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## EXECUTIVE SUMMARY

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# Evaluation of the Coverage and Benefit Incidences of Food Fortification in Mozambique

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International Policy Centre for Inclusive Growth (IPC-IG)

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**EVALUATION OF THE COVERAGE AND  
BENEFIT INCIDENCES OF FOOD  
FORTIFICATION IN MOZAMBIQUE**

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# GLOSSARY OR CONCEPTS, DEFINITIONS AND MEASUREMENTS

## FOOD FORTIFICATION

**Food fortification:** Food fortification is the practice of adding one or more essential nutrients to improve the nutritional quality of the food supply.

**Mass fortification:** Mass fortification (or population-based fortification) aims at fortifying foods that are widely consumed by the general population, often staple foods such as grains, salt and other condiments, to provide the population with additional amounts of essential vitamins and minerals.

**Targeted fortification:** Aims groups in society such as infants or women of reproductive age.

**Vehicle of micronutrients:** Vehicles are foods (such as salt, flour, sugar, and oil) to which vitamins and minerals are added during the processing stage to increase the food's micronutrient content. The selection of a suitable food vehicle is one of the key processes in developing a fortification programme.

**Premix:** Premix is a commercially prepared blend of vitamins and minerals that is added to food vehicles during the processing stage in order to increase the content of micronutrients.

**National Food Fortