questionnaire, Gauteng and the Eastern Cape, South Africa, 2015[1]

Characteristic	GAUTENG		EASTERN CAPE	
	n	Mean (95% CI), or % (95% CI)	n	Mean (95% CI), or % (95% CI)
Age in years[2]	243	32.7 (31.6, 33.9)	245	30.0 (28.8, 31.1)
Pregnant[3]	243	7.8 (4.4, 11.2)	245	6.5 (3.4, 9.6)
Lactating[3]	243	9.9 (6.1, 13.7)	245	9.0 (5.4, 12.6)

Abbreviation: CI, confidence interval
[1] All values are mean or percent as indicated.
[2] Mean (95% CI).
[3] Percent (95% CI).

An estimated 19.6% of Gauteng households and 33.8% of Eastern Cape households were classified at risk of acute poverty based on the MPI (**Table 4**). MPI is constructed from three domains: living standards, household education, and health and nutrition. One of the variables that composes living standards is lack of electricity; 13.4% and 11.6% of Gauteng and the Eastern Cape households, respectively. Flooring made of earth, dung or sand was found in 4.6% of households in Gauteng compared to 13.3% of households in the Eastern Cape. Unsafe drinking water was found in 0.5% of households in Gauteng compared to 17.5% of households in the Eastern Cape. One of the variables that composes the education component is head of household with less than five years of education: 11.9% in Gauteng and 29.6% in the Eastern Cape. Any household member 5-14 years not currently attending school is another component of the education domain: 1.6% of Gauteng and 1.9% in the Eastern Cape households had at least one household member of school-attending age who was not in school. The health and nutrition domain has a component related to whether a child less than five years of age died in the past five years. 0.5% and 3.0% of Gauteng and the Eastern Cape households, respectively, reported that a pre-school age child died in the past five years. Another component is poor access to health services: 5.1% and 28.3% of households in Gauteng and the Eastern Cape had poor access to health service.

Table 4. Multidimensional Poverty Index (MPI) and the variables that compose it, Gauteng and the Eastern Cape, South Africa, 2015[1]

Multidimensional Poverty Index and components	GAUTENG		EASTERN CAPE	
	N	% (95% CI)	N	% (95% CI)
At risk of acute poverty (MPI ≥0.33)[2]	372	19.6 (15.6, 23.7)	361	33.8 (28.9, 38.7)
Living standards component				
No electricity	372	13.4 (10.0, 16.9)	361	11.6 (8.3, 15.0)
Inadequate cooking fuel[3]	372	14.6 (11.0, 18.2)	361	8.0 (5.2, 10.9)
Flooring made of earth, dung or sand[4]	372	4.6 (2.4, 6.7)	361	13.3 (9.8,16.8)
Probably unsafe drinking water source[5]	372	0.5 (0.0, 1.3)	361	17.5 (13.5, 21.4)
Poor toilet sanitation[6]	372	12.1 (8.8, 15.4)	361	12.5 (9.0, 15.9)
< 2 household assets[7]	372	0.8 (0.0, 1.7)	361	0.0 (---, ---)
Education component				
Head of household with less than five years of education, % (95% CI)	372	11.9 (8.6, 15.2)	361	29.6 (24.9, 34.4)
Any household member 5-14 years NOT currently attending school	372	1.6 (0.3, 2.9)	361	1.9 (0.5, 3.4)
Health and nutrition component				
Moderate to severe household hunger	372	2.4 (0.9, 4.0)	361	2.2 (0.7, 3.7)
Child ≤ 5 years who died in past 5 years	372	0.5 (0.0, 1.3	361	3.0 (1.3, 4.8)
Poor access to health services[8]	372	5.1 (2.9,7.4)	361	28.3 (23.6, 32.9)

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

[1] All values are percent as indicated.

[2] MPI greater than or equal to 0.33 is a proxy for poverty risk.

[3] Inadequate cooking fuel sources include any sources not from electricity or liquefied petroleum gas,

[4] Flooring made of earth, dung or sand

[5] Any water source that is not piped water into yard/plot, public tap, neighbors tap

[6] Toilet sanitation is considered inadequate if the household does not use a flush toilet piped into a sewer system or to a septic tank

[7] From a list of household assets (radio, television, dvd, satellite tv, air conditioner, computer, vacuum cleaner, dishwasher, dryer, landline phone, freezer, refrigerator, electric stove, gas stove, microwave, kitchen sink, home security, home theatre, bicycle or tricycle, motor vehicle, motor boat, canoe or fishing net, animal cart, domestic worker, hot water heater, mobile phone, live in a house. Only households with less than 2 got an MPI asset score that counted towards the overall acute poverty risk score variable derivation. [8] Travel duration from a household to the nearest health post was more than 60 minutes.

Median dietary diversity score for women of reproductive age was five in Gauteng and four in the Eastern Cape (**Table 5**). Correspondingly, 62.1% and 66.1% of Gauteng and the Eastern Cape women, respectively, were classified as having a higher dietary diversity score. Nearly 100% of women in both provinces consumed vitamin-A rich sources of animal origin. In Gauteng about 90% of women consumed iron- and zinc-rich foods. In the Eastern Cape, about 75% of women consumed iron- and zinc-rich foods.

Table 5. Dietary diversity score and its components for women of reproductive age, Gauteng and the Eastern Cape, South Africa, 2015[1]

Dietary diversity score and components	GAUTENG		EASTERN CAPE	
	n	Median (25%, 75%), % (95% CI)	n	Median (25%, 75%), % (95% CI)
Dietary diversity score[2]	243	5 (4, 7)	245	4 (3, 6)
Higher dietary diversity score[3,4]	243	62.1 (56.0, 68.3)	245	66.1 (60.2, 72.1)
Consumed plant sources of vitamin A[3,5]	243	72.8 (67.2, 78.5)	245	64.9 (58.9, 70.9)
Consumed animal sources of vitamin A[3,5]	243	100.0 (100.0, 100.0)	245	97.6 (95.6, 99.5)
Consumed iron or zinc rich foods[3,5]	243	90.5 (86.8, 94.2)	245	75.5 (70.1, 80.9)

Abbreviation: CI, confidence interval
[1] All values are median or percent as indicated.
[2] Median (25%, 75%).
[3] Percent (95% CI).
[4] Dietary diversity score greater than or equal to the population median is a proxy for higher dietary diversity.
[5] Women consumed at least one food item from this food group. Plant sources of vitamin A consumed in the last 24 hours a food from either food groups 7 or 8; for animal sources of vitamin A groups 5 or 6; for iron rich or / zinc rich foods groups 5 (see Annex F).

When stratified by household poverty risk (from the MPI), the proportion of women with higher dietary diversity score was lower among the poor (47.5%) than non-poor (65.0%) households in Gauteng (**Table 6**). A lower percentage of poor households in Gauteng consumed iron rich and zinc rich foods compared with non-poor households (80.0% vs 92.6%, respectively). There were no statistically significant differences between poor and non-poor households in the Eastern Cape.

Table 6. Dietary diversity score and its components for women of reproductive age by poverty risk, Gauteng and the Eastern Cape, South Africa, 2015[1]

Dietary diversity score and components	Poor (% (95% CI))[2]	Non-poor (% (95% CI))[2]	p-value[3]
GAUTENG	**N= 40**	**N=203**	
Higher dietary diversity score[4]	47.5 (31.9, 63.1)	65.0 (58.4, 71.6)	0.037
Consumed plant sources of vitamin A[5]	62.5 (47.4, 77.6)	74.9 (68.9, 80.9)	0.108
Consumed animal sources of vitamin A[5]	100.0 (100.0, 100.0)	100.0 (100.0, 100.0)	N/A[6]
Consumed iron orzinc rich foods[5]	80.0 (67.5, 92.5)	92.6 (89.0, 96.2)	0.0128
EASTERN CAPE	**N=176**	**N=69**	
Higher dietary diversity score[4]	62.3 (50.8, 73.8)	67.6 (60.7, 74.6)	0.431
Consumed plant sources of vitamin A[5]	64.2 (57.1, 71.3)	66.7 (55.5, 77.9)	0.717
Consumed animal sources of vitamin A[5]	98.6 (95.7, 100.0)	97.2 (94.7, 99.6)	0.526
Consumed iron or zinc rich foods[5]	75.4 (65.1-85.6)	75.6 (69.2-82)	0.973

Abbreviation: CI, confidence interval
[1] All values are percent as indicated.
[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. Complex survey chi-square test was used to compare percentages.
[4] Dietary diversity score greater than or equal to the population median. The population median is 5 for Gauteng and 4 for the Eastern Cape.
[5] Women consumed at least one food item from this food group. Plant sources of vitamin A consumed in the last 24 hours a food from either food groups 7 or 8; for animal sources of vitamin A groups, 5 or 6; for iron rich foods and for zinc rich foods group 5 (see Annex F).
[6] Chi square could not be calculated due to small cell size.

The household food samples collected are summarized in **Table 7;** except for salt which was analyzed for iodine, all other types of samples were analyzed for iron. The number of maize meals samples was about the same in Gauteng (n=266) and the Eastern Cape (n=259). Few wheat flour samples were analyzed: 4 in Gauteng and 39 in the Eastern Cape. With regard to wheat bread samples, 134 were analyzed in Gauteng and 75 in the Eastern Cape. Salt was the food with the most samples analyzed: 272 in Gauteng and 273 in the Eastern Cape.

Table 7. Summary of food samples collected and analyzed, Gauteng and the Eastern Cape, South Africa, 2015.

Food samples	Provinces Combined	GAUTENG (n)	EASTERN CAPE (n)
Maize meal	525	266	259
Wheat flour	43	4	39
Wheat bread	209	134	75
Salt	545	272	273

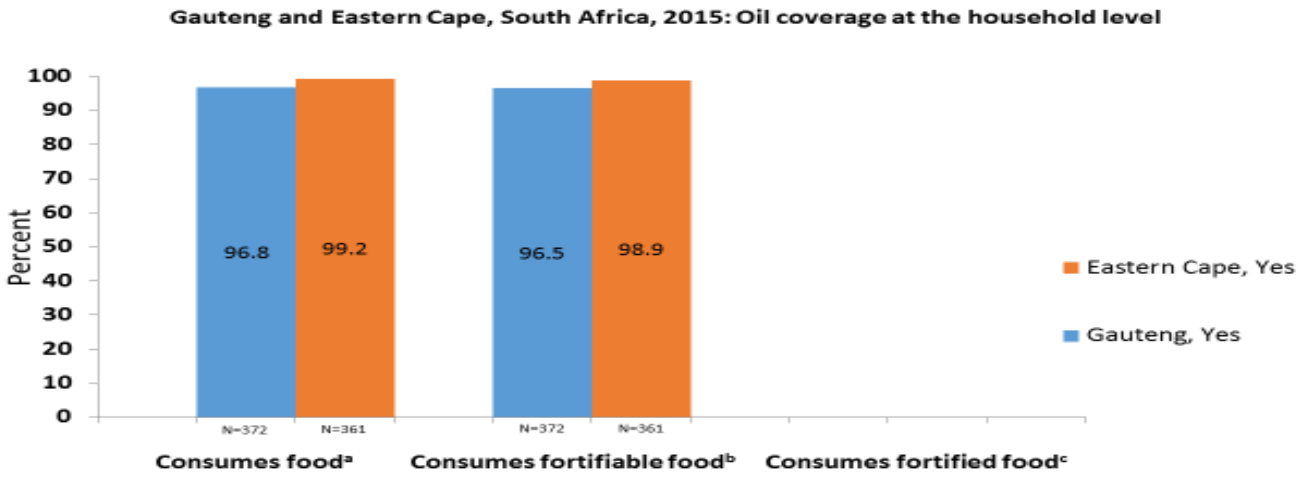
The household coverage of foods is noted in **Figure 1** and **Annex G**. For oil, 96.8% of Gauteng and 99.2% of Eastern Cape households reported consuming oil (**Figure 1A**). A similar percentage consumed fortifiable oil (i.e. oil that was not made at home and is assumed to be industrially processed). An estimated 96.5% of Gauteng households and 98.9% of Eastern Cape households consumed fortifiable oil.

For wheat bread, 95.4% of Gauteng households consumed wheat bread and fortifiable wheat bread, while 87.4% consumed fortified wheat bread (laboratory analysis confirmed iron concentrations above the intrinsic level) (**Figure 1B**). In the Eastern Cape, 86.7% of households consumed wheat bread and fortifiable wheat bread, while 51.8% consumed fortified wheat bread. Although wheat bread was commonly consumed, it was usually not made at home. Wheat flour was not commonly used to prepare food at home and therefore is not considered a staple food prepared in the home. Only 4.3% of Gauteng households consumed wheat flour 0.8% consumed wheat flour that was fortified (**Figure 1C**). In the Eastern Cape, 25.5% consumed wheat flour and fortifiable wheat flour, while 16.6% consumed fortified wheat flour. Cake flour was consumed by 43.5% of households in Gauteng and 71.7% of Eastern Cape households (**Figure 1D**).

Maize meal was consumed by 95.4% of Gauteng and 98.6% of the Eastern Cape households; fortified maize meal was consumed by 77.4% and 86.7% of households, respectively (**Figure 1D**). Salt was consumed by 95.4% of households in Gauteng and 99.7% of households in the Eastern Cape (**Figure 1E**). For Gauteng 79.6% of households and 83.9% of households in the Eastern Cape consumed fortified salt.

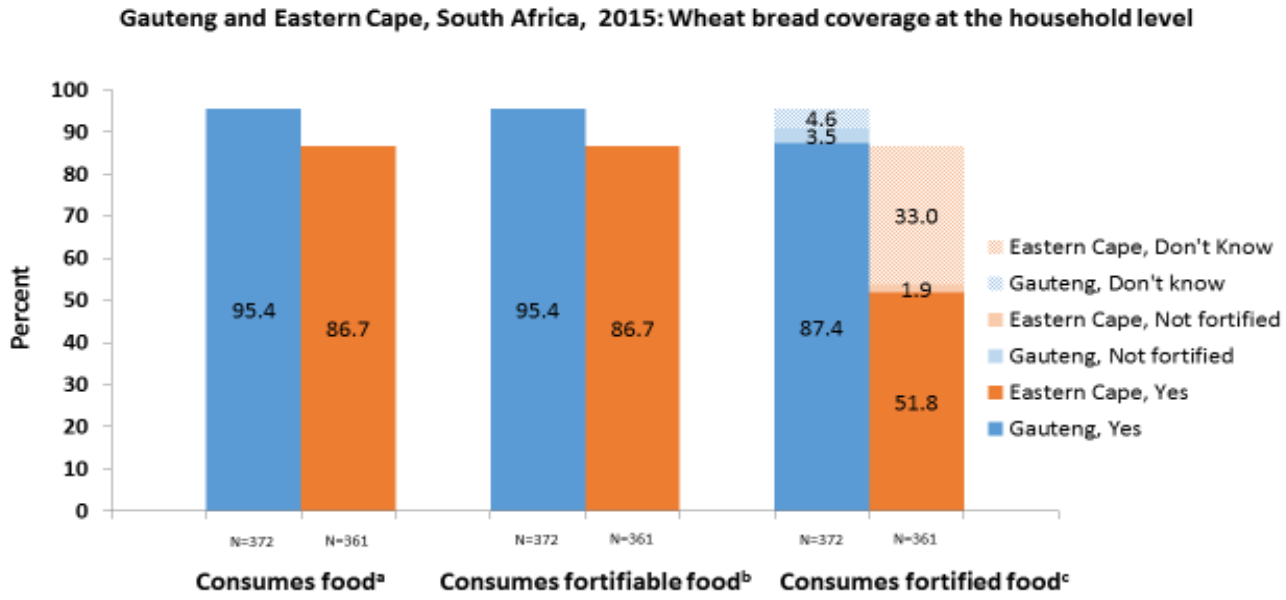
Figure 1. Household coverage of foods.[1,2]

A. Oil



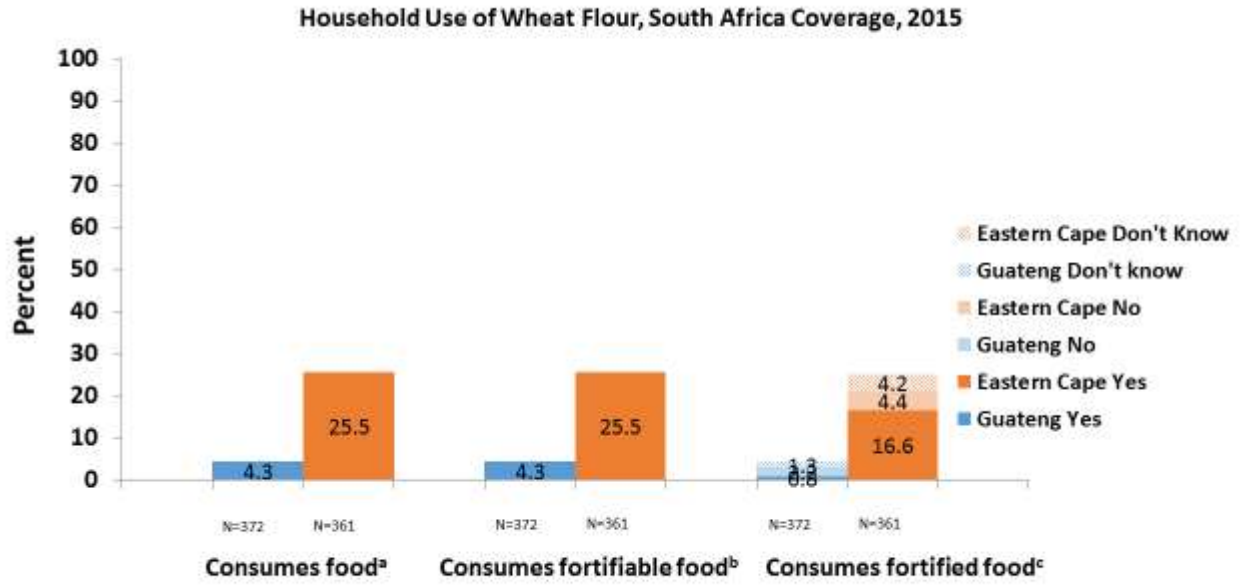
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed; [c] Food is not mandated to be fortified therefore samples were not analyzed.

B. Wheat Bread



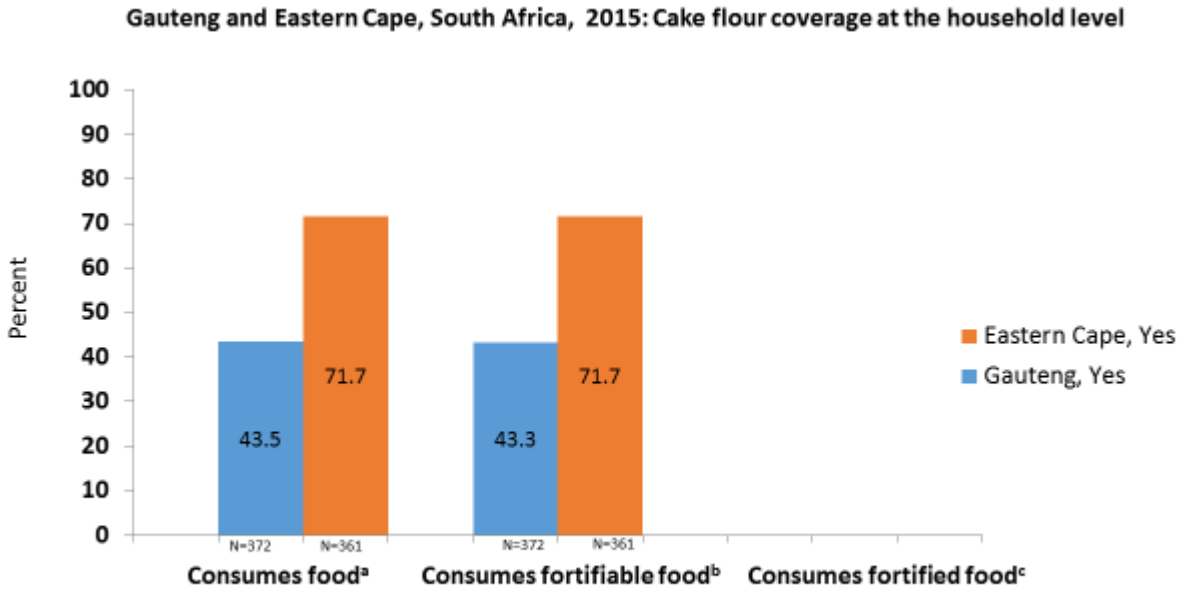
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic 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.

C. Wheat flour



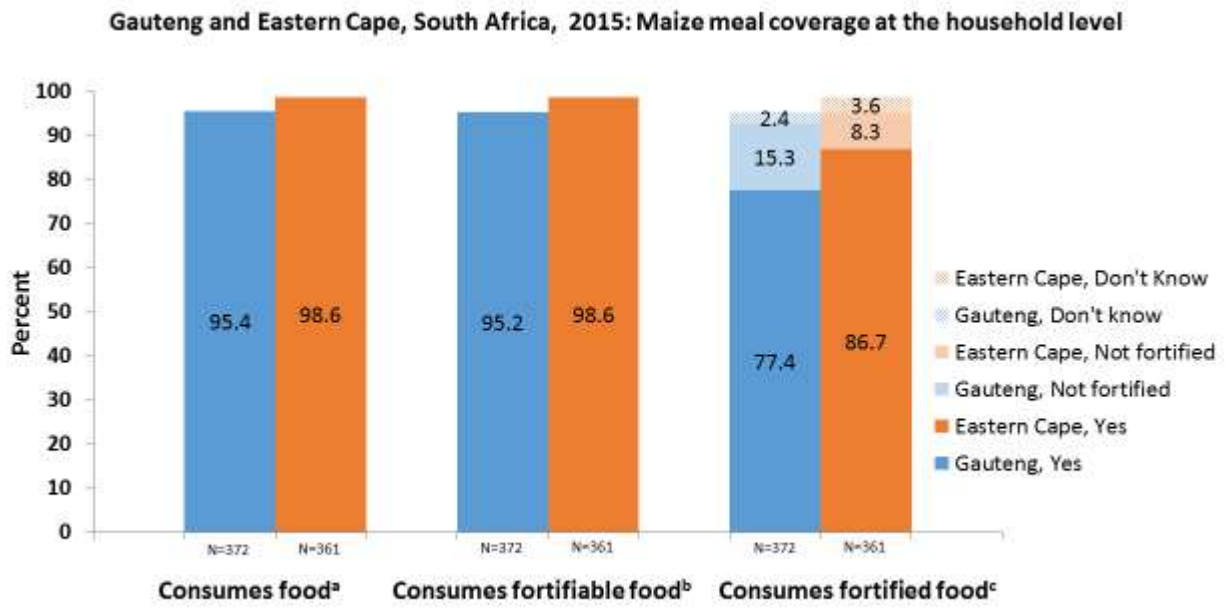
[a]Households prepare food regularly or sometimes; [b]Food not made at home and assumed to be industrially processed; and [c]Yes refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analysis not to contain the nutrient above the 9intrinsic level; "Don't know" refers to households that could not be classified because no sample was available; households that did not consume a fortifiable food are not shown.

C. Cake Flour



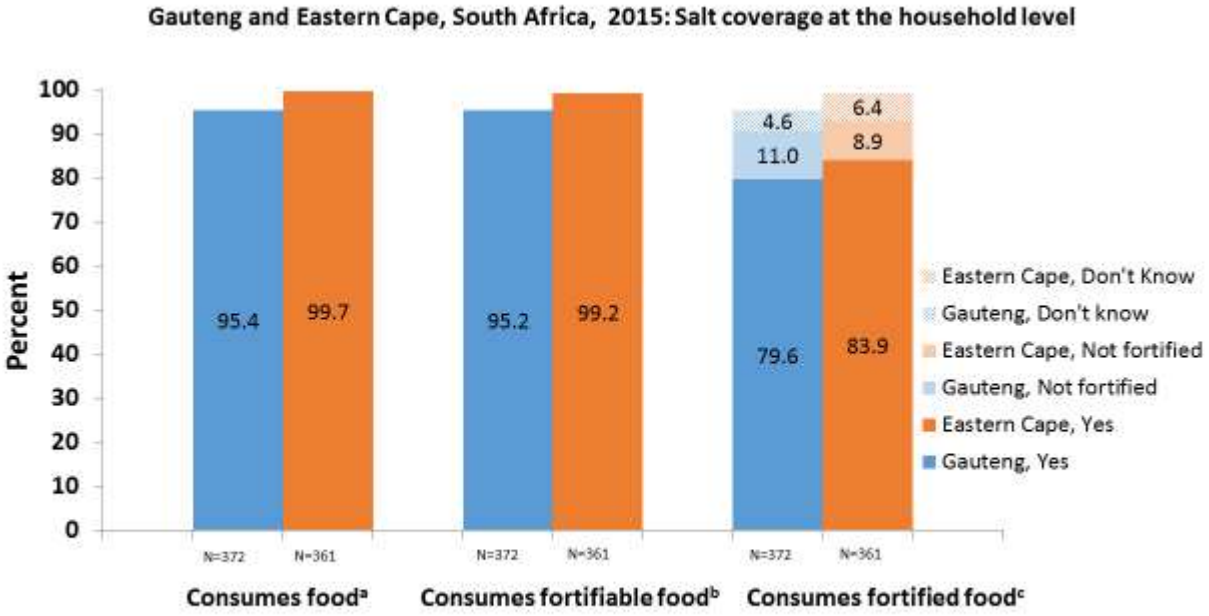
[a]Household prepares the food at home; [b]Food was not made at home and is assumed to be industrially processed; [c]Food is not mandated to be fortified therefore samples were not analyzed.

D. Maize meal



[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.

E. Salt



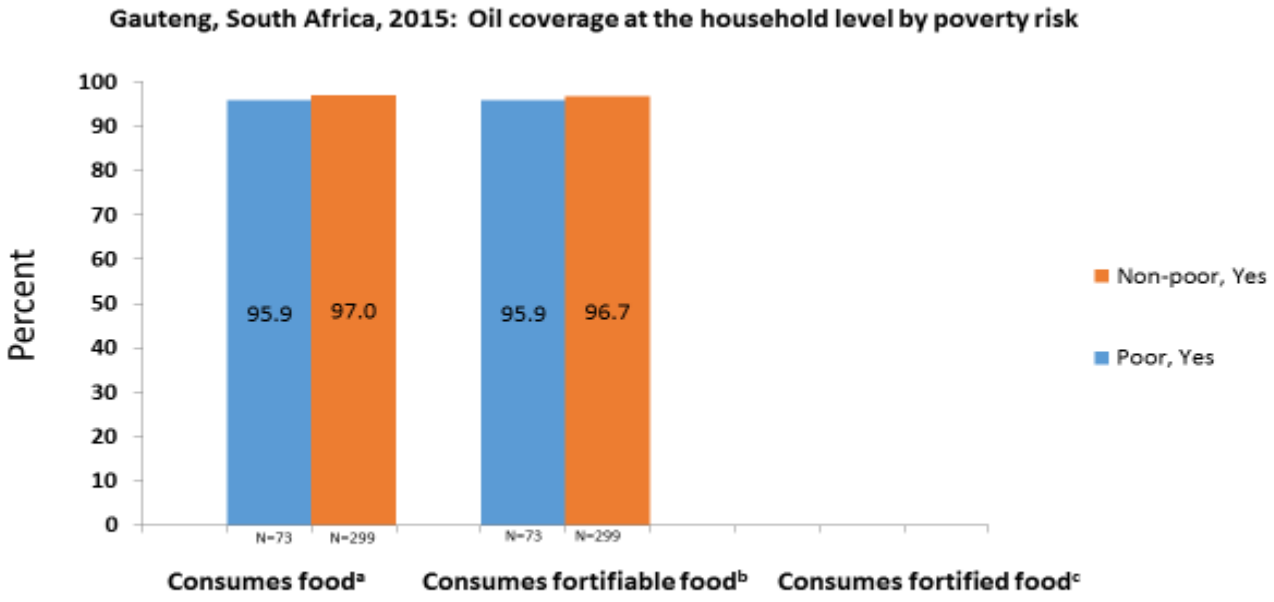
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic 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.

[1] "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 criteria: wheat flour with > 18 mg/kg iron, wheat bread >15.25 mg/kg iron; super maize meal and coarse/Braaipap, >6.5 mg/kg iron, sifted maize meal >14.2 mg/kg iron, and salt ≥ 10.0 mg/kg iodine. (Instant/quick cooking maize was considered to be not fortified). "Consumes fortified food" was determined 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 "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 of all samples analyzed from that brand 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 taken and the brand name was not available, the household's fortification status could not be determined and 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.

Household coverage of foods (except for wheat flour which was not considered a household staple) were stratified by poverty risk for households in Gauteng and the Eastern Cape States (**Figure 2A-E** and **Annex G/table 2**). For Gauteng, the coverage was statistically different only for consumption of fortified wheat bread. Specifically, the consumption of fortified wheat bread was lower among poor households than among non-poor households. In the Eastern Cape, consumption of wheat bread, fortifiable wheat bread and fortified wheat bread was lower among the poor households compared to non-poor households.

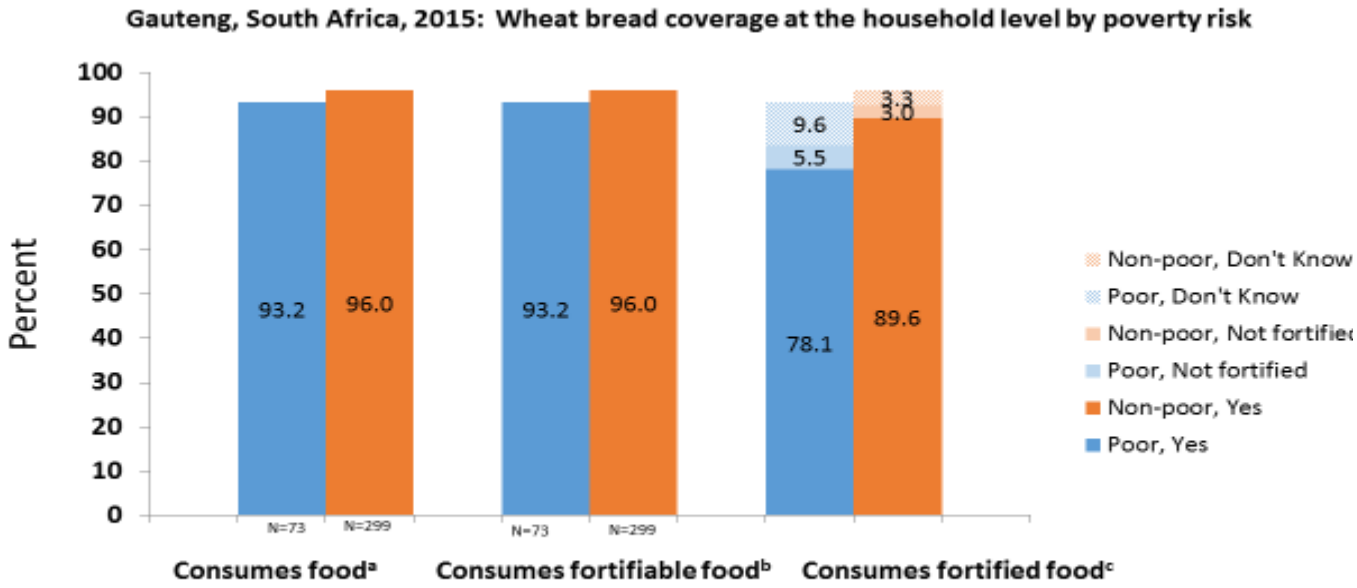
Figure 2. Household coverage of foods by poverty risk. [1,2,3]

A. **Gauteng: Oil**



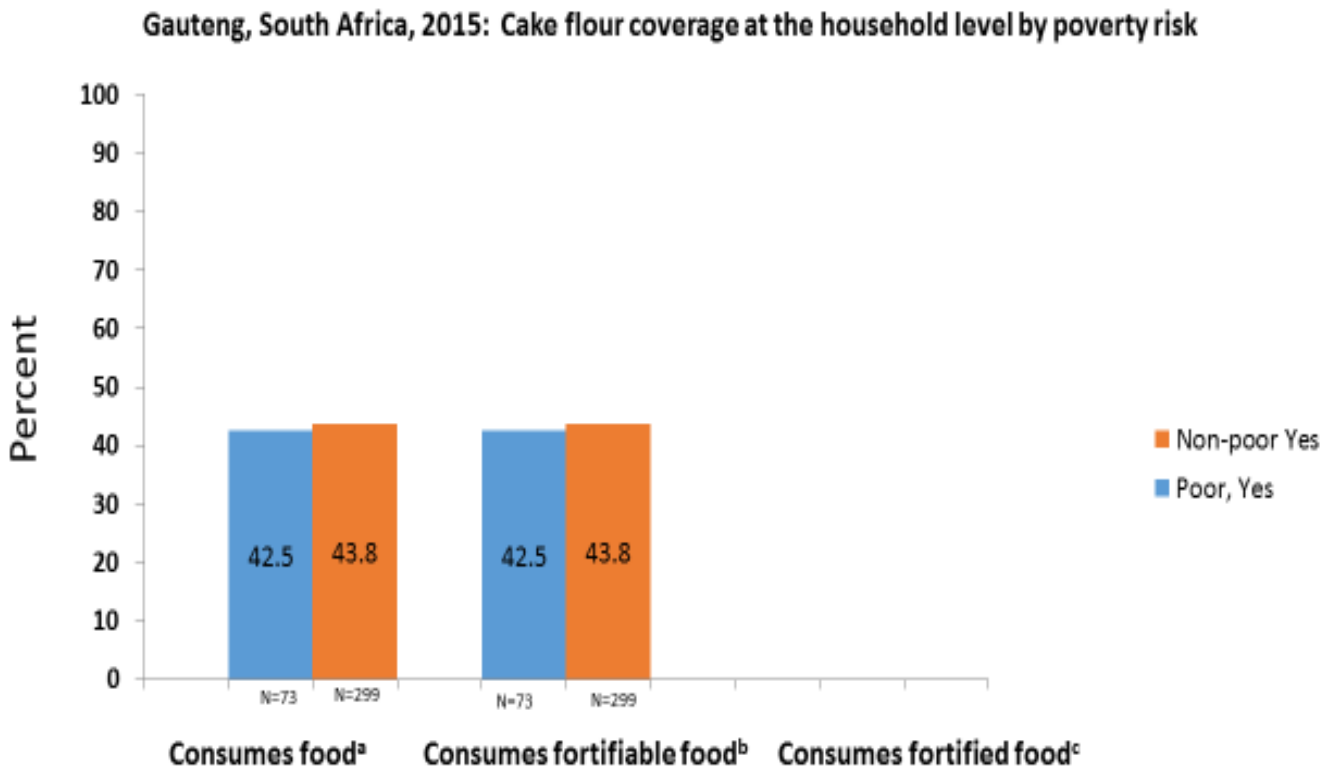
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed; [c] Food is not mandated to be fortified therefore samples were not analyzed.

B. **Gauteng: Wheat Bread**



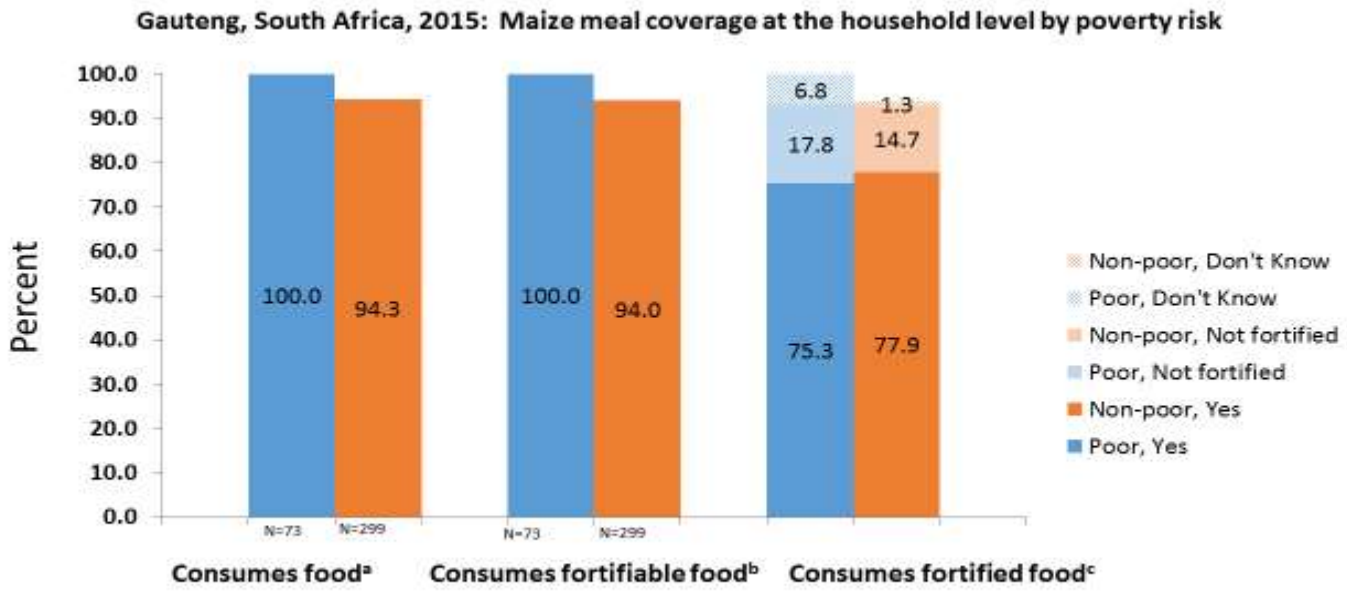
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, re consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic level; "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.

C. **Gauteng: Cake Flour**



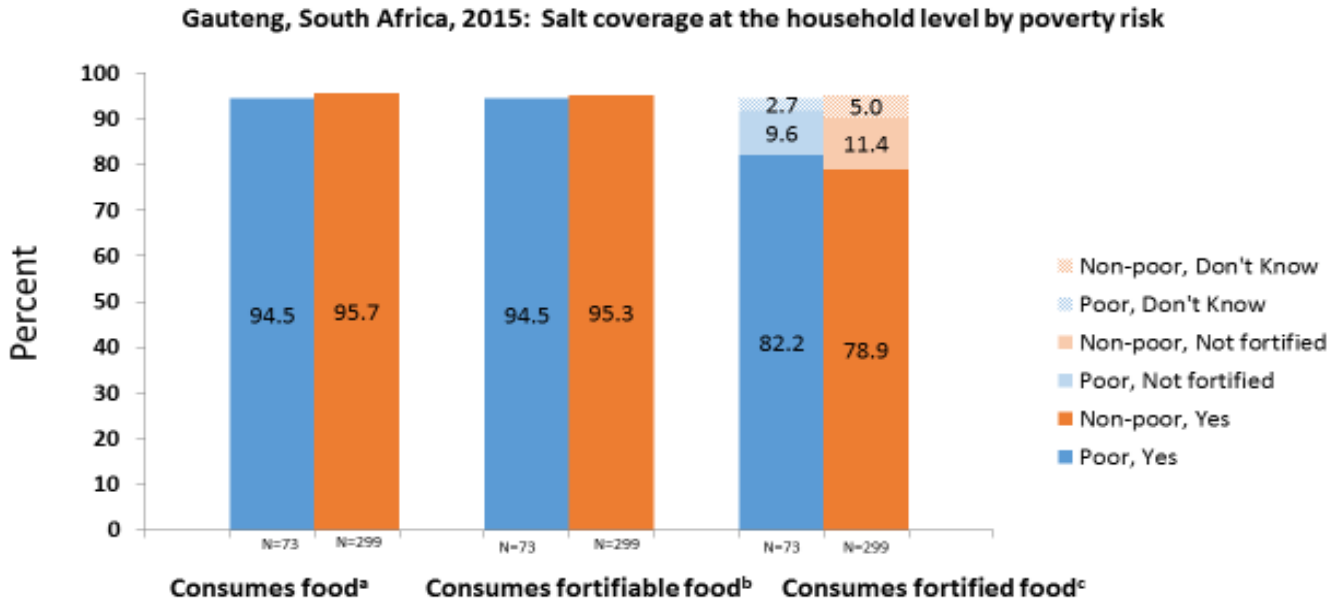
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed; [c] Food is not mandated to be fortified therefore samples were not analyzed.

D. **Gauteng: Maize Meal**



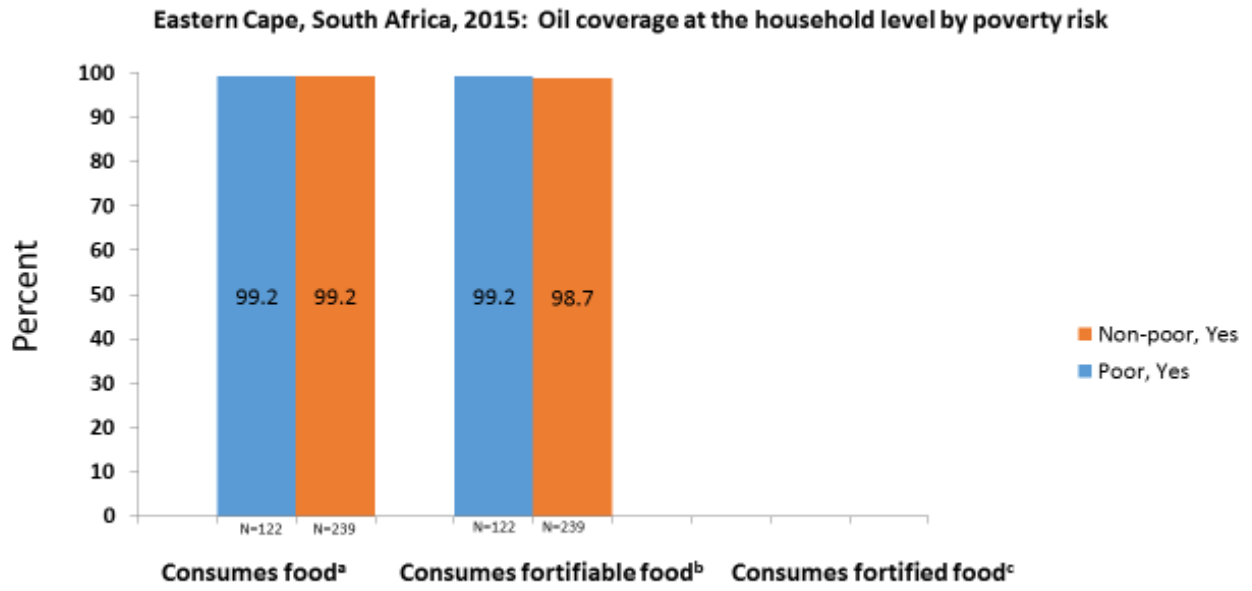
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic 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.

E. **Gauteng: Salt**



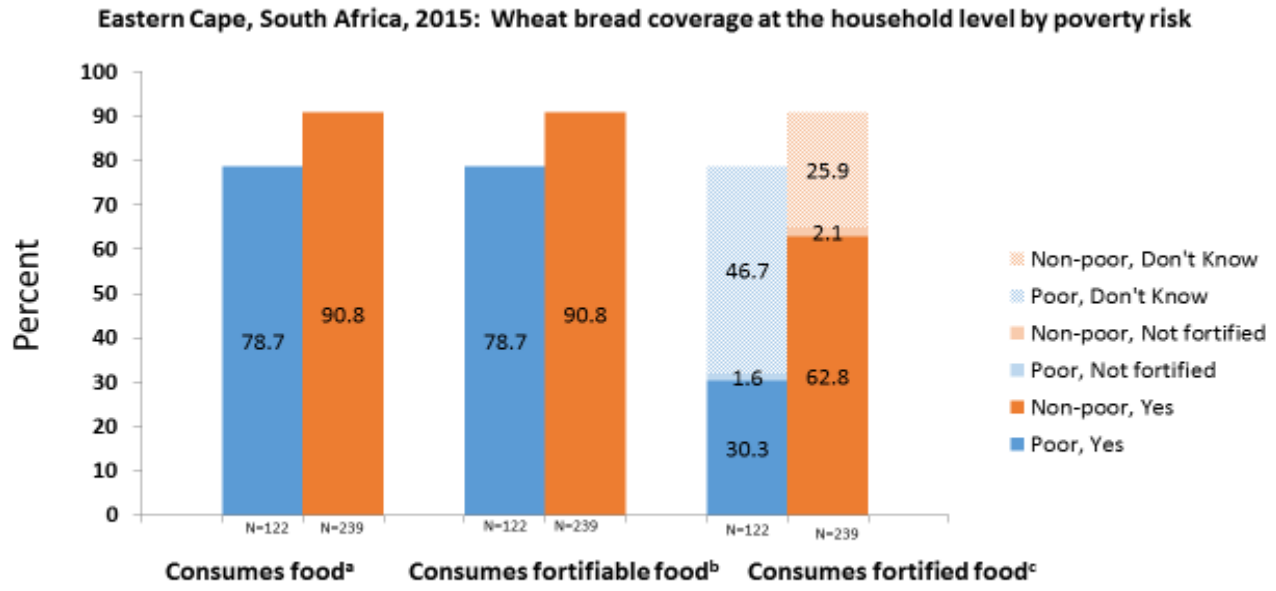
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic 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.

F. **Eastern Cape: Oil**



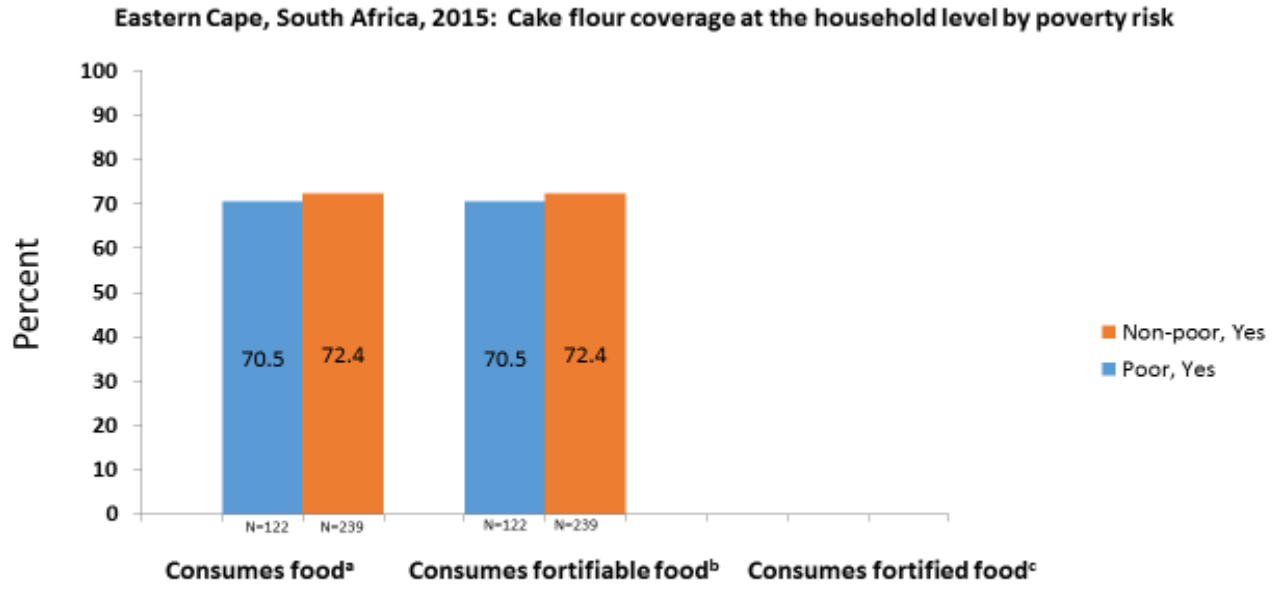
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed; [c] Food is not mandated to be fortified therefore samples were not analyzed.

G. **Eastern Cape: Wheat Bread**



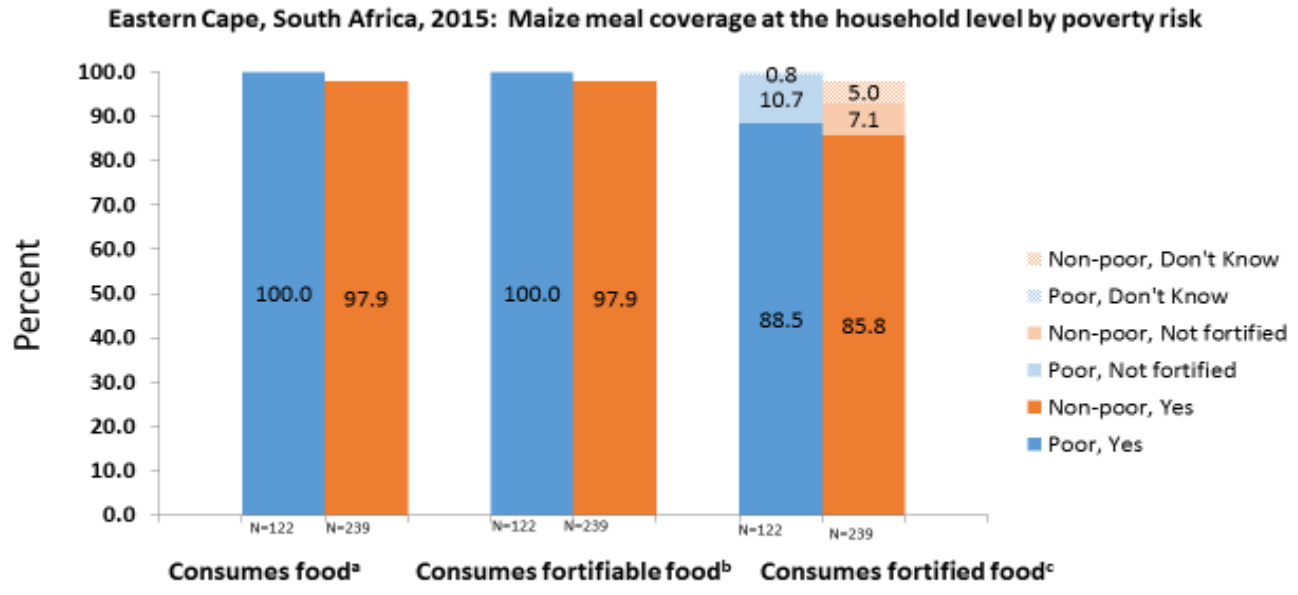
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic 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.

H. **Eastern Cape: Cake Flour**



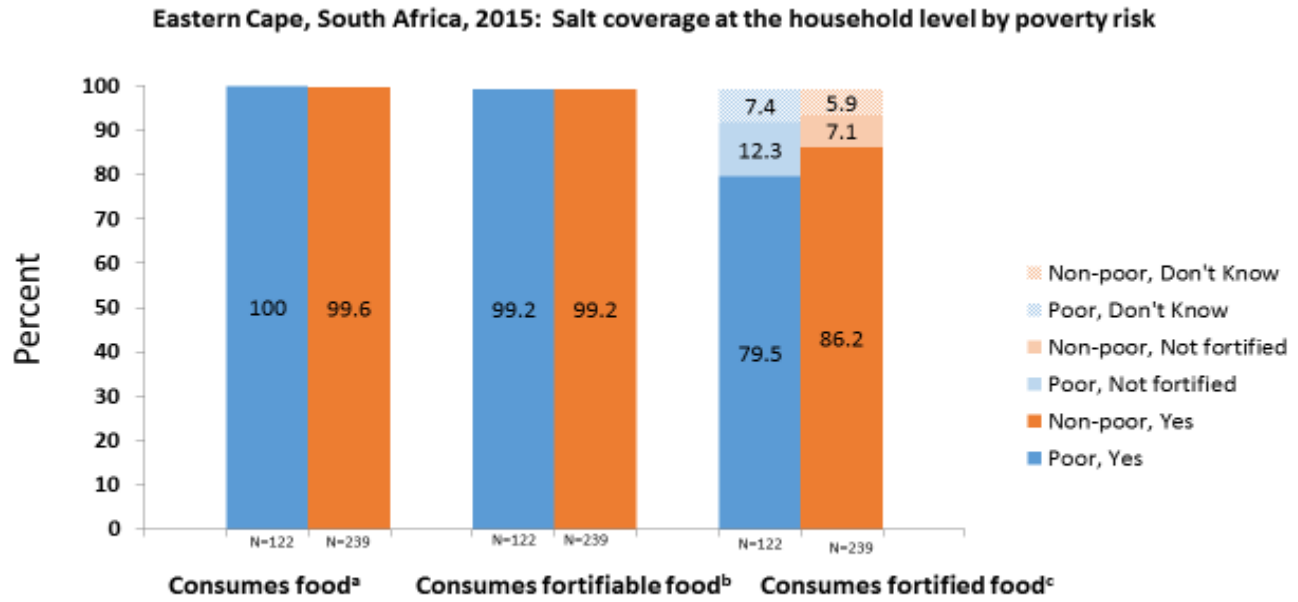
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed; [c] Food is not mandated to be fortified therefore samples were not analyzed.

I. Eastern Cape: Maize Meal



[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.

J. Eastern Cape: Salt



[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.

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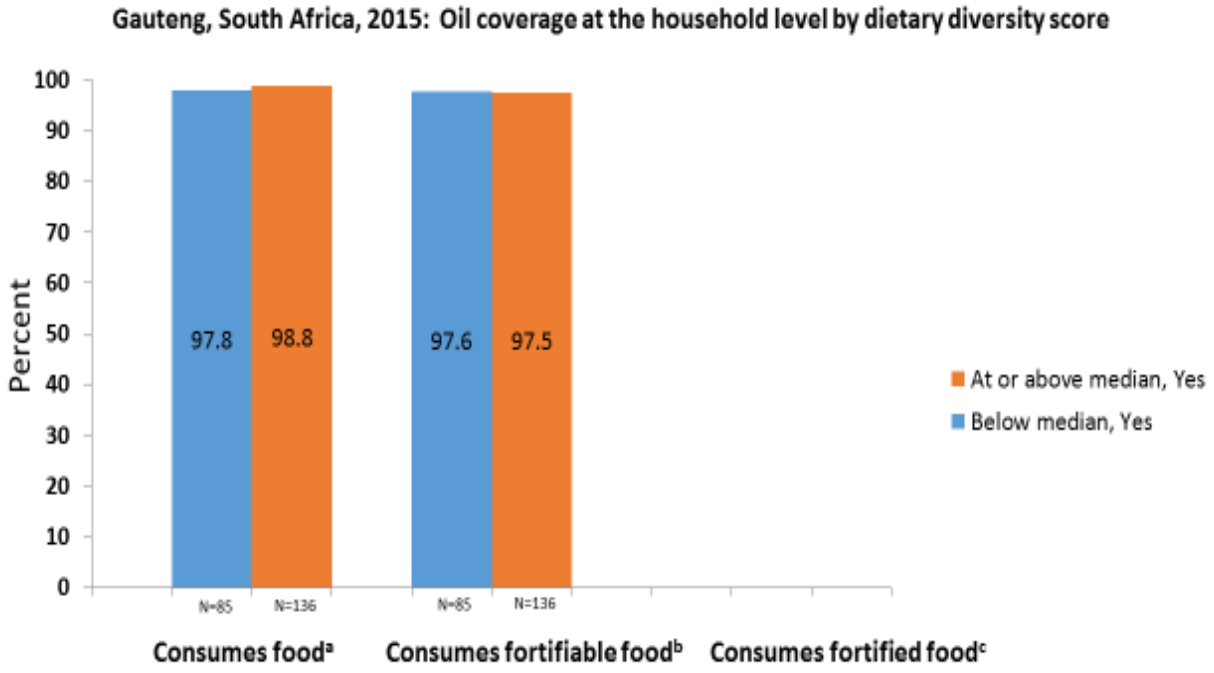
The next series of figures show household coverage of foods stratified by women's dietary diversity score (lower or higher) (**Figure 3** and **Annex G/table 3**). For Gauteng, the coverage was statistically different by dietary diversity for consumption of fortified salt. In the Eastern Cape there were no statistically significant differences by dietary diversity.

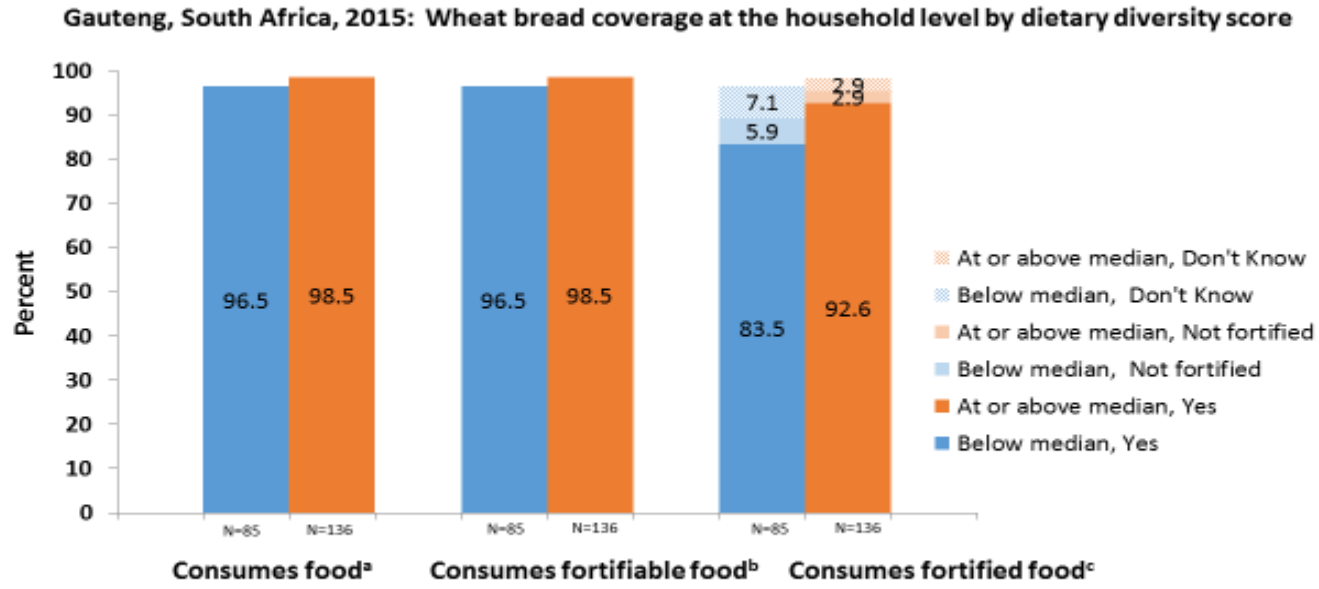
Figure 3. Household coverage of foods by women's dietary diversity score.[1,2,3]

A. Gauteng: Oil



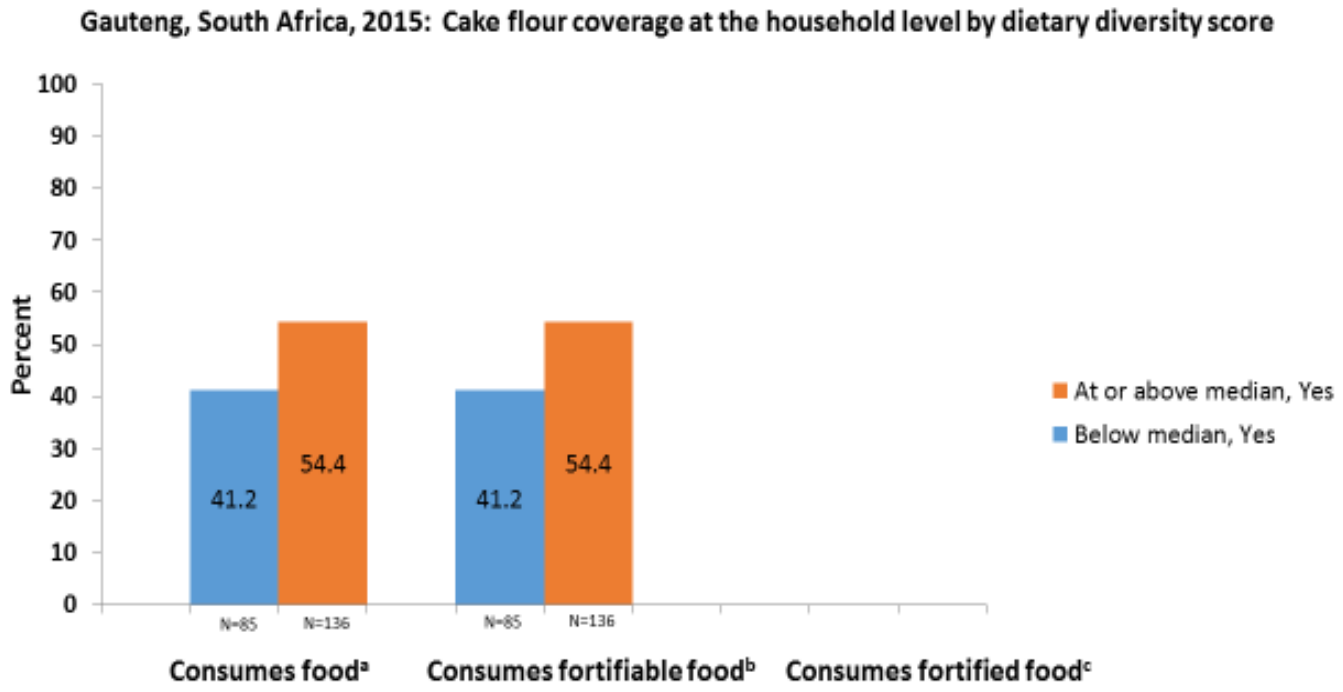
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed; [c] Food is not mandated to be fortified therefore samples were not analyzed.

B. Gauteng: Wheat Bread



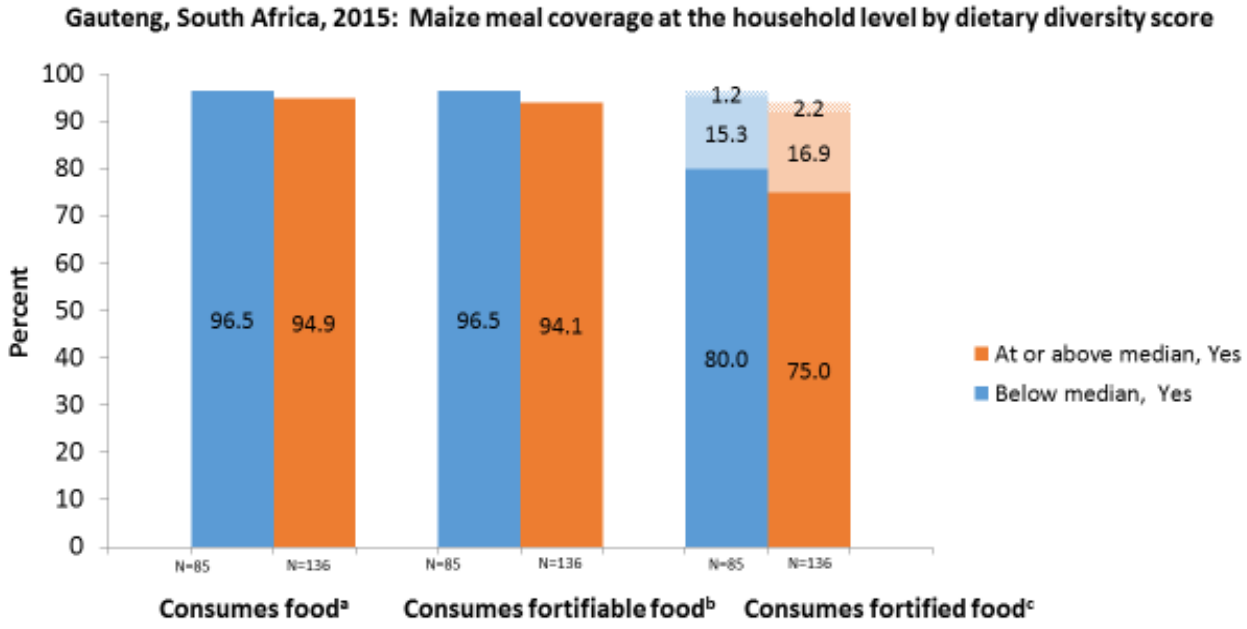
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, report consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic 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.

C. Gauteng: Cake Flour



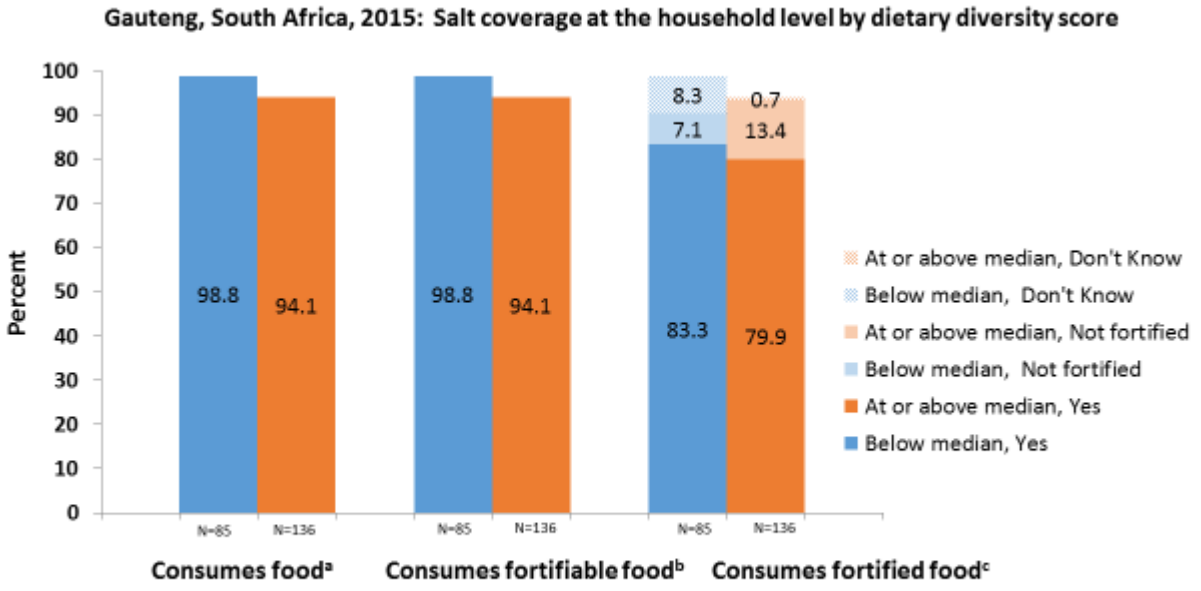
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed; [c] Food is not mandated to be fortified therefore samples were not analyzed.

D. Gauteng: Maize Meal



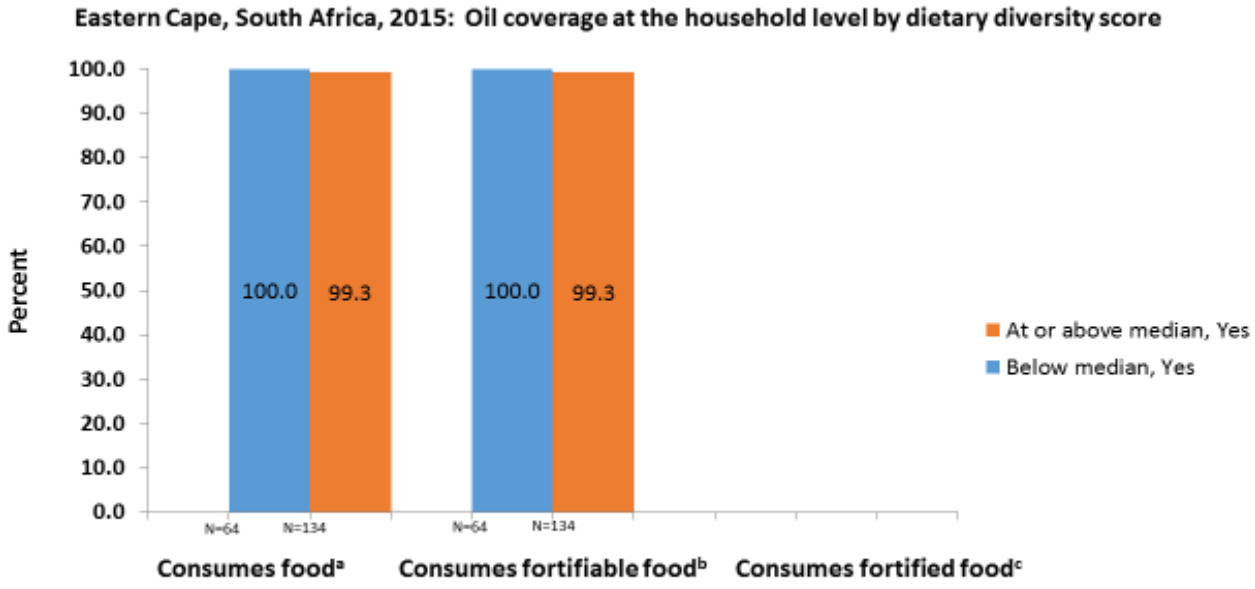
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic 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.

E. Gauteng: Salt



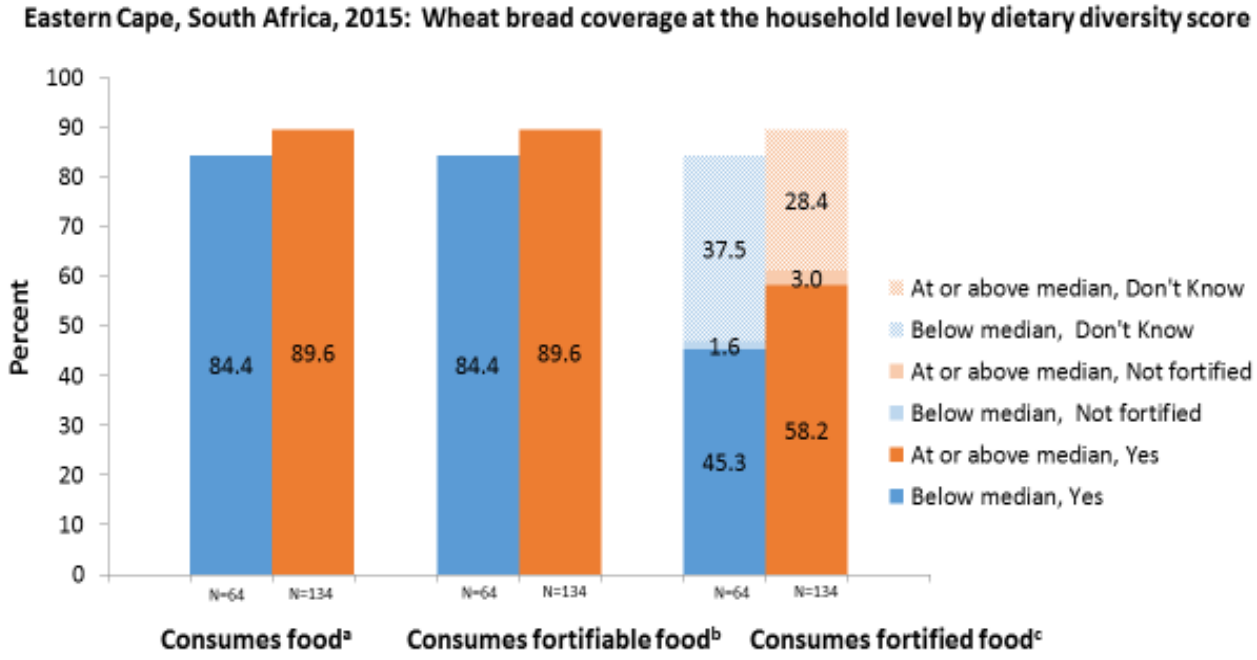
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic 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.

F. The Eastern Cape: Oil



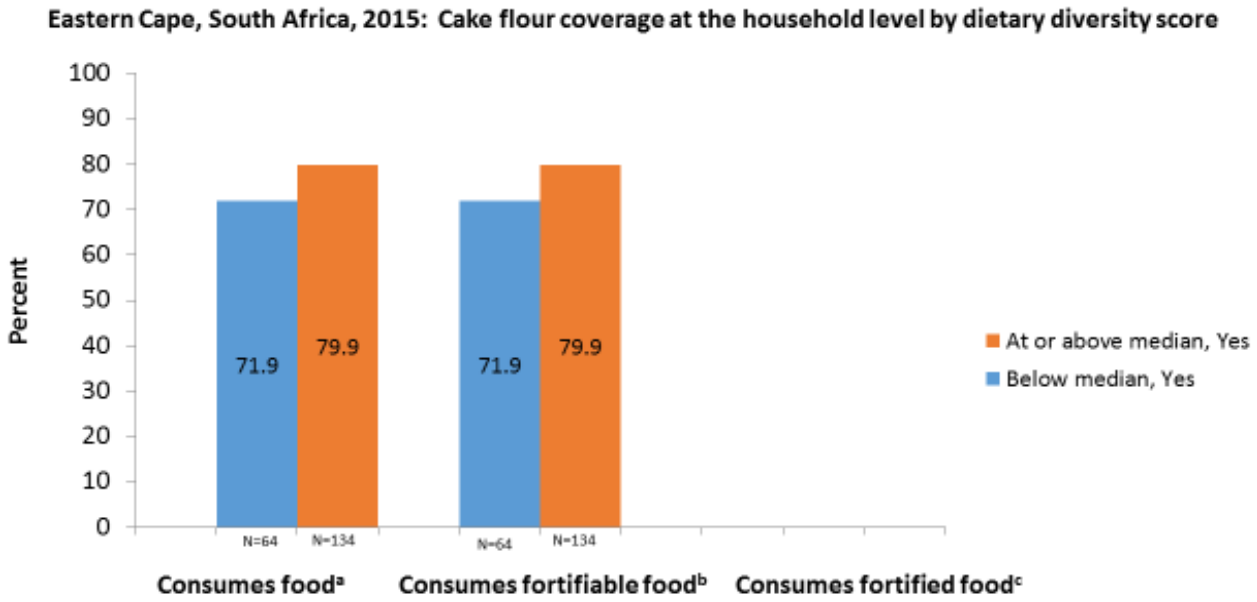
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed; [c] Food is not mandated to be fortified therefore samples were not analyzed.

G. The Eastern Cape: Wheat Bread



[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.

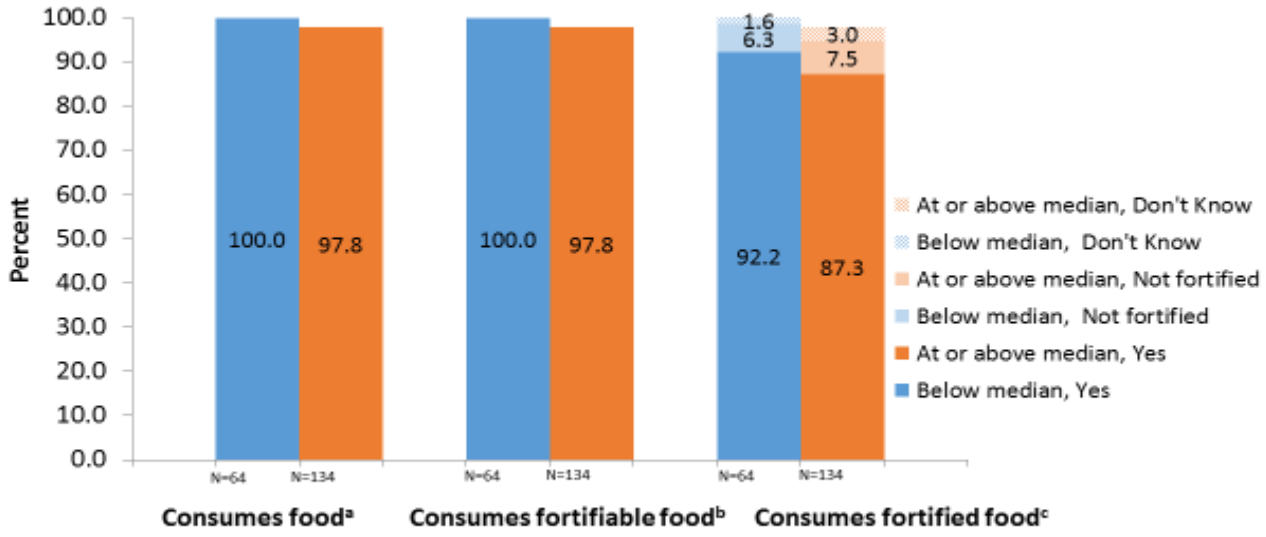
H. The Eastern Cape: Cake Flour



[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed; [c] Food is not mandated to be fortified therefore samples were not analyzed.

I. The Eastern Cape: Maize Meal

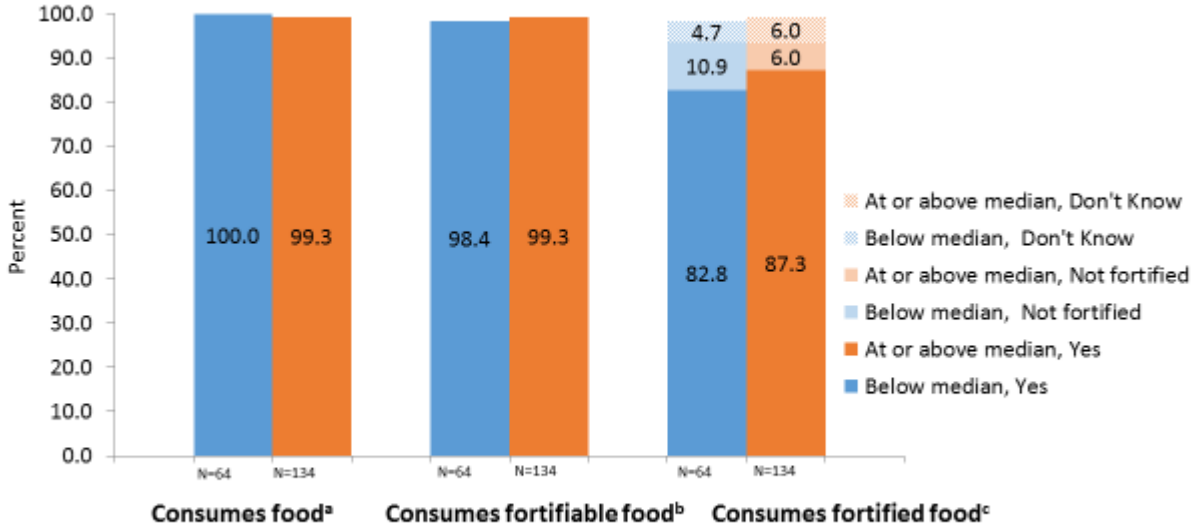
Eastern Cape, South Africa, 2015: Maize meal coverage at the household level by dietary diversity score



[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.

J. The Eastern Cape: Salt

Eastern Cape, South Africa, 2015: Salt coverage at the household level by dietary diversity score



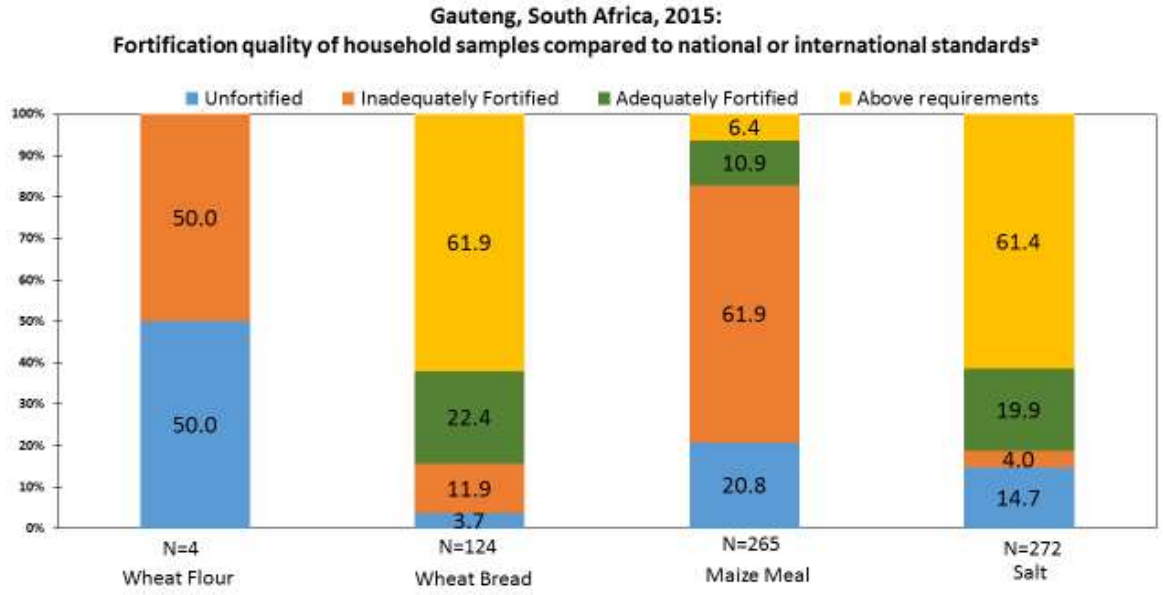
[a] Household prepares the food at home; [b] Food was not made at home and is assumed to be industrially processed [c] "Yes" refers to households that provided a sample or, if not available, reported consuming a brand that was confirmed by laboratory analyses to contain the nutrient above the intrinsic 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.

[1] "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 criteria: wheat flour with > 18 mg/kg iron, wheat bread >15.25 mg/kg iron; super maize meal and coarse/Braaipap, >6.5 mg/kg iron, sifted maize meal >14.2 mg/kg iron, and salt ≥ 10.0 mg/kg iodine. (Instant/quick cooking maize was considered to be not fortified). "Consumes fortified food" was determined 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 "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 of all samples analyzed from that brand 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 taken and the brand name was not available, the household's fortification status could not be determined and 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. Higher dietary diversity refers to a dietary diversity score greater than or equal to the population median. The population median is 5 in Gauteng and 4 in Eastern Cape. 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 fortification quality compared to national standards varied greatly depending on the food (**Figure 4** and **Annex G/table 4**). Oil and cake flour are not mandatorily fortified and were not tested. In Gauteng, wheat bread flour was collected from only 4 households; 2 of which were unfortified and 2 of which were inadequately fortified. In Gauteng, among wheat bread samples, 4% were unfortified, 12% were inadequately fortified, 22% were adequately fortified and 62% were fortified above requirements. Among maize meal samples, 21% were unfortified, 62% were inadequately fortified, 11% were adequately fortified and 6% were fortified above requirements. According to UNICEF/WHO standards for salt iodization, 15% of salt samples were unfortified, 4 4% were inadequately fortified, 20% were adequately fortified, and 61% were fortified above requirements, respectively. (According to the RSA standards for salt iodization, 15% of salt samples were unfortified, 18% were inadequately fortified, 52% were adequately fortified, and 16%were fortified above requirements, respectively (see Annex G, Table 4). In the Eastern Cape, wheat bread flour was collected from 39 households; 33% were unfortified, 26% were inadequately fortified, 21% were adequately fortified and 21% were fortified above requirements. Among wheat bread samples, 8% were unfortified, 33% were inadequately fortified, 24% were adequately fortified and 35% were fortified above requirements. Among maize meal samples, 12% were unfortified, 57% were under fortified, 17% were adequately fortified and 13% were over fortified. According to the UNICEF/WHO standards for salt iodization, these percentages were: 12%, 2%, 29% and 57%, respectively. (According to RSA standards for salt iodization, 12% were unfortified, 23% were under fortified, 48% were adequately fortified, and 16% were over fortified **(see Annex G Table 4).**

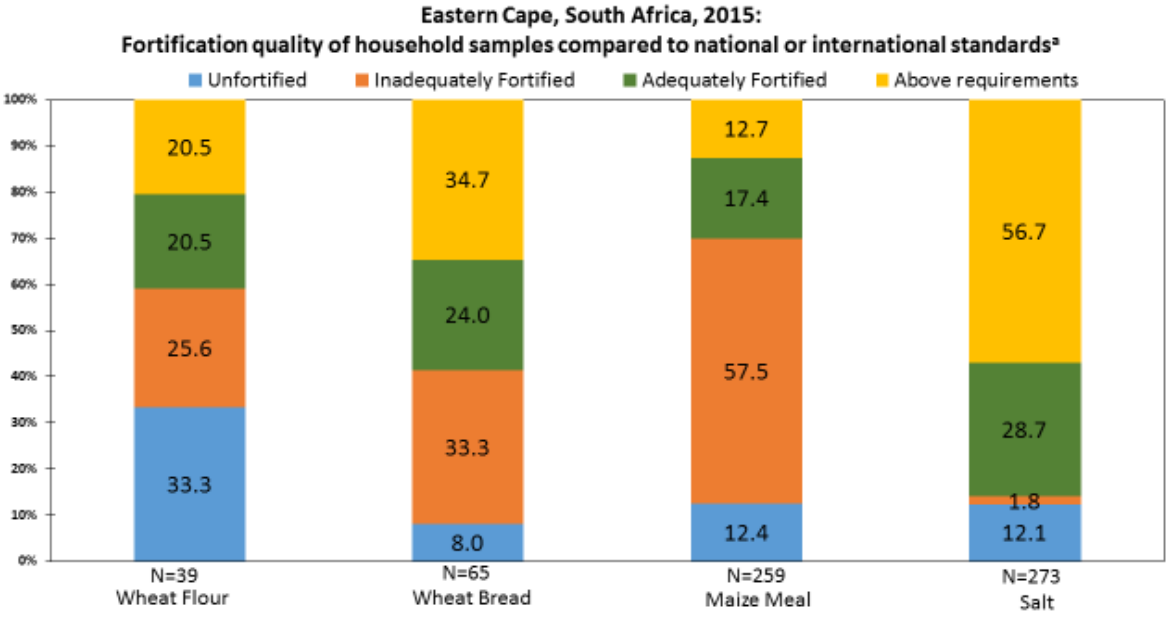
Figure 4. Fortification quality of household food samples compared to South Africa national standards for wheat flour, wheat bread and maize meal and international standards for salt.[1,2]

A. Gauteng



* Wheat flour, wheat bread, and maize meal samples were compared against the 2008 South African National Standards for retail samples. Salt samples were compared again the World Health Organization standard for household salt samples.

B. The Eastern Cape



* Wheat flour, wheat bread, and maize meal samples were compared against the 2008 South African National Standards for retail samples. Salt samples were compared again the World Health Organization standard for household salt samples.

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

*[2] Fortification levels (mg/kg of total iron) for wheat flour were classified as follows: not fortified (≤18), fortified below standard (>18 to <45.81), adequately fortified (45.81 to 55.99) and over-fortified (>55.99). Fortification levels (mg/kg of total iron) for wheat bread were classifeid as follow: "not fortified"(≤ 15.25), "inadequately fortified" (>15.25 to < 33.48), "adequately fortified" (33.48 to 40.91), "over fortified" (>40.91). Fortification levels (mg/kg of total iron) were classified by type of maize meal. For super maize meal and coarse/Braaaipap, classifications were: unfortified (≤6.5), fortified below standard (>6.5 to <37.35), adequately fortified (37.35 to 45.65) and over-fortified (>45.65). For sifted maize meal, classifications were: unfortified (≤14.2), fortified below standard (>14.2 to <44.28), adequately fortified (44.28 to 54.12) and over-fortified (>54.12). There are no regulations for instant and quick cooking maize meal and these types were considered to be not fortified) (**Annex E**). Fortification levels (mg/kg of iodine) for salt were clasifed accordign to the UNICEF/WHO criteria:as follow: unfortified (<10), fortified below standard (10 to <15), adequately fortified (15 to <40) and over-fortified (≥40). (See Appendix G Table 4 for classification according the RSA standard for iodine fortification of salt.*

For South Africa's food fortification logo, 44.4% of Gauteng respondents and 36.8% of the Eastern Cape respondents reported ever seeing the logo (**Table 8**). Among those who had seen the logo in Gauteng, 79.46% of respondents reported positive attributes to this logo; in the Eastern Cape, it was 65.4%. Respondents noted that the logo influences their decision to buy fortified food; this was the case for 57.0% of Gauteng respondents and 42.1% of The Eastern Cape respondents.

Table 8. Fortification logo and knowledge results.[1]

Characteristic	GAUTENG		EASTERN CAPE	
	N	% (95% CI)	N	% (95% CI)
Fortification logo				
Reported ever seeing fortification logo	372	44.4 (39.3, 49.4)	361	36.8 (31.9, 41.8
Reported positive attributes[2] to logo	165	79.4 (73.2, 85.6)	133	65.4 (57.3, 73.5)
Reported that logo influences decision to buy	165	57.0 (49.4, 64.6)	133	42.1 (33.7, 50.5)

Abbreviation: CI, confidence interval
[1] All values are percent as indicated.
[2] Reported that the logo means "fortified / enriched / added micronutrients", "good for health" or "better quality".

Based on the individual dietary assessment of WRA, it was estimated that women in Gauteng consume 13.2% of the iron Recommended Nutrient Intake (RNI, per the World Health Organization) from fortifiable wheat flour (**Table 9**). Additionally, they consume 12.2% of the iron RNI from maize meal. For women in the Eastern Cape, the values are as follows: fortifiable wheat flour contributes 8.4% of iron RNI, and maize meal contributes 7.2%.

Table 9. Daily food consumption (grams/day) by and micronutrient contribution (% RNI) for all surveyed women of reproductive age based on individual assessment of women.[1]

Food	GAUTENG		THE EASTERN CAPE	
	N	Median (25%, 75%)	N	Median (25%, 75%)
Fortifiable[2] wheat flour consumed[3] (grams/day)	243	62.8 (41.1, 105)	245	59.6 (32.8, 105.1)
Iron from fortifiable[2] wheat flour (% RNI[4])	243	13.2 (8.5, 19.4)	245	8.4 (5.6, 12.8)
Fortifiable[2] maize meal consumed[3] (grams/day)	243	160.7 (90.5, 236.8)	245	73.8 (33.8, 143.2)
Iron from fortifiable[2] maize meal (% RNI[4])	243	12.2(6.8,18.1)	245	7.2 (3.3, 15.1)

Abbreviation: RNI, recommended nutrient intakes
[1] All values are median as indicated.
[2] Refers to any food that is fortifiable (i.e. assumed to be processed at industrial scale) and falls under the mandatory national fortification legislation.
[3] Women were asked to report the frequency in the past 7 days with which they consumed foods containing wheat flour and maize meal. They were asked to approximate the usual *portion size they ate in the previous 7 days, using picture cards of different portion sizes. The bread and flour in the portion sizes was estimated from recipes and used in conjunction with the frequency to estimate the daily wheat flour/maize meal consumed. For both wheat flour and maize meal products, added iron was calculated by subtracting intrinsic value from the total iron. To estimate daily micronutrient contribution (% RNI) of added iron (ppm) in fortified foods, the grand median nutrient value (added iron) in wheat bread and wheat flour samples analyzed in both provinces was multiplied by women's daily consumption of foods containing wheat flour and maize meal (see* ***Annex C****). For maize meal nutrient, province-specific grand median was used.*
[4] 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 nutrient consumed from flour / nutrient RNI x 100%.

The contribution of fortifiable flour to women's nutrient RNIs was stratified by households' poverty risk (**Table 10**). In Gauteng and the Eastern Cape, there were no statistically significant differences by poverty status in the contribution of wheat flour to the iron RNI, but in both provinces a higher added iron intake (median % RNI) was observed from maize meal intake in poor compared with non-poor women (Gauteng: 16.2% versus 11.1%; Eastern Cape 10.8% versus 6.6%).

Table 10. Daily food consumption (grams/day) by and micronutrient contribution (% RNI) for all surveyed women of reproductive age based on individual assessment by poverty risk[1] by province, South Africa, 2015

Food	Poor (Median (25%, 75%))[2]	Non-poor (Median (25%, 75%))[2]	p-value[3]
GAUTENG	**N=40**	**N=203**	
Fortifiable[4] wheat flour consumed[5] (grams/day)	84.2 (42.1,130.6)	61.5 (39.8, 97.3)	0.0604
Iron from fortifiable[4] wheat flour (% RNI[6])	13.2(10.4,14.2)	12.9(7.8, 19.6)	0.7909
Fortifiable[4] maize meal consumed[5] (grams/day)	217.3 (152.7, 358.4)	128.5 (84.5, 221.7)	0.0002
Iron from fortifiable[4] maize flour (% RNI[6])	16.2(11.1, 28.4)	11.1(6.5, 16.8)	0.0007
THE EASTERN CAPE	**N=69**	**N=176**	
Fortifiable[4] wheat flour consumed[5] (grams/day)	54.9 (25.1, 107.4)	60.6 (35.4, 104.8)	0.5212
Iron from fortifiable[4] wheat flour (% RNI[6])	10.1(7.5-12.4)	7.1(4.3, 14.0)	0.2503
Fortifiable[4] maize meal consumed[5] (grams/day)	100.9 (47.1, 193.4)	66.4 (29.5, 115.2)	0.0168
Iron from fortifiable[4] maize meal (% RNI[6])	10.8(4.4,19.0)	6.6(3.1, 12.0)	0.0111

Abbreviation: RNI, recommended nutrient intakes

[1] All values are median as indicated.

[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. Wilcoxon rank sum test was used to compare median values.

[4] Refers to any food that is fortifiable (i.e. assumed to be processed at industrial scale) and falls under the mandatory national fortification legislation.

[5] Women were asked to report the frequency in the past 7 days with which they consumed foods containing fortifiable wheat flour and maize meal. They were asked to approximate the usual *portion size they ate in the previous 7 days, using picture cards of different portion sizes. The bread and flour in the portion sizes was estimated from recipes and used in conjunction with the frequency to estimate the daily wheat flour/maize meal consumed. For both wheat flour and maize meal products, added iron was calculated by subtracting intrinsic value from the total iron. To estimate daily micronutrient contribution (% RNI) of added iron (ppm) in fortified foods, the grand median nutrient value (added iron) in wheat bread, and wheat flour samples analyzed in both provinces was multiplied by women's daily consumption of foods containing wheat flour and maize meal (see* ***Annex C****). For maize meal nutrient, province-specific grand median was used.*

[6] 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 nutrient consumed from flour / nutrient RNI x 100%.

The contribution of fortifiable flour to women's nutrient RNIs was stratified by the dietary diversity score of one woman per household (in the case of two or more women in a household, one woman was randomly selected to represent the household) (**Table 11**). In Gauteng a significantly greater proportion of the RNI was contributed by wheat flour in women with higher dietary diversity than in those with lower dietary diversity. However, in the Eastern Cape, there were no statistically significant differences among women with higher dietary diversity compared to those with lower dietary diversity.

Table 11. Daily food consumption (grams/day) by and micronutrient contribution (% RNI) for all surveyed women of reproductive age based on individual assessment by women's dietary diversity score, Gauteng and the Eastern Cape, South Africa, 2015.[1]

Food	Lower ((Median (25%, 75%))[2]	Higher (Median (25%, 75%))[2]	p-value[3]
GAUTENG	**N=108**	**N=135**	
Fortifiable[4] wheat flour consumed[5] (grams/day)	57.2 (21.9, 86.7)	67.9 (41.7, 119.5)	0.0147
Iron from fortifiable[4] wheat flour (% RNI[6])	6.2 (5.2, 10.0)	14.3 (10.5, 21.6)	0.0083
Fortifiable[4] maize meal consumed[5] (grams/day)	168.5 (101.3, 297.3)	139.4 (81.3, 220.4)	0.0615
Iron from fortifiable[4] maize flour (% RNI[6])	12.6 (7.6, 22.1)	11.5 (6.4, 17.0)	0.1286
THE EASTERN CAPE	**N=99**	**N=146**	
Fortifiable[4] wheat flour consumed[5] (grams/day)	55.1 (25.9, 93.1)	63.8 (35.5, 108.6)	0.0959
Iron from fortifiable[4] wheat flour (% RNI[6])	7.2 (4.1,10.3)	8.4 (5.6, 13.1)	0.6164
Fortifiable[4] maize meal consumed[5] (grams/day)	79.9 (29.5, 149.8)	67.6 (34.1, 130.9)	0.6247
Iron from fortifiable[4] maize meal (% RNI[6])	7.8 (2.8,6.1)	6.8 (3.4,14.4)	0.6574

Abbreviation: RNI, recommended nutrient intakes

[1] All values are median as indicated.

[2] Lower dietary diversity refers to a dietary diversity score lower than the population median. Higher dietary diversity refers to a dietary diversity score greater than or equal to the population median. The population median is 5 in Gauteng and 4 in Eastern Cape.

[3] Comparing poor versus non-poor. Wilcoxon rank sum test was used to compare median values.

[4] Refers to any food that is fortifiable (i.e. assumed to be processed at industrial scale) and falls under the mandatory national fortification legislation.

[5] Women were asked to report the frequency in the past 7 days with which they consumed foods containing wheat flour and maize meal. They were asked to approximate the usual *portion size they ate in the previous 7 days, using picture cards of different portion sizes. The bread and flour in the portion sizes was estimated from recipes and used in conjunction with the frequency to estimate the daily wheat flour/maize meal consumed. For both wheat flour and maize meal products, added iron was calculated by subtracting intrinsic value from the total iron. To estimate daily micronutrient contribution (% RNI) of added iron (ppm) in fortified foods, the grand median nutrient value (added iron) in wheat bread and wheat flour samples analyzed in both provinces was multiplied by women's daily consumption of foods containing wheat flour and maize meal (see **Annex C**). For maize meal nutrient, province-specific grand median was used.*

[6] 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 nutrient consumed from flour / nutrient RNI x 100%.

The amount of foods apparently consumed and the corresponding contribution to RNI of select micronutrients among women of reproductive age from households *that reported consuming the food* was estimated using the household assessment method and fortification quality results from the food samples analyzed (**Table 12**). In Gauteng, women apparently consumed 145.5 grams of wheat bread daily and this contributed 15.7% of women's iron RNI. In comparison, women apparently consumed 99.8 grams daily of fortifiable maize meal, contributing 6.5% to the iron RNI. Finally, women in Gauteng apparently consumed 2.8 grams daily of fortifiable salt, contributing 68.1% to their iodine RNI. In The Eastern Cape, fortifiable wheat bread and maize meal contributed 16.5% and 7.2%, respectively, to women's iron RNI. Fortifiable salt contributed most to the RNI: 115.7% of iodine RNI.

Table 12. Daily apparent food consumption by and micronutrient contribution (% RNI) for women of reproductive age based assessment among households that reported consuming the food based on household assessment and adult male equivalent methodology, Gauteng and the Eastern Cape, South Africa, 2015[1]

Asked Food	GAUTENG	THE EASTERN CAPE
	Median (25%, 75%)	Median (25%, 75%)
	N=232	N= 151
Fortifiable wheat bread apparently consumed[3] (grams/day)	145.5 (114.1, 207.9)	156.8 (110.3, 207.0)
Iron from fortifiable[2] wheat bread (% RNI[4])	15.7 (12.1, 23.2)	16.4(12.3, 22.7)
	N=234	N=240
Fortifiable[2] maize meal apparently consumed[3] (grams/day)	99.8 (71.5, 144.7)	83.8 (45.3, 131.3)
Iron from fortifiable[2] maize meal (% RNI[4])	6.5 (2.4,11.7)	7.2 (3.2,12.6)
	N=231	N=241
Fortifiable[2] salt apparently consumed[3] (grams/day)	2.8 (1.8, 4.8)	4.2 (2.6, 6.5)
Iodine from fortifiable[2] salt (% RNI[4])	68.1 (31.3, 128.8)	115.7 (54.2, 185.8)

Abbreviation: RNI, recommended nutrient intakes

[1] All values are median as indicated.

[2] Fortifiable refers to maize meal and salt that were not made at home and was assumed to be processed at industrial scale. All wheat bread was assumed to be fortifiable whether or not it was made at home [see Annex C].

[3] Households that consumed a food 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 levels assigned to each food in a household was done 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. (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. (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.[4] 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 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 women of reproductive age from households that reported consuming the food was stratified by households' poverty risk (**Table 13**). In Gauteng, women in poor households consumed more wheat bread and maize meal than women in non-poor households; however, this did not result in a statistically higher contribution of bread or maize meal to the women's iron intakes. In the Eastern Cape, there was no difference in the amount of wheat bread apparently consumed by women in poor and non-poor households. Women in poor households consumed more maize meal than women in non-poor households, but there was no statically significant difference in the contribution of fortified maize meal to intake. The apparent consumption of salt and the contribution of salt to iodine intake was not statistically different by poverty status.

Table 13. Daily apparent food consumption by 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[1], Gauteng and the Eastern Cape, South Africa, 2015

Food	Poor (Median (25%, 75%))[2]	Non-poor (Median (25%, 75%))[2]	p-value[3]
Gauteng			
	N= 38	N= 194	
Fortifiable[4] wheat bread apparently consumed[5] (grams/day)	164.1(137.9, 257.5)	143.9 (110.9, 205.0)	0.0418
Iron from fortifiable[4] wheat bread (% RNI[6])	17.1(14.0, 26.2)	15.7(11.8, 23.0)	0.1086
	N=40	N= 194	
Fortifiable[4] maize meal apparently consumed[5] (grams/day)	130.6 (93.7, 169.0)	92.8(69.4, 133.2)	0.0012
Iron from fortifiable[4] maize meal (% RNI[6])	8.3 (3.5, 12.2)	6.0 (2.4, 10.9)	0.2335
	N=38	N=193	
Fortifiable[4] salt apparently consumed[5] (grams/day)	3.2(1.6, 6.2)	2.8(1.8, 4.2)	0.4459
Iodine from fortifiable[4] salt (% RNI[6])	78.7 (37.4, 141.3)	67.9(29.6, 128.8)	0.5058
Eastern Cape			
	N=29	N=122	
Fortifiable[4] wheat bread apparently consumed[5] (grams/day)	141.3(107.8, 206.6)	158.9(115.4, 207.1)	0.4949
Iron from fortifiable[4] wheat bread (% RNI[6])	16.8(11.8,29.6)	16.4(13.5, 21.7)	0.8225
	N=69	N=171	
Fortifiable[4] maize meal apparently consumed[5] (grams/day)	92.8(75.1, 149.8)	77.2(35.9, 123.3)	0.0013
Iron from fortifiable[4] maize meal (% RNI[6])	7.9 (4.3, 14.4)	6.5 (3.1, 12.4)	0.2508
	N=69	N=172	
Fortifiable[4] salt apparently consumed[5] (grams/day)	4.5(2.6, 7.0)	4.1(2.6, 6.6)	0.3912
Iodine from fortifiable[4] salt (% RNI[6])	115.4(46.1, 177.9)	116.1(59.4, 187.3)	0.531

Abbreviation: RNI, recommended nutrient intakes

[1] All values are median as indicated.

[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. Wilcoxon rank sum test was used to compare median values.

[4] Fortifiable refers to any food that was not made at home and could be processed and fortified at industrial scale.

[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 levels assigned to each food in a household was done 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 (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. (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 within each stratum was used.

[6] 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 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 women of reproductive age among households that consumed the food was stratified by dietary diversity score (**Table 14**). In Gauteng, women in households with lower dietary diversity consumed more maize meal than women in households with higher dietary diversity; however, despite this difference, the contribution of maize meal to iron intake was not significantly

different. There were no statistically significant differences in the amount of wheat bread or salt consumed by household dietary diversity. In the Eastern Cape, there were no statistically significant differences in the contribution to iron intake for any food (wheat bread, maize meal or salt) by household dietary diversity.

Table 14. Daily apparent food consumption by and micronutrient contribution (% RNI) for women of reproductive age among households that consumed the food based on household assessment and adult male equivalent methodology by women's dietary diversity score[1], Gauteng and the Eastern Cape, South Africa, 2015

Food	Lower (Median (25%, 75%))[2]	Higher (Median (25%, 75%))[2]	p-value[3]
Gauteng			
	N=76	N=134	
Fortifiable[4] wheat bread apparently consumed[5] (grams/day)	144.3115.9184.8	148.7(113.5, 214.7)	0.6492
Iron from fortifiable[4] wheat bread (% RNI[6])	15.3(11.76, 21.1)	16.7(12.2, 24.3)	0.2360
	N=78	N=134	
Fortifiable[4] maize meal apparently consumed[5] (grams/day)	117.6(84.2, 165.1)	89.3 (65.7,132.8)	0.0021
Iron from fortifiable[4] maize meal (% RNI[6])	6.9(2.5,13.4)	6.0 (1.7, 10.8)	0.1821
	N=78	N=130	
Fortifiable[4] salt apparently consumed[5] (grams/day)	3.0(1.9,5.0)	2.7 (1.7, 4.7)	0.4246
Iodine from fortifiable[4] salt (% RNI[6])	77.3(44.7,139.1)	63.6 (24.6, 110.7)	0.0928
Eastern Cape			
	N=32	N=91	
Fortifiable[4] wheat bread apparently consumed[5] (grams/day)	146.4(105.0,181.5)	165.2(128.1, 221.4)	0.0470
Iron from fortifiable[4] wheat bread (% RNI[6])	15.5 (10.9,20.1)	18.1(14.0, 25.4)	0.0725
	N=58	N=137	
Fortifiable[4] maize meal apparently consumed[5] (grams/day)	101.5 (62.4,150.8)	87.2(49.7, 128.6)	0.1328
Iron from fortifiable[4] maize meal (% RNI[6])	8.4(2.8,15.6)	7.4 (4.0, 13.3)	0.7006
	N=57	N=139	
Fortifiable[4] salt apparently consumed[5] (grams/day)	4.2(2.5,6.9)	4.4 (2.9, 6.7)	0.7752
Iodine from fortifiable[4] salt (% RNI[6])	133.1(67.9,213.4)	115.0(59.8,188.9)	0.3558

Abbreviation: RNI, recommended nutrient intakes

[1] All values are median as indicated and are based on dietary score of 1 randomly woman.

[2] Lower dietary diversity refers to a dietary diversity score lower than the population median. Higher dietary diversity refers to a dietary diversity score greater than or equal to the population median. The population median is 5 in Gauteng and 4 in Eastern Cape. 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 versus higher. Wilcoxon rank sum test was used to compare median values.

[4] Fortifiable refers to 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 nutrients assigned to each household's food was 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 maize meal). (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. (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 within each state was used.

[6] 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 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.

Annex A: Sample Consent form

The English-language consent form applied to respondents. When administering the survey in another language, enumerators interpreted the consent text to the appropriate language.

EAID☐☐☐☐☐☐☐☐ HH☐☐

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CONSENT FORM

Research topic: Fortification Assessment Survey
Name of study leader: Professor Rina Swart, University of the Western Cape

	Tick
I confirm that I fully understand the explanation that the researcher gave me about the above study, and have had a chance to ask questions. I have read and understood the information sheet.	
I understand that the aim of the study is to assess the coverage and potential contribution of fortified foods to the micronutrient intake of women of reproductive age (18-49 years of age) in Gauteng and Eastern Cape provinces in South Africa.	
I understand that the findings from this study could contribute to the improvement of the fortification programme of the Department of Health.	
The researcher regards the proposed study to have minimal risk to the participants and described the level of risk as low. The researcher also explained that I may receive counselling at no cost to myself, if I may experience any discomfort as a result of questions asked.	
I am fully aware that the information I will provide will remain confidential and that my personal details will not be made known.	
I understand that my participation is voluntary.	
I agree to take part in the above study.	
I disagree to take part in the above study.	

_____ _____ _____
Name of participant **Signature** **Date**

_____ _____ _____
Name of fieldworker **Signature** **Date**

This research has been approved by the University of the Western Cape's Senate Research Committee (reference number 15/2/5).

Annex B - Questionnaires

HOUSEHOLD QUESTIONNAIRE 1

Dateint	Date of interview	DD / MM / YY ☐☐/☐☐/☐☐			
Teamid	Team identifier	☐☐	intid	Interviewer identifier	☐☐
Proid	Province	Gauteng……..1 Eastern Cape…….2			☐☐
Eaid	Enumeration area identifier	☐☐☐☐☐☐☐☐			
areaname	Mainplace (area/village/town)	_____			
Areacode	Mainplace code	☐☐☐☐☐☐			
hh	Household identifier	☐☐	GPS	GPS coordinates	☐☐☐-☐☐☐

Hello, my name is _____. I work for the UWC. We are interested in learning about your family and food in your house. Who is the person in your household who is most knowledgeable about purchasing and preparing most of the food for your family? For example, we would like to know how much is purchased and how long it lasts for foods like oil, maize meal, and wheat flour. May we speak to this person? *(Do not interview a household member <18 years of age.)*

If this person is available:
- *Ask him/her to complete Consent Form and Household Questionnaires 1 and 2;*
- *Ask all eligible women in the household to complete Consent Form and Female Respondent Questionnaire.*

If this person is not available:
- *Ask another household member to complete Consent Form and Household Questionnaire 1;*
- *Ask all eligible women in the household to complete Consent Form and Female Respondent Questionnaire;*
- *Schedule a second visit to return to complete the Household Questionnaire 2 when the person knowledgeable about food in the household is available.*

On the second visit:
- *If the person knowledgeable about food is available, ask him/her to complete Consent Form and Household Questionnaire 2. If that person is not available, ask the next most knowledgeable person.*
- *If there are no adult members of the household who are familiar with food preparation and purchasing, have another household member to complete Consent Form and Household Questionnaire 2.*

cons	Written consent obtained?	Yes……1 No……2	If **yes**, begin If **no**, end
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	Outcome of HH questionnaire *Fill in only after questionnaire has been completed for this household.*	Completed.....1 Refused.....2 No household member at home or no adult respondent at home at time of visit(s).....3 Household member incapacitated or intoxicated……..4 Dwelling vacant for extended period of time.....5 Household has permanently moved or address is not a dwelling...6 Dwelling destroyed.....7 Other: _____.....99	If 3 or 4, return later for a second visit. If 5, 6 or 7,go on to next selected household.
		Supervisor check	Initial _____

HOUSEHOLD ROSTER

Now we would like some information about persons who usually stay in your household. This will include anybody who sleeps in this household for at least 4 nights of the week and eats from the same pot of food.
Start by listing the head of the household.

Line number	A. Name of person	B. Sex	C. C. Age *(in years OR months). Record in months if <5 years or <60 months*							
			Years	Months	D. Currently attending school or college?	E. Highest educational level (grade) completed				
01	Head of Household	M / F	☐☐		Yes……1 No…….2	0	5	7	12	>12
02		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
03		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
04		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
05		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
06		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
07		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
08		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
09		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
10		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
11		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
12		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12

13		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
14		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
15		M / F	☐☐	☐☐	Yes……1 No…….2	0	5	7	12	>12
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 pot of food for at least 4 days of the week? *If YES, add name to table.*									
Note: Add a new page if more people in the household										
Lnr	Line number of respondent *(WRITE IN THE NUMBER FROM THE HOUSEHOLD ROSTER)*				☐☐					

Check the roster regarding completion!

SHORT BIRTH HISTORY			
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 **household characteristics** module.
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? *(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 / Parafin.....5 Coal / Lignite.....6 Candles.....7 Firewood.....8 Straw / Shrubs / Grass.....9 Animal dung.....10 Sun/solar cooker……..11 No food cooked in household.....12 Don't know.....88 Other: _____ 99	
hc3	Does your household or anyone in the household have … ? ***(PROMPT FOR EACH ITEM**; RECORD ALL ITEMS IN THE HOUSEHOLD.)* *(CIRCLE ONLY **ONE** ANSWER FOR EACH ITEM.)*	A. Radio (other than a car radio) Yes……..1 No……...2 B. Television Yes……..1 No……...2 C. DVD player Yes……..1 No……...2 D. MNet-DSTV subscription Yes……..1 No……...2 E. Air conditioner Yes……..1 No……...2 F. Computer / desktop / laptop Yes……..1 No……...2 G. Vacuum cleaner / floor polisher Yes……..1 No……...2 H. Dishwashing machine Yes……..1 No……...2 I. Tumble dryer Yes……..1 No……...2 J. Home telephone (landline) Yes……..1 No……...2 K. Deep freezer Yes……..1 No……...2 L. Refrigerator / combined fridge/freezer Yes…...1 No……..2	

	Does your household or anyone in the household have … ? ***(PROMPT FOR EACH ITEM**; RECORD ALL ITEMS IN THE HOUSEHOLD.)* *(CIRCLE ONLY **ONE** ANSWER FOR EACH ITEM.)*		
		M. Cooking stove (electric) Yes……..1 No……..2	
		N. Cooking stove (gas) Yes……..1 No……..2	
		O. Microwave oven Yes……..1 No……..2	
		P. Built-in kitchen sink Yes……..1 No……..2	
		Q. Home security system Yes……..1 No……..2	
		R. Home theatre system Yes……..1 No……..2	
		S. Bicycle or tricycle Yes……..1 No……..2	
		T. Motorcycle, scooter, auto-rikshaw, car, truck, jeep, or tractor Yes……..1 No……..2	
		U. Boat with motor Yes……..1 No……..2	
		V. Canoe or fishing nets Yes……..1 No……..2	
		W. Animal-drawn cart Yes……..1 No……..2	
		X. Domestic worker Yes……..1 No……..2	
		Y. Hot water running from a geyser Yes……..1 No……..2	
		Z. Cell phone Yes……..1 No……..2	
		AA. 2 cell phones in household Yes……...1 No……...2	
		BB. 3 or more cell phones in household Yes……1 No……2	
hc3a	Does your household live in a single house, cluster house or town house? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……..1 No……2	

hc4	*WHAT IS THE MAIN MATERIAL OF THE FLOOR OF THE DWELLING?* *(OBSERVATION.)* *(CIRCLE ONLY **ONE** ANSWER.)*	Natural floor Earth / sand.....1 Dung.....2 Rudimentary floor Wood planks.....3 Palm / bamboo.....4 Finished floor Parquet / polished wood.....5 Vinyl / asphalt strips.....6 Ceramic tiles.....7 Cement.....8 Carpet.....9 Other: _____ 99	
hc5	*WHAT IS THE MAIN MATERIAL OF THE ROOF OF THE DWELLING?* *(OBSERVATION.)* *(CIRCLE ONLY **ONE** ANSWER.)*	Natural roofing No roofing.....1 Thatch / palm leaves.....2 Sod.....3 Rudimentary roofing Rustic mat.....4 Palm / bamboo.....5 Wood planks.....6 Cardboard.....7 Finished roofing Metal.....8 Wood.....9 Calamine / cement fiber.....10 Ceramic tiles.....11 Cement.....12 Roofing shingles.....13 Other: _____ 99	
hc6	*WHAT IS THE MAIN MATERIAL OF THE EXTERIOR WALLS OF THE DWELLING?* *(OBSERVATION.)* *(CIRCLE ONLY **ONE** ANSWER.)*	Plastic / Cardboard……..... 1 Mud..... 2 Mud and cement..... 3 Corrugated iron / zinc..... 4 Prefab ..... 5 Bare brick or cement blocks…… 6 Plaster / finished..... 7 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 Tube well / borehole.....4 Dug well Protected /covered well.....5 Unprotected / open well.....6 Water from spring Protected spring.....7 Unprotected spring.....8 Rainwater.....9 Tankertruck.....10 Cart with small tank.....11 Surface water River / stream .....12 Dam .....13 Lake / Pond .....14 Water vendor / Bottled / sachet .....15 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 **usually** do anything to your drinking water to make it safer to drink? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes.....1 No.....2	If **No**, skip to **w6**
w5	What do you **usually** do to the water to make it safer to	A. Boil Yes / No B. Add bleach / chlorine Yes / No C. Strain through a cloth Yes / No	

	drink? *(DO **NOT** PROMPT. PROBE "ANYTHING ELSE?")* *(CIRCLE YES FOR EACH ITEM MENTIONED AND NO FOR EACH ITEM NOT MENTIONED.)*	D. Use a water filter (ceramic / sand / composite ...) Yes / No E. Solar disinfection Yes / No F. Let it stand and settle Yes / No G. Don't know Yes / No H. Other: _____ Yes / No	
w6	What kind of toilet facility do members of your household usually use? *(DO **NOT** PROMPT.)* *(CIRCLE ONLY **ONE** ANSWER.)*	Flush / pour flush toilet Flush to piped sewer system.....1 Flush to septic tank.....2 Flush to pit latrine.....3 Flush to elsewhere.....4 Flush, don't know where.....5 Pit latrine Ventilated improved pit latrine.....6 Pit latrine with slab.....7 Pit latrine without slab / open pit.....8 Composting toilet.....9 Bucket toilet.....10 Hanging toilet / hanging latrine.....11 No facilities / bush / field.....12 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	How long does it take to travel to the nearest primary health care facility? *(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**, skip to **income** module.

HOUSEHOLD INCOME			
N°	QUESTIONS	ANSWERS	SKIPS
hi1	Do any members of this household receive any grants? *(CIRCLE **ALL** RESPONSES THAT APPLY.)*	None……1 Child support……..2 Social relief…….3 Disability……4 Old age pension……5 Don't know……88 Other _____.....99	
hi2	How many people contribute to the total income (money) in this household? *(CIRCLE ONLY **ONE** ANSWER.)*	None……1 1 person……..2 2 persons……3 3-4 persons……4 5-6 persons……...5 More than 6 persons……6 Don't know……88 Other: _____.....99	
hi3	What is the total household income per month before deductions (including wages, rent, grants, sales of vegetables, etc.) of everybody in the household added together? If you can tell me the amount off hand please do so, otherwise I will read out various income brackets. Please stop me when I say the amount that you think represents the total monthly income of the household. *(CIRCLE ONLY **ONE** ANSWER.)*	Less than R3001……..……..1 R3001-4000……..2 R4001-5000……..3 R5001-R7500……4 R7501-R10,000……5 R10,0001-R15,000……..6 R15,001-R20,000……7 R20,0001-R30,000……..8 R30,0001-R40,000……..9 R40,001 or more……10 Don't know……..88	

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

HOUSEHOLD QUESTIONNAIRE 2					
dateint	Date of interview	DD / MM / YY			☐☐/☐☐/☐☐
teamid	Team identifier	☐☐	intid	Interviewer identifier	☐☐
proid	Province	Gauteng…….1 Eastern Cape….2			☐☐
eaid	Enumeration area identifier	☐☐☐☐☐☐☐☐			
areaname	Mainplace (area/village/town)	_____			
areacode	Mainplace code	☐☐☐☐☐☐			
hh	Household identifier	☐☐			
lnr	Line number of respondent *Write in the number from the household roster in household questionnaire 1.*				☐☐
cons	Written consent obtained?	Yes…….1 No……2			If **yes**, begin If **no**, end
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*				☐
outhh2	Outcome of HH2 questionnaire *Fill in only after questionnaire has been completed for this household.*	Completed.....1 Refused.....2 No household member at home or no adult respondent at home at time of visit(s).....3 Household member incapacitated or intoxicated……..4 Other: _____....._.....99			If 3 or 4, return later for a second visit.
		Supervisor check			Initial for yes _____

“I would like to ask some questions about the availability of food in your household over the last month.”

HOUSEHOLD HUNGER SCALE			
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 ☐☐	

"Now I'm going to ask you some questions about food items including cooking oil, maize meal, bread flour, bread and salt. If you have any of these food items in your household, please bring them here now before we start."

OIL FORTIFICATION COVERAGE			
N°	QUESTIONS	ANSWERS	SKIPS
of1	First I would like to talk with you about cooking oil. Does your household prepare foods using cooking oil? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes, regularly……...1 Yes, sometimes ……..……2 No, never ……..3	If **3**, skip to **maize meal** module.
of2	What is the **main** type of cooking **oil** that is used in your household for most meals on most days? *(CIRCLE ONLY **ONE** ANSWER.)*	Refined palm oil…….....1 Soybean oil.....2 Groundnut oil…….3 Sunflower oil……..4 Olive oil.....5 Canola oil……6 Coconut oil……..……7 Vegetable oil……..…….8 Don't know / Don't remember.....88 Other: _____.....99	
of3	Can you show me this **main** cooking **oil**? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……..1 No……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):* The **last time** your household got [MAIN OIL TYPE], where did you get it from? *(CIRCLE ONLY **ONE** ANSWER.)*	Purchased…….....1 Made it at home.....2 Received from food aid.....3 Don't know / Don't remember.....88 Other: _____.....99	If **2,** skip to **maize meal** module.
of5	*(IF MAIN OIL TYPE IS AVAILABLE):* When your household got this [MAIN OIL TYPE], how was it packaged?	Original package……...1 Re-packaged……..2 My own container.....3 Don't know	

	(IF MAIN OIL TYPE IS NOT AVAILABLE): The **<u>last time</u>** your household got [MAIN OIL TYPE], how was it packaged? *(READ **<u>ALL</u>** RESPONSES)* *(CIRCLE ONLY **<u>ONE</u>** ANSWER.)*	.....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 **<u>last time</u>** your household got [MAIN OIL 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. Kg.....1 g.....2 L.....3 mL.....4	
of7	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	
of8	*(IF MAIN OIL TYPE IS AVAILABLE):* ***<u>OBSERVE BRAND</u>***. *(IF MAIN OIL TYPE IS NOT AVAILABLE, **<u>ASK THE RESPONDENT</u>**):* What is the brand of this [MAIN OIL TYPE]? *(WRITE IN ONLY **<u>ONE</u>** BRAND NAME.)*	Brand name (write in) …… (Code assigned) ☐☐ Don't know .....88 Other: _____.....99	
of9	*(IF MAIN OIL TYPE IS AVAILABLE):* ***<u>OBSERVE PRODUCER</u>***. *(IF MAIN OIL TYPE IS NOT*	Producer name (write in) …… (Code assigned) ☐☐	If **oil is not available,** skip to

	*AVAILABLE, **ASK THE RESPONDENT**):* Who is the producer of this [MAIN OIL TYPE]? *(WRITE IN ONLY **ONE** ANSWER.)*	Don't know .....88 Other: _____.....99	**maize meal** module.
of10	***LOOK FOR FORTIFICATION LOGO**.* *(CIRCLE ONLY **ONE** ANSWER.)*	Logo not observed (labelled)……1 Logo not observed (no label)……2 Logo observed……..…….....3	
of11	May I take a small sample? *(IF 'YES', TAKE SAMPLE AND STICK OIL LABEL ON SAMPLE CONTAINER.)*	Sample taken……1 No sample taken……..……2	

MAIZE MEAL FORTIFICATION COVERAGE			
N°	QUESTIONS	ANSWERS	SKIPS
mf1	Now, I would like to talk with you about maize meal. Does your household prepare foods using maize meal (e.g. porridge, pap)? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes, regularly……...1 Yes, sometimes ……..……2 No, never ……..3	If **3,** skip to **cake flour** module.
mf1a	What types of maize meal are used in your household? *(CIRCLE **ALL** RESPONSES THAT APPLY.)*	Sifted……..1 Supersifted……2 Course / Braaipap……..……..……..3 Instant / Quick cooking...……..……..4 Other:_____99	
mf1b	What is the **main** type of **maize meal** that is used in your household? *(CIRCLE ONLY **ONE** ANSWER.)*	Sifted……..1 Supersifted……2 Course / Braaipap……..……..……..3 Instant / Quick cooking...……..……..4 Other:_____99	
mf2	Can you show me this **main maize meal**? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……..1 No……2	
mf3	*(IF MAIZE MEAL IS AVAILABLE):* When your household got this maize meal, where did you get it from? *(IF MAIZE MEAL IS NOT AVAILABLE):* The **last time** your household got maize meal, where did you get it from? *(CIRCLE ONLY **ONE** ANSWER.)*	Purchased…….....1Grinded it at home.....2 Received from food aid.....3 Don't know / Don't remember.....88 Other: _____.....99	If **2,** skip to **cake flour** module.

mf4	*(IF MAIZE MEAL IS AVAILABLE):* When your household got this maize meal, how was it packaged? *(IF MAIZE MEAL IS NOT AVAILABLE):* The **last time** your household got maize meal, how was it packaged? *(READ **ALL** RESPONSES)* *(CIRCLE ONLY **ONE** ANSWER.)*	Original package……....1 Re-packaged……..2 My own container.....3 Don't know .....88 Other: _____.....99	

mf5	*(IF MAIZE MEAL IS AVAILABLE):* When your household got this maize meal, how much did you get? *(IF MAIZE MEAL IS NOT AVAILABLE):* The **last time** your household got maize meal, 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. Kg.....1 g.....2	
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 MEAL IS AVAILABLE):* ***OBSERVE BRAND***. *(IF MAIZE MEAL IS NOT AVAILABLE, **ASK THE RESPONDENT**):* What is the brand of this maize meal? *(WRITE IN ONLY **ONE** ANSWER.)*	Brand name (write in) ..... (Code assigned) ☐☐ Don't know .....88 Other: _____.....99	
mf8	*(IF MAIZE MEAL IS AVAILABLE):* ***OBSERVE PRODUCER***. *(IF MAIZE MEAL IS NOT AVAILABLE, **ASK THE RESPONDENT**):* Who is the producer of this maize meal? *(WRITE IN ONLY **ONE** ANSWER.)*	Producer name (write in) ..... (Code assigned) ☐☐ Don't know .....88 Other: _____.....99	If **maize meal is not available**, skip to **cake flour** module.
mf9	***LOOK FOR FORTIFICATION LOGO***. *(CIRCLE ONLY **ONE** ANSWER.)*	Logo not observed (labelled)……1 Logo not observed (no label)……2 Logo observed…….…….....3	

mf10	May I take a small sample? *(IF 'YES', TAKE SAMPLE AND STICK MAIZE MEAL LABEL ON SAMPLE CONTAINER.)*	Sample taken……1 No sample taken……..……2	

CAKE FLOUR COVERAGE			
N°	QUESTIONS	ANSWERS	SKIPS
cf1	Now, I would like to talk with you about cake flour. Does your household prepare foods using cake flour (e.g. bread or cakes)? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes, regularly……...1 Yes, sometimes ……..……2 No, never ……..3	If **3,** skip to **bread flour** module .
cf2	What products does your household prepare using cake flour? *(CIRCLE **ALL** RESPONSES THAT APPLY.)*	Bread……..1 Fat cakes……2 Dry biscuits……3 Cake / confectionary……4 Other:_____99	
cf3	Can you show me what **main cake flour** your household uses? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……..1 No……2	
cf4	*(IF CAKE FLOUR IS AVAILABLE):* When your household got this cake flour, where did you get it from? *(IF CAKE FLOUR IS NOT AVAILABLE):* The **last time** your household got cake flour, where did you get it from? *(CIRCLE ONLY **ONE** ANSWER.)*	Purchased…….....1 Made at home…….....2 Received from food aid.....3 Don't know / Don't remember.....88 Other: _____.....99	
cf5	*(IF CAKE FLOUR IS AVAILABLE):* When your household got this cake flour, how was it packaged?	Original package……....1 Re-packaged……..2 My own container.....3 Don't know .....88 Other: _____.....99	

	(IF CAKE FLOUR IS NOT AVAILABLE): The **last time** your household got cake flour, how was it packaged? *(READ **ALL** RESPONSES)* *(CIRCLE ONLY **ONE** ANSWER.)*		

cf6	*(IF CAKE FLOUR IS AVAILABLE):* When your household got this cake flour, how much did you get? *(IF CAKE FLOUR IS NOT AVAILABLE):* The **last time** your household got cake 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. Kg.....1 g.....2	
cf7	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	
cf8	*(IF CAKE FLOUR IS AVAILABLE):* ***OBSERVE BRAND***. *(IF CAKE FLOUR IS NOT AVAILABLE,* ***ASK THE RESPONDENT****):* What is the brand of this cake flour? *(WRITE IN ONLY* ***ONE*** *ANSWER.)*	Brand name (write in) ..... (Code assigned) ☐☐ Don't know .....88 Other: _____.....99	
cf9	*(IF CAKE FLOUR IS AVAILABLE):* ***OBSERVE PRODUCER***. *(IF CAKE FLOUR IS NOT AVAILABLE,* ***ASK THE RESPONDENT****):* Who is the producer of this cake flour? *(WRITE IN ONLY* ***ONE*** *ANSWER.)*	Producer name (write in) ..... (Code assigned) ☐☐ Don't know .....88 Other: _____.....99	

BREAD FLOUR FORTIFICATION COVERAGE			
N°	QUESTIONS	ANSWERS	SKIPS
wf1	Now, I would like to talk with you about bread flour. Does your household prepare foods using bread flour (e.g. bread)? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes, regularly……...1 Yes, sometimes ……..……2 No, never ……..3	If **3,** skip to **bread** module .
wf2	Can you show me what **main bread flour** your household uses? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……...1 No……2	
wf3	*(IF BREAD FLOUR IS AVAILABLE):* When your household got this bread flour, where did you get it from? *(IF BREAD FLOUR IS NOT AVAILABLE):* The **last time** your household got bread flour, where did you get it from? *(CIRCLE ONLY **ONE** ANSWER.)*	Purchased…….....1 Made it at home.....2 Received from food aid.....3 Don't know / Don't remember.....88 Other: _____.....99	If **2,** skip to **bread** module.
wf4	*(IF BREAD FLOUR IS AVAILABLE):* When your household got this bread flour, how was it packaged? *(IF BREAD FLOUR IS NOT AVAILABLE):* The **last time** your household got bread flour, how was it packaged? *(READ **ALL** RESPONSES)* *(CIRCLE ONLY **ONE** ANSWER.)*	Original package……...1 Re-packaged……..2 My own container.....3 Don't know .....88 Other: _____.....99	
wf5	*(IF BREAD FLOUR IS AVAILABLE):* When your household got this bread flour, how much did you get? *(IF BREAD FLOUR IS NOT AVAILABLE):* The **last time** your household got	A. Quantity ☐☐☐☐ B. Kg.....1 g.....2	

	bread flour, how much did you get? *(SHOW EXAMPLES OF COMMONLY USED CONTAINERS AND MEASURES.)* *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*		
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 BREAD FLOUR IS AVAILABLE):* ***OBSERVE BRAND****.* *(IF BREAD FLOUR IS NOT AVAILABLE,* ***ASK THE RESPONDENT****):* What is the brand of this bread flour? *(WRITE IN ONLY* ***ONE*** *ANSWER.)*	Brand name (write in) ..... (Code assigned) ☐☐ Don't know .....88 Other: _____.....99	
wf8	*(IF BREAD FLOUR IS AVAILABLE):* ***OBSERVE PRODUCER****.* *(IF BREAD FLOUR IS NOT AVAILABLE,* ***ASK THE RESPONDENT****):* Who is the producer of this bread flour? *(WRITE IN ONLY* ***ONE*** *ANSWER.)*	Producer name (write in) ..... (Code assigned) ☐☐ Don't know .....88 Other: _____.....99	If **bread flour is not available,** skip to **bread** module.
wf9	***LOOK FOR FORTIFICATION LOGO****.* *(CIRCLE ONLY* ***ONE*** *ANSWER.)*	Logo not observed (labelled)……1 Logo not observed (no label)……2 Logo observed…….…….....3	
wf10	May I take a small sample? *(IF 'YES', TAKE SAMPLE AND STICK BREAD FLOUR LABEL ON SAMPLE CONTAINER.)*	Sample taken……1 No sample taken……..……2	

BREAD FORTIFICATION COVERAGE			
N°	QUESTIONS	ANSWERS	SKIPS
br1	Now, I would like to talk with you about bread. Does your household eat bread at home? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes, regularly……...1 Yes, sometimes ……..……2 No, never ……..3	If **3,** skip to **salt** module .
br2	Can you show me what **main bread** your household eats? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……..1 No……2	
br3	*(IF BREAD IS AVAILABLE):* When your household got this bread, where did you get it from? *(IF BREAD IS NOT AVAILABLE):* The **last time** your household got bread, where did you get it from? *(CIRCLE ONLY **ONE** ANSWER.)*	Purchased…….....1 Made it at home.....2 Received from food aid.....3 Don't know / Don't remember.....88 Other: _____.....99	If **2,** skip to **salt** module.
br4	*(IF BREAD IS AVAILABLE):* When your household got this bread, how was it packaged? *(IF BREAD IS NOT AVAILABLE):* The **last time** your household got bread, how was it packaged? *(READ **ALL** RESPONSES)* *(CIRCLE ONLY **ONE** ANSWER.)*	Packaged in branded bag……...1 Packaged in clear plastic bag……..2 Unpackaged….....3 Don't know .....88 Other: _____.....99	
br5	*(IF BREAD IS AVAILABLE):* When your household got this bread, how much did you get? *(IF BREAD IS NOT AVAILABLE):* The **last time** your household got bread, how much did you get? *(SHOW EXAMPLES OF*	A. Quantity ☐☐☐☐ B. Kg.....1 g.....2 Loaf……3 ½ loaf……4	

	COMMONLY USED CONTAINERS AND MEASURES.) *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*		
br6	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	
br7	*(IF BREAD IS AVAILABLE):* ***OBSERVE BRAND****.* *(IF BREAD IS NOT AVAILABLE,* ***ASK THE RESPONDENT****):* What is the brand of this bread? *(WRITE IN ONLY* ***ONE*** *ANSWER.)*	Brand name (write in) ..... (Code assigned) ☐☐ Don't know .....88 Other: _____.....99	
br8	*(IF BREAD IS AVAILABLE):* ***OBSERVE PRODUCER****.* *(IF BREAD IS NOT AVAILABLE,* ***ASK THE RESPONDENT****):* Who is the producer of this bread? *(WRITE IN ONLY* ***ONE*** *ANSWER.)*	Producer name (write in) ..... (Code assigned) ☐☐ Don't know .....88 Other: _____.....99	If **bread is not available,** skip to **salt** module.
br9	***LOOK FOR FORTIFICATION LOGO****.* *(CIRCLE ONLY* ***ONE*** *ANSWER.)*	Logo not observed (labelled)……1 Logo not observed (no label)……2 Logo observed…….…….....3	
br10	May I take a small sample? *(IF 'YES', TAKE SAMPLE AND STICK BREAD LABEL ON SAMPLE CONTAINER.)*	Sample taken……1 No sample 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……...1 Yes, sometimes ……..……2 No, never ……..3	If **3,** skip to **logo** module .
si2	Can you show me what **main salt** your household uses? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes…….1 No……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 Made it at home.....2 Received from food aid.....3 Don't know / Don't remember.....88 Other: _____.....99	If **2,** skip to **logo** module.
si4	*(IF SALT IS AVAILABLE):* When your household got this salt, how was it packaged? *(IF SALT IS NOT AVAILABLE):* The **last time** your household got salt, how was it packaged? *(READ **ALL** RESPONSES)* *(CIRCLE ONLY **ONE** ANSWER.)*	Original package……...1 Re-packaged……..2 My own container.....3 Don't know .....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*	A. Quantity ☐☐☐☐ B. Kg.....1 g.....2	

	AND MEASURES.) *(A. WRITE IN THE NUMBER.)* *(B. CIRCLE THE UNIT.)*		
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 AVAILABLE):* ***OBSERVE BRAND**.* *(IF SALT IS NOT AVAILABLE, **ASK THE RESPONDENT**):* What is the brand of this salt? *(WRITE IN ONLY **ONE** ANSWER.)*	Brand name (write in) ..... (Code assigned) ☐☐ Don't know .....88 Other: _____.....99	
si8	*(IF SALT IS AVAILABLE):* ***OBSERVE PRODUCER**.* *(IF SALT IS NOT AVAILABLE, **ASK THE RESPONDENT**):* Who is the producer of this salt? *(WRITE IN ONLY **ONE** ANSWER.)*	Producer name (write in) ..... (Code assigned) ☐☐ Don't know .....88 Other: _____.....99	If **salt is not available,** skip to **logo** module.
si9	***LOOK FOR FORTIFICATION LOGO**.* *(CIRCLE ONLY **ONE** ANSWER.)*	Logo not observed (labelled)……1 Logo not observed (no label)……2 Logo observed…….…….....3	
si10	May I take a small sample? *(IF 'YES', TAKE SAMPLE AND STICK SALT LABEL ON SAMPLE CONTAINER.)*	Sample taken……1 No sample taken…….……2	

FORTIFICATION LOGO KNOWLEDGE AND INFLUENCE			
lk1	*(SHOW FORTIFICATION LOGO.)* Have you ever seen this logo? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……1 No……..2	If **no**, skip to **lk2**.
lk1a	Where did you hear about it or see it? *(DO NOT READ RESPONSES TO RESPONDENT.)* *(CIRCLE **ALL** RESPONSES THAT APPLY.)*	Television……1 Radio……2 Campaign of Department of Health……..3 Health facility / clinic ……...4 Newspaper / magazine……..5 Other: _____.....99	
lk2	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 The food is better for your health than a similar food without the logo……..7 The food tastes good……8 The food is more expensive than a similar food without the logo……9 The food is good for the growth and development of children……10 Happy / smiling people / family……11 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	
lk4	Do you know that the government has a law that important vitamins and minerals must be added to maize meal and bread flour?	Yes……1 No……..2	If **no**, then **end**.

	*(CIRCLE ONLY **ONE** ANSWER.)*		
lk4a	Where did you hear about it or see it? *(DO NOT READ RESPONSES TO RESPONDENT.)* *(CIRCLE **ALL** RESPONSES THAT APPLY.)*	Television……1 Radio……2 Campaign of Department of Health……3 Health professional in health facility/clinic (medical doctor / nurse / health worker / pharmacist / etc.)…..4 Other: _____.....99	

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

SOUTH AFRICA FACT COVERAGE SURVEY 2015

FEMALE RESPONDENT (18 TO 49 YEARS) QUESTIONNAIRE

dateint	Date of interview	DD / MM / YY ☐☐/☐☐/☐☐			
teamid	Team identifier	☐☐	intid	Interviewer identifier	☐☐
proid	Province	Gauteng…….1 Eastern Cape….2			☐☐
eaid	Enumeration area identifier	☐☐☐☐☐☐☐☐			
areaname	Mainplace (area/village/town)	_____			
areacode	Mainplace code	☐☐☐☐☐☐			
hh	Household identifier	☐☐			
lnr	Line number of respondent *Write in the number from the household roster in household questionnaire 1.*				☐☐
cons	Written consent obtained?	Yes……1 No……2			If **yes**, begin If **no**, end
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*				☐
outfem	Outcome of female respondent questionnaire *Fill in only after questionnaire has been completed for this woman.*	Completed.....1 Refused.....2 No household member at home or no adult respondent at home at time of visit(s).....3 Household member incapacitated or intoxicated……..4 Other: _____.....99			If 3 or 4, return later for a second visit.
		Supervisor check			Initial for yes _____

HEALTH DATA			
N°	QUESTIONS	ANSWERS	SKIPS
hd1	Are you currently pregnant? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……..1 No……2	
hd2	Are you currently breastfeeding? *(CIRCLE ONLY **ONE** ANSWER.)*	Yes……..1 No……2	

INDIVIDUAL BREAD FLOUR CONSUMPTION

In the last 7 days, how many times did you eat products made from bread flour, such as [FOOD ITEM]?

(IF FREQUENCY = 00, DON'T ASK THE PORTION SIZE)

Usually how much of [FOOD ITEM] did you eat at one sitting? *(SHOW PICTURES OF PORTIONS!)*

REPEAT QUESTIONS FOR EACH FOOD ITEM LISTED BELOW.

N°	ITEMS	1. Frequency (# times)	2. Portion size
wfc1	Bread slice (white)	☐☐	☐
wfc2	Bread slice (brown)	☐☐	☐
wfc3	Bread homemade (Umbhaqu)	☐☐	☐
wfc4	Steamed bread (Doboro / Idombolo)	☐☐	☐
wfc5	Kota (bread filled with hot chips) white	☐☐	☐
wfc6	Kota (bread filled with hot chips) brown	☐☐	☐
wfc7	Rusks (made with bread flour)	☐☐	☐
wfc8	Vetkoek (made with bread flour)	☐☐	☐
wfc21	Others: _____	☐☐	☐

DIETARY DIVERSITY

Since the time you woke up yesterday to when you woke up today, did you have any of the following things to eat or drink?

I am interested in whether you had the item I mention, even if it was combined with other foods. For example, if you ate a millet porridge made with a mixed vegetable sauce, you should reply yes to any food I ask about that was an ingredient in the porridge or sauce. Please do not include any food used in a small amount for seasoning or condiments (like chilies, spices, herbs, or fish powder), I will ask you about those foods separately.

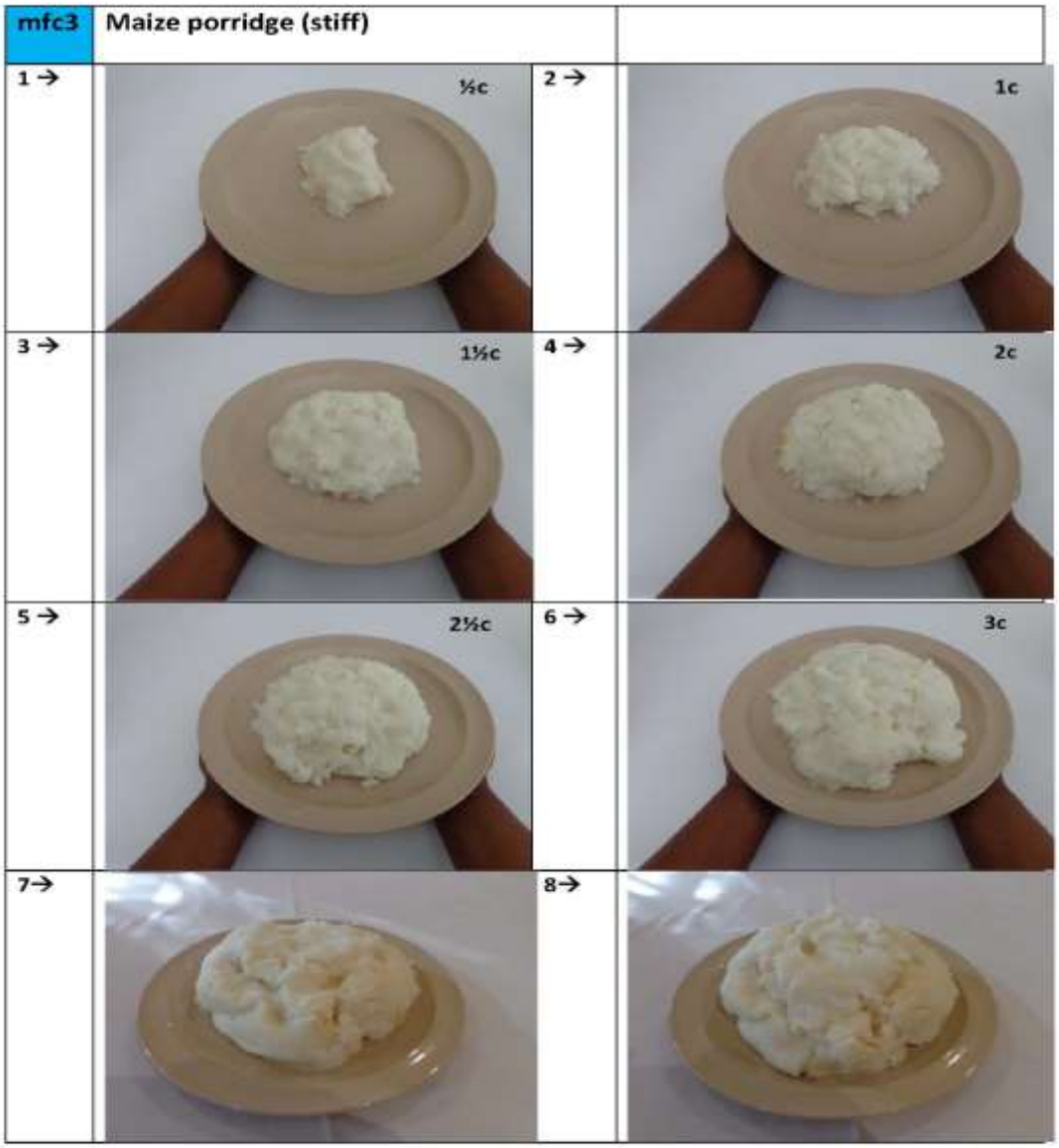
*(READ **ALL** QUESTIONS. CIRCLE ONLY **ONE** ANSWER FOR EACH.)*

N°	ITEMS	
dd1	Any bread, rice noodles, biscuits, or any other foods made from millet, sorghum, maize, rice, wheat?	Yes…….....1 No……..2
dd2	Any potatoes, white sweet potatoes, or any other foods made from roots or tubers?	Yes…….....1 No……..2
dd3	Any food made from vegetables or root crops with yellow or orange flesh such as carrots, pumpkin, orange sweet potatoes?	Yes…….....1 No……..2
dd4	Any food made from dark green leafy vegetables such as potato leaves, kale, spinach and other locally available dark green leafy vegetables such as imifino or marog?	Yes…….....1 No……..2
dd5	Any other vegetables?	Yes…….....1 No……..2
dd6	Any food made from fruits with yellow or orange flesh such as mangoes, papaya, pawpaw, squash or melon?	Yes…….....1 No……..2
dd7	Any other fruits?	Yes…….....1 No……..2
dd8	Any beef, pork, lamb, goat, rabbit wild game, chicken, duck, or other birds?	Yes…….....1 No……..2
dd9	Any liver, kidney, heart, or other organ meats?	Yes…….....1 No……..2
dd10	Any eggs?	Yes…….....1 No……..2
dd11	Any fresh, canned or dried fish or shellfish?	Yes…….....1 No……..2
dd12	Any foods made from beans, peas, lentils, soya or peanuts?	Yes…….....1 No……..2
dd13	Any cashew, walnuts, almonds, pecan nuts, seeds or any other foods made from these nuts and seeds?	Yes…….....1 No……..2
dd14	Any cheese, yogurt, milk or other milk products?	Yes…….....1 No……..2
dd15	Any foods made with oil, fat, or butter?	Yes…….....1 No……..2
dd16	Any sugar or honey?	Yes…….....1 No……..2
dd17	Any other foods, such as condiments, coffee, tea?	Yes…….....1 No……..2
dd18	Red palm oil	Yes…….....1 No……..2

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

Annex C: Example photo grid used with female questionnaire

A photo grid such as this were prepared for each of 15 flour-containing foods that women were interviewed about in the Female Respondent Questionnaire.



Annex D: In-depth description of analytical methods applied to food samples

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

Date: 2015-11-25

1. Introduction

GAIN has collected samples of staple foods from households in South Africa to assess the coverage of fortified foods and the levels of micronutrients in these foods. The samples of salt, bread and flour were sent to BioAnalyt (http://www.bioanalyt.com)

the measurement of iodine and iron levels. Salt 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. Flour and bread samples were analyzed by an accredited commercial laboratory.

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. 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 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 (I_2) and triiodide (I_3^-), 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 (1).

The salt samples were analyzed individually and part of them were pooled according to customer specifications. 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.

The composite samples were prepared by weighing in exactly 0.5 g of each individual salt sample and mixing together for 5 minutes to ensure homogeneity. The composite samples were also diluted 1:10 with water. Exactly 2 g of salt was dissolved completely in 18 mL of water. The salt solutions were injected and analyzed according with iCheck Iodine.

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.

3.2 Analysis of Iron in Bread, Wheat and Maize Flour

An external laboratory (SGS INSTITUT FRESENIUS GmbH) measured the iron content in individual as well as in pooled flour samples and in individual bread samples. The expected type of iron in these samples is electrolytic iron. This iron type cannot be reliable measured using iCheck technology. The external laboratory analyzed the flour samples according to DIN EN 15510 mod. ICP/OES method.

The maize flour samples were pooled according to customer specification by BioAnalyt. Samples were shaken briefly to ensure homogeneity and 10 g of each individual samples was used to make the composite sample. The resulting composite samples were shaken vigorously for 2 minutes to ensure homogeneous mixing. Unfortified samples were also measured to assess the level of intrinsic iron, since the methodology does not allow for differentiation of added and natural iron.

4. Results

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

Salt:

A total of 555 salt (545 individual and 10 pooled) 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 triplicate measurement of 15 pooled salt samples, is 99%. The trueness, as assessed by the recovery with iodized salt control sample, is 96%±7%.

Bread:

A total of 209 bread samples were analyzed for total iron content. The average iron content in the bread was measured to be 44 ppm (mg Fe per kg of fresh bread). 39% moisture content is expected in the bread as per South Africa regulations. For the analysis of electrolytic iron in bread, the average precision is 91%±8% (assessed by duplicate measurement of 20 samples).

Wheat Flour:

A total of 43 wheat flour samples were analyzed for total iron content. The average intrinsic iron content of the flour was measured to be 19.5±6.9 ppm (mg Fe/kg). This value was obtained by taking the average tested value of 4 different unfortified bread flours. The average precision, as assessed by measuring 5 wheat flour samples in duplicates is 95%±5%. The average added iron content in the wheat flour was measured to be 38 ppm.

Maize Flour:

A total of 535 maize flour samples (525 individual and 10 pooled) were analyzed for total iron content. The intrinsic iron content of the maize flour was measured to be 6.4±2.5 ppm (mg

Fe/kg). The precision, as assessed by measuring 52 maize flour samples in duplicates, is 93%±7%. The average of added iron content in maize flour was measured to be 28 ppm.

The trueness for all iron analysis, as assessed by the recovery with spiked wheat flour sample, is 111%±3%.

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 over 1300 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.

Annex E: Timeline

Main survey activities were carried out between March and July 2015.

Activities	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**
Finalize survey areas and sample size	X					
Submit applications for ethical review and country approvals	X	X				
Collect recipes of products made from staples that are not prepared in the household and take pictures of typical portion sizes	X	X				
Translation/back-translation of protocol, questionnaire and other materials	X	X				
Finalize training manual		X				
Recruit all staff required for survey		X				
Prepare supplies and logistics for training and data collection		X				
Field training			X			
Pre-testing of questionnaires			X			
Data collection			X	X		
Collect and ship food samples			X	X		
Enter data from questionnaires			X	X		
Clean data				X	X	
Write final report of survey activities					X	
Data analysis, interpretation and reporting						TBD
Present results at a workshop with all stakeholders						TBD

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 categories. These responses were distilled into a 10 point scoring system based on the following 10 food groups: group 1. all starchy staple foods (questions 1 &2 : rice, cereals and tubers), group 2. beans and peas (question:12: legumes), group 3. nuts and seeds (question 13: cashew, walnuts, almonds, pecan nuts and other seeds), group 4. dairy (question 14 – cheese, milk, milk products), group 5. flesh foods (questions 8,9,11: meats, fish, organ meats), group 6. Eggs (question 10), group 7. Vitamin A rich dark green leafy vegetables (question 4:kale, spinach, etc.), group 8. other vitamin A-rich fruits and vegetables (questions 3 & 6 : yellow or orange flesh vegetables /root crops – carrots; fruit/vegetables such as mangoes, papaya, pawpaw, squash or melon), group 9. other vegetables (question 5: other vegetables) , group 10. other fruits (question 7: 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 dietary diversity score less than the population median in each stratum (i.e. rural or urban residence) was classified as "lower dietary diversity (below the median)" and otherwise, it was termed "higher dietary diversity (at or above the median)". A woman's DDS less than the province median was classified as "lower DDS" and otherwise, it was termed "higher DDS".
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".
Fortifiable food consumed	Fortifiable refers to any food that was not made at home and is assumed to be processed at industrial scale. All wheat bread was assumed to be fortifiable whether or not it was made at home.
Fortified food consumed	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 the "inadequately fortified", "adequately fortified" or "over-fortified" criteria; that is, if they met or exceeded the following criteria: Foods were classified as fortified if they met or exceeded the "inadequately fortified" criteria: wheat bread > 15.25mg/kg iron, super maize meal > 6.5 mg/kg iron, sifted maize meal >14.2 mg/kg iron, and salt > 10 mg/kg iodine.)

Variable	Calculation
	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 "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 of all samples analyzed from that brand 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 taken and the brand name was not available, the household's fortification status could not be determined and the household was classified as "don't know" for consumes fortified food.
Fortification classification for (wheat flour): not fortified, under fortified, adequately fortified and over-fortified.	The fortification standard for the composition of white flour is 48.50 mg/kg and for brown flour the composition is 53.3 mg.kg. Because we could not distinguish white and brown flour, we averaged. Fortification levels for wheat flour were *classified as follows: not fortified (≤18), fortified below standard (>18 to <45.81), adequately fortified (45.81 to 55.99) and over-fortified (>55.99 mg/kg..*
Fortification classification for wheat bread	The fortification standards for the composition of white bread is 35.84 mg/kg and for brown bread the composition is 38.54 mg.kg. Because we could not distinguish white and brown flour in our samples, we averaged. Fortification classifications for wheat bread were a*s follows: not fortified (≤15.25), fortified below standard (>15.25 to <33.48), adequately fortified (33.48 to 40.91) and over-fortified (>40.91).*
Fortification classification for maize meal.	Fortification classifications for super maize meal were as follows: not fortified (≤6.5), fortified below standard (>6.5 to <37.35), adequately fortified (37.35 to 45.65) and over-fortified (>45.65). Fortification classifications for sifted maize meal were as follows: not fortified (≤14.2), fortified below standard (>14.2 to <44.28), adequately fortified (44.28 to 54.12) and over-fortified (>54.12). There are no regulations for instant/quick cooking maize meal and these were considered to be not fortified. (Special maize meal is mandatorily fortified, but was not included as a separate category). .
Fortification classification for salt:	Two methods of classifying salt fortification were used: those based on UNICEF/WHO classifications and those base on RSA regulations. UNICEF/WHO classification were as follows: not fortified (<10), fortified below standard (10 to <15), adequately fortified (15 to <40) and over-fortified (≥40 mg/kg). The RSA classifications are: not fortified (<10), fortified below standard (10 to < 35), adequately fortified (35 to 65) and over-fortified (>65 m/kg).
Percent Recommended Nutrient Intake (RNI) and calculation of RNI	Recommended Nutrient Intakes (RNI) from the World Health Organization were used, to compare women's nutrient intake from 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 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%. In order to measure the contribution of added nutrients to the RNI, all analysis were based on added iron (i.e. intrinsic values were subtracted

Variable	Calculation
	from the total iron in the household samples). The intrinsic values were based on those listed in the RSA regulations (see "not fortified" classifications) (RSA, 2004) and the total iron values were based on the analysis by Bioanalyt of household samples. Because we could not distinguish between white and brown bread or flour in our samples, we averaged. For white and brown wheat bread slices (wfc1 and wfc2), added iron was calculated by subtracting intrinsic iron (average of white and brown bread) from the total iron in bread samples in both provinces. Because we could not distinguish white and brown wheat flour, we also averaged. For super and coarse/Braaipap maize meal, added iron was calculated by subtracting intrinsic iron (super maize meal) from the total iron measured in super maize meal and coarse/Braaipap samples as measured by Bioanalyt in both provinces. For sifted maize meal, added iron was calculated by subtracting the value for intrinsic iron (sifted maize meal) from the total iron in sifted maize meal samples as measured by Bioanalyt in both provinces. For salt, the intrinsic value was consistent with the UNICEF/WHO classification for "not fortified". Assessment of the micronutrient contribution (%RNI) of the added iron provided by fortification was assessed through a 7 day abbreviated food frequency instrument. Women were asked to report the frequency in the past 7 days with which they consumed wheat bread and other foods containing wheat flour and maize meal. Women were asked to approximate the usual portion size they ate at each sitting, using picture cards of different portion sizes. The wheat flour and maize meal in the portion sizes was estimated from recipes and used in conjunction with the frequency and number of portion sizes to estimate the daily wheat flour and maize meal consumed by women **(**as a weekly amount consumed in grams divided by 7). To estimate the daily micronutrient contribution (% RNI) of added iron (ppm) in wheat bread (wfc1 and wfc2), the grand median nutrient value (added iron) in all wheat bread samples analyzed in both provinces was multiplied by women's daily consumption of wheat bread. To estimate the daily micronutrient contribution (% RNI) of added iron (ppm) in other wheat flour products (wfc3-21), the grand median nutrient value (added iron) in all wheat flour samples analyzed in both provinces was multiplied by women's daily consumption. To estimate daily micronutrient contribution (% RNI) of added iron (ppm) in maize meal products, the province-specific grand median nutrient value (added iron) was multiplied by women's daily consumption of maize meal. The percent of RNI met was calculated as follows: "amount of nutrient consumed from food per day" 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: RESULTS FROM FIGURES 1-4 IN TABLE FORMAT

Table 1. Results from Figure 1: household coverage of foods, Gauteng and the Eastern Cape, South Africa, 2015.

Coverage[2]	Gauteng (n=372)		Eastern Cape (n=361)	
	n	% (95% CI)	n	% (95% CI)
Consumes oil	360	96.8 (95.0, 98.6)	358	99.2 (98.2, 100.0)
Consumes fortifiable oil	359	96.5 (94.6, 98.4)	357	98.9 (97.8, 100.0)
Consumes cake flour	162	43.5 (38.5 48.6)	259	71.7 (67.1, 76.4)
Consumes fortifiable cake flour	161	43.3 (38.248.3)	259	71.7 (67.1, 76.4)
Consumes wheat flour	16	4.3 (2.2, 6.4)	92	25.5 (21.0, 30.0)
Consumes fortifiable wheat flour	16	4.3 (2.2, 6.4)	92	25.5 (21.0, 30.0)
Consumes fortified wheat flour				
Yes	3	0.8 (0, 1.7)	60	16.6 (12.8, 20.5)
Not fortified	8	2.2 (0.7,3.6)	16	4.4 (2.3,6.6)
Don't know	5	1.3 (0.2, 2.5)	15	4.2 (2.1,6.2)
Does not consume fortifiable wheat flour	356	95.7 (93.6,97.8)	269	74.7 (70.2,79.2)
Consumes wheat bread	355	95.4 (93.3, 97.5)	313	86.7 (83.2, 90.2)
Consumes fortifiable wheat bread	355	95.4 (93.3, 97.5)	313	86.7 (83.2, 90.2)
Consumes fortified wheat bread				
Yes	325	87.4 (84.0, 90.8)	187	51.8 (46.6, 57.0)
Not fortified	13	3.5 (1.6, 5.4)	7	1.9 (0.5,3.4)
Don't know	17	4.6 (2.5,6.7)	119	33.0 (28.1, 37.8)
Does not consume fortifiable wheat bread	17	4.6 (2.4,6.7)	48	13.3 (9.8,16.8)
Consumes maize meal	355	95.4 (93.3,97.6)	356	98.6 (97.4, 99.8)
Consumes fortifiable maize meal	354	95.2 (93.0, 97.4)	356	98.6 (97.4, 99.8)
Consumes fortified maize meal				
Yes	288	77.4 (73.2, 81.7)	313	86.7 (83.2, 90.2)
Not fortified	57	15.3 (11.6,19.0)	30	8.3 (5.4,11.2)
Don't know	9	2.4 (0.9,4)		3.6 (1.7, 5.5)
Does not consume fortifiable maize meal	18	4.8 (2.6,7)	5	1.4 (0.2,2.6)
Consumes salt	355	95.4 (93.3, 97.6)	360	99.7 (99.2, 100.0)
Consumes fortifiable salt	354	95.2 (93.0, 97.4)	358	99.2 (98.2, 100.0)
Consumes fortified salt				
Yes	232	79.6 (75.5,83.7)	240	83.9 (80.1,87.7)
Not fortified	40	11.0 (7.8,14.2)	32	8.9 (5.9,11.8)
Don't know	82	4.6 (2.4,6.7)	86	6.4 (3.8,8.9)
Does not consume fortifiable salt	18	4.8 (2.6,7)	3	0.8 (0,1.8)

Abbreviation: CI, confidence interval

[1] All values are percent as indicated [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 criteria: wheat flour with > 18 mg/kg iron, wheat bread >15.25 mg/kg iron; super maize meal and coarse/Braaipap, >6.5 mg/kg iron, sifted maize meal >14.2 mg/kg iron, and salt ≥ 10.0 mg/kg iodine. (Instant/quick cooking maize was considered to be not fortified).

"Consumes fortified food" was determined 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 "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 of all samples analyzed from that brand 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 taken and the brand name was not available, the household's fortification status could not be determined and the household was classified as "don't know" for consumes fortified food.
(D) Households that did not consume a fortifiable food are not shown.

Table 2. Results from Figure 2: household coverage of foods by poverty status, Gauteng and the Eastern Cape, South Africa, 2015

Coverage[2]	Poor (% (95% CI))[3]	Non-poor (% (95% CI))[3]	p-value[4]
Gauteng	**N=73**	**N=299**	
Consumes oil	95.9 (91.3, 100.0)	97.0 (95.0, 98.9)	0.6336
Consumes fortifiable oil	95.9 (91.3, 100.0)	96.7 (94.6, 98.7)	0.7496
Consumes cake four	42.5 (31.1, 53.9)	43.8 (38.2, 49.5)	0.8352
Consumes fortifiable cake flour	42.5 (31.1, 53.9)	43.5 (37.8, 49.1)	0.8756
Consumes wheat bread	93.2 (87.3, 99.0)	96.0 (93.8, 98.2)	0.2982
Consumes fortifiable wheat bread	93.2 (87.3, 99.0)	96.0 (93.8, 98.2)	0.2982
Consumes fortified wheat bread			0.0469
Yes	78.1 (68.5,87.6)	89.6 (86.2,93.1)	
Not fortified	5.5 (0.2,10.7)	3 (1.1,5)	
Don't know	9.6 (2.8,16.4)	3.3 (1.3,5.4)	
Does not consume fortifiable wheat bread	6.8 (1,12.7)	4 (1.8,6.2)	
Consumes maize meal	100.0 (100.0, 100.0)	94.3 (91.7, 97.0)	n/a
Consumes fortifiable maize meal	100.0 (100.0, 100.0)	94.0 (91.3, 96.7)	n/a
Consumes fortified maize meal			0.0882
Yes	75.3 (65.4,85.3)	77.9 (73.2,82.6)	
Not fortified	17.8 (9,26.6)	14.7 (10.7,18.7)	
Don't know	6.8 (1,12.7)	1.3 (0,2.6)	
Does not consume fortifiable maize meal	0 (.,.)	6 (3.3,8.7)	
Consumes salt	94.5 (89.3, 99.8)	95.7 (93.3, 98.0)	0.6781
Consumes fortifiable salt	94.5 (89.3, 99.8)	95.3 (92.9, 97.7)	0.7760
Consumes fortified salt			0.8036
Yes	82.2 (73.4,91)	78.9 (74.3,83.6)	
Not fortified	9.6 (2.8,16.4)	11.4 (7.8,15)	
Don't know	2.7 (0,6.5)	5 (2.5,7.5)	
Does not consume fortifiable salt	5.5 (0.2,10.7)	4.7 (2.3,7.1)	
Eastern Cape	**N=122**	**N=239**	
Consumes oil	99.2 (97.6,100.0)	99.2 (98.0, 100.0)	0.9865
Consumes fortifiable oil	99.2 (97.6, 100.0)	98.7 (97.3,100.0)	0.7084
Consumes cake flour	70.5 (62.4, 78.6)	72.4 (66.7, 78.1)	0.7055
Consumes fortifiable cake flour	70.5 (62.4, 78.6)	72.4 (66.7, 78.1)	0.7055
Consumes wheat bread	78.7 (71.4, 86.0)	90.8 (87.1, 94.5)	0.0014
Consumes fortifiable wheat bread	78.7 (71.4, 86.0)	90.8 (87.1, 94.5)	0.0014
Consumes fortified wheat bread			<0.0001
Yes	30.3 (22.1,38.5)	62.8 (56.6,68.9)	
Not fortified	1.6 (0,3.9)	2.1 (0.3,3.9)	
Don't know	46.7 (37.8,55.6)	25.9 (20.4,31.5)	
Does not consume fortifiable wheat bread	21.3 (14,28.6)	9.2 (5.5,12.9)	

Coverage[2]	Poor (% (95% CI))[3]	Non-poor (% (95% CI))[3]	p-value[4]
Consumes maize meal	100.0 (100.0, 100.0)	97.9 96.1 99.7	n/a
Consumes fortifiable maize meal	100.0 (100.0, 100.0)	97.9 96.1 99.7	n/a
Consumes fortified maize meal			n/a
Yes	88.5 (82.8,94.2)	85.8 (81.3,90.2)	
Not fortified	10.7 (5.2,16.2)	7.1 (3.8,10.4)	
Don't know	0.8 (0,2.4)	5 (2.2,7.8)	
Does not consume fortifiable maize meal	. (.,.)	2.1 (0.3,3.9)	
Consumes salt	100.0 (100.0, 100.0)	99.6 (98.8, 100.0)	n/a
Consumes fortifiable salt	99.2 (97.6, 100.0)	99.2 (98.0, 100.0)	0.9865
Consumes fortified salt			
Yes	79.5 (72.3,86.7)	86.2 (81.8,90.6)	0.3662
Not fortified	12.3 (6.4,18.1)	7.1 (3.8,10.4)	
Don't know	7.4 (2.7,12)	5.9 (2.9,8.8)	
Does not consume fortifiable salt	0.8 (0,2.4)	0.8 (0,2)	

Abbreviations: CI, confidence interval; n/a, not applicable

[1] All values are percent as indicated.

[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 criteria: wheat flour with > 18 mg/kg iron, wheat bread >15.25 mg/kg iron; super maize meal and coarse/Braaipap, >6.5 mg/kg iron, sifted maize meal >14.2 mg/kg iron, and salt $\geq$ 10.0 mg/kg iodine. (Instant/quick cooking maize was considered to be not fortified). "Consumes fortified food" was determined 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 "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 of all samples analyzed from that brand 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 taken and the brand name was not available, the household's fortification status could not be determined and the household was classified as "don't know" for consumes fortified food.
(D) Households that did not consume a fortifiable food are not shown.

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

[4] Comparing poor versus non-poor. Survey test of differences in 2 independent proportions was used to compare percentages. Chi square values were not available (n/a) where p values were not estimable because at least one table cell has a 0 frequency.

Table 3. Results from Figure 3: household coverage of foods by women's dietary diversity score, Gauteng and the Eastern Cape, South Africa, 2015

Coverage	Lower (% (95% CI))[3]	Higher (% (95% CI))[3]	p-value[4]
Gauteng	**N=85**	**N=136**	
Consumes oil	98.8 (96.5, 100.0)	97.8 (95.3, 100.0)	0.5765
Consumes fortifiable oil	97.6 (94.4, 100.0)	97.8 (95.3, 100.0)	0.9430
Consumes cake flour	41.2 (30.6, 51.7)	54.4 (46.0, 62.8)	0.0555
Consumes fortifiable cake flour	41.2 (30.6, 51.7)	54.4 (46.0, 62.8)	0.0555
Consumes wheat bread	96.5 (92.5,100.0)	98.5 (96.5, 100.0)	0.3167
Consumes fortifiable wheat bread	96.5 (92.5, 100.0)	98.5 (96.5, 100.0)	0.3167
Consumes fortified wheat bread			0.2088
Yes	83.5 (75.6,91.5)	92.6 (88.2,97.1)	
Not fortified	5.9 (0.8,10.9)	2.9 (0.1,5.8)	
Don't know	7.1 (1.6,12.5)	2.9 (0.1,5.8)	
Does not consume fortifiable what bread	3.5 (0,7.5)	1.5 (0,3.5)	
Consumes maize meal	96.5 (92.5, 100.0)	94.9 (91.1, 98.6)	0.5735
Consumes fortifiable maize meal	96.5 (92.5, 100.0)	94.1 (90.1, 98.1)	0.4339
Consumes fortified maize meal			0.7669
Yes	80.0 (71.4,88.6)	75 (67.7,82.3)	
Not fortified	15.3 (7.6,23)	16.9 (10.6,23.3)	
Don't know	1.2 (0,3.5)	2.2 (0,4.7)	
Does not consume fortifiable maize meal	3.5 (0,7.5)	5.9 (1.9,9.9)	
Consumes salt	98.8 (96.5, 100.0)	94.1 (90.1, 98.1)	0.0851
Consumes fortifiable salt	98.8 (96.5, 100.0)	94.1 (90.1, 98.1)	0.0851
Consumes fortified salt			0.0049
Yes	83.3 (75.3,91.4)	79.9 (73,86.7)	
Not fortified	7.1 (1.6,12.7)	13.4 (7.6,19.3)	
Don't know	8.3 (2.4,14.3)	0.7 (0,2.2)	
Does not consume fortifiable salt	1.2 (0,3.5)	6 (1.9,10)	
Eastern Cape	**N=64**	**N=134**	
Consumes oil	100.0 (100.0, 100.0)	99.3 (97.8, 100.0)	n/a
Consumes fortifiable oil	100.0 (100.0, 100.0)	99.3 (97.8, 100.0)	n/a
Consumes cake flour	71.9 (60.8, 83.0)	79.9 (73.0, 86.7)	0.2104
Consumes fortifiable cake flour	71.9 (60.8, 83.0)	79.9 (73.0, 86.7)	0.2104
Consumes wheat bread	84.4 (75.4, 93.3)	89.6 (84.3, 94.8)	0.2965
Consumes fortifiable wheat bread	84.4 (75.4, 93.3)	89.6 (84.3, 94.8)	0.2965
Consumes fortified wheat bread			0.2846
Yes	45.3 (33,57.6)	58.2 (49.8,66.6)	
Not fortified	1.6 (0,4.6)	3 (0.1,5.9)	
Don't know	37.5 (25.5,49.5)	28.4 (20.7,36.1)	
Does not consume fortifiable wheat bread	15.6 (6.7,24.6)	10.4 (5.2,15.7)	

Coverage	Lower (% (95% CI))[3]	Higher (% (95% CI))[3]	p-value[4]
Consumes maize meal	100.0 (100.0, 100.0)	97.8 (95.2, 100.0)	n/a
Consumes fortifiable maize meal	100.0 (100.0, 100.0)	97.8 (95.2, 100.0)	n/a
Consumes fortified maize meal			n/a
Yes	92.2 (85.6,98.8)	87.3 (81.6,93)	
Not fortified	6.3 (0.3,12.2)	7.5 (3,12.0)	
Don't know	1.6 (0,4.6)	3 (0.1,5.9)	
Does not consume fortifiable maize meal	. (.,.)	2.2 (0,4.8)	
Consumes salt	100.0 (100.0, 100.0)	99.3 (97.8, 100.0)	n/a
Consumes fortifiable salt	98.4 (95.4, 100.0)	99.3 (97.8, 100.0)	0.5911
Consumes fortified salt			
Yes	82.8 (73.5,92.1)	87.3 (81.6,93.0)	0.5877
Not fortified	10.9 (3.2,18.7)	6 (1.9,10.0)	
Don't know	4.7 (0,9.9)	6 (1.9,10.0)	
Does not consume fortifiable salt	1.6 (0,4.6)	0.7 (0,2.2)	

Abbreviation: CI, confidence interval; n/a, not applicable

[1] All values are percent as indicated.

[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 criteria: wheat flour with > 18 mg/kg iron, wheat bread >15.25 mg/kg iron; super maize meal and coarse/Braaipap, >6.5 mg/kg iron, sifted maize meal >14.2 mg/kg iron, and salt ≥ 10.0 mg/kg iodine. (Instant/quick cooking maize was considered to be not fortified).

"Consumes fortified food" was determined 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 "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 of all samples analyzed from that brand 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 taken and the brand name was not available, the household's fortification status could not be determined and the household was classified as "don't know" for consumes fortified food.

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

[3] Lower dietary diversity refers to a dietary diversity score lower than the population median. Higher dietary diversity refers to a dietary diversity score greater than or equal to the population median. The population median is 5 for Gauteng and 4 for the Eastern Cape. 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 higher versus lower: chi square test of differences in 2 independent proportions was used to compare percentages*. Chi square values were not available (n/a) where p values were not estimable because at least one table cell has a 0 frequency.

Table 4. Results from Figure 4: Quantitative sample testing of food samples, by province and combined, South Africa, 2015.

Food	Total N	(%)			
		Unfortified	Inadequately fortified	Adequately fortified	Over fortified
Gauteng					
Wheat flour[1]	4	50.0	50.0	-	-
Wheat bread[2]	124	3.7	11.9	22.4	61.9
Maize meal[3]	265	20.8	61.9	10.9	6.4
Salt[4] (UNICEF/WHO)	272	14.7	4.0	19.9	61.4
Salt [5] (RSA regulations)	272	14.7	17.7	51.8	15.8
Eastern Cape					
Wheat flour[1]	39	33.3	25.6	20.5	20.5
Wheat bread[2]	65	8	33.3	24	34.7
Maize meal[3] (all)	259	12.4	57.5	17.4	12.7
Salt[4] (UNICEF/WHO)	273	12.1	1.8	28.9	57.1
Salt [5] (RSA regulations)	273	12.1	23.4	48.0	16.5

Abbreviation: NA, not applicable. Note: Fortification quality for all foods was determined by analyzing samples taken from households. See Annex E for more detailed information.

[1]. Fortification levels (mg/kg of total iron) for wheat flour were classified as follows: not fortified (≤18), fortified below standard (>18 to <45.81), adequately fortified (45.81 to 55.99) and over-fortified (>55.99).

[2]. Fortification levels (mg/kg of total iron) for wheat bread were classifeid as follow: "not fortified"(≤ 15.25), "inadequately fortified" (>15.25 to < 33.48), "adequately fortified" (33.48 to 40.91), "over fortified" (>40.91).

[3] Fortification levels (mg/kg of total iron) were classified by type of maize meal. For super maize meal and coarse/Braaaipap, classifications were: unfortified (≤6.5), fortified below standard (>6.5 to <37.35), adequately fortified (37.35 to 45.65) and over-fortified (>45.65). For sifted maize meal, classifications were: unfortified (≤14.2), fortified below standard (>14.2 to <44.28), adequately fortified (44.28 to 54.12) and over-fortified (>54.12). There are no regulations for instant and quick cooking maize meal and these types were considered to be not fortified).

[4] Fortification levels (mg/kg of iodine) for salt classified according to the UNICEF/WHO criteria:were as follows: unfortified (<10), fortified below standard (10 to <15), adequately fortified (15 to <40) and over-fortified (≥40).

[5] Fortification levels (mg/kg of iodine) for salt classified acording to the RSA standard were as follows: unfortified (<10), fortified below standard (10 to <35), adequately fortified (35 to 65) and over-fortified (>65 m/kg).

REFERENCES

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.

Aaron GJ, Sarpong D, Strutt N, Siling K, Norris A, Guevarra E, Myatt M (2014) Coverage of a market-based approach to deliver a complementary food supplement to infants and children in three districts in Eastern Ghana: use of the simple spatial survey method (S3M). Experimental Biology. http://www.fasebj.org/content/28/1_Supplement/255.5 Accessed 2 December 2015.

Aaron GJ, Jacobson M, Manian N, Lunn L, Megazzini K, Rog D, Lo A, Wulfe M, Garrett GS, Neufeld LM, Fairhurst J, Ndiaye S (2014) National program coverage of fortified wheat flour and oil is high among women of reproductive age in Senegal. Micronutrient Forum. http://micronutrientforum.org/wp-content/uploads/2014/12/0371.pdf Accessed 2 December 2015.

Alkire S, Santos ME, Measuring Acute Poverty in the Developing World: Robustness and Scope of the Multidimensional Poverty Index (OPHI Working Paper 59), Oxford Poverty & Human Development Initiative (OPHI), University of Oxford, March 2013, ISBN 978-1-907194-44-3.

Ballard, T. et al., Household Hunger Scale: Indicator Definition and Measurement Guide (2011) Washington, FANTA-2 Bridge and FHI 360, Washington DC, USA.

Deitchler M, Ballard T, Swindale A, Coates J, Validation of a Measure of Household Hunger for Cross-Cultural Use (2010), Food and Nutrition Technical Assistance II Project (FANTA-2) (2010), AED. Washington DC, USA.

Deitchler M, Ballard T, Swindale A, Coates J, Introducing a Simple Measure of Household Hunger for Cross-Cultural Use (2011), Food and Nutrition Technical Assistance II Project, AED, Washington DC, USA.

Department of Health. Foodstuffs, Cosmetics and Disinfectants Act (Act 54 of 1972). Regulations relating to the fortification of certain foodstuffs. Government notice no. R7634. Pretoria: Department of Health, 2003.

Department of Health. Foodstuffs, Cosmetics and Disinfectants Act (Act 54 of 1972). Regulations relating to food grade salt (2007) Government notice no. R184. Pretoria: Department of Health.

Department of Health, Medical Research Council, Macro. 2007*. South Africa Demographic and Health Survey 2003. Pretoria: Department of Health.*

Department of Health. Foodstuffs, Cosmetics and Disinfectants Act (Act 54 of 1972). Amendment of regulations relating to the fortification of certain foodstuffs (2016). Government notice no. 39776. Pretoria: Department of Health

Department of Health. Foodstuffs, Cosmetics and Disinfectants Act (Act 54 of 1972). Amendment of regulations relating to the fortification of certain foodstuffs (2008). Government notice no. R1206. Pretoria: Department of Health

Ezzati M, Lopez AD, Rodgers A, et al. (2002) Selected major risk factors and global and regional burden of disease. Lancet 360:1347-1360.

Food and Agriculture Organization of the United Nations (FAO) and FHI 360. *Minimum Dietary Diversity for Women: A Guide for Measurement (2016).* Rome: FAO.
Imhoff-Kunsch B, Flores R, Dary O, Martorell R (2012) Methods of using Household Consumption and Expenditures Survey (HCES) data to estimate the potential nutritional impact of fortified staple foods. Food and Nutrition Bulletin 33 (3 suppl):S185-S189.

Langenhoven ML, Conradie PJ, Wolmarans P, Faber M (1991) MRC food quantities manual. 2nd ed. Parow Valley, Cape Town: South African Medical Research Council.

Nutriview (2003) Mandatory food enrichment. http://www.sahealthinfo.org/nutrition/nutriview2003special.pdf Accessed 14 March 2015.

Sablah M, Grant F, Fiedler JL (2013) Food fortification in Africa. Sight and Life 27(3):18-24.

Statistics South Africa, 2012. Census 2011 Statistical release – P0301.4 / Statistics South Africa, Pretoria. http://www.statssa.gov.za/publications/P03014/P030142011.pdf Accessed 9 September 2015.

Sununtnasuk C (2013) Household Consumption and Expenditure Surveys: A tool for estimating food and nutrient intake. Presentation at Smarter Futures Cost and Economic Benefit Training Workshop, Tanzania. Workshop is described here: http://ffinetwork.org/about/calendar/2013/CostBenefit2013.html Accessed 12 January 2016.

Thompson FE, Kirkpatrick SI, Subar AF, Reedy J, Schap TE, Wilson MM, Krebs-Smith SM (2015) The National Cancer Institute's Dietary Assessment Primer: A resource for diet research. Journal of the Academy of Nutrition and Dietetics 115:1986-1995.

UNICEF (2005) Universal Salt Iodization in Nigeria: Processes, successes and lessons. http://www.unicef.org/nigeria/ng_publications_USI_in_Nigeria_Report.pdf Accessed 14 March 2015.

UNICEF (2006) Nutrition information sheet. http://www.unicef.org/wcaro/WCARO_Nigeria_Factsheets_Nutrition.pdf Accessed 14 March 2015.

van Jaarsveld PJ, Faber M, van Stuijvenberg ME (2015) Vitamin A, Iron, and Zinc Content of Fortified Maize Meal and Bread at the Household Level in 4 Areas of South Africa Food and Nutrition Bulletin 36(3): 315-326.

Wolmarans P, Danster N, Dalton A, Schönfeldt H (2009) Condensed food composition tables for South Africa. 2009. Parow Valley, Cape Town: South African Medical Research Council.

World Health Organization (WHO), UNICEF, ICCIDD (2007) (2007). *Assessment of iodine deficiency disorders and monitoring their elimination: A guide for programme managers*. Third edition (updated 1st September 2008). Geneva, Switzerland: World Health Organization; 2007. http://whqlibdoc.who.int/publications/2007/9789241595827_eng.pdf

World Health Organization/FAO (2004). Vitamin and mineral requirements in human nutrition, second edition. World Health Organization: Geneva, Switzerland. http://www.who.int/nutrition/publications/micronutrients/9241546123/en/ Accessed 7 January 2016.

World Health Organization/FAO (2006). Guidelines on food fortification with micronutrients. World Health Organization: Geneva, Switzerland. http://www.who.int/nutrition/publications/guide_food_fortification_micronutrients.pdf Accessed 14 March 2015.

WHO, FAO, UNICEF, GAIN, MI, & FFI (2009) Recommendations on wheat and maize flour fortification. Meeting Report: Interim Consensus Statement. World Health Organization: Geneva, Switzerland. http://www.who.int/nutrition/publications/micro-nutrients/wheat_maize_fort.pdf Accessed 14 March 2015.

Yusufali R, Sunley N, De Hoop M & Panagides D (2012) Flour fortification in South Africa: post-implementation survey of micronutrient levels at point of retail. Food and Nutrition Bulletin; 33(4Suppl): S321-9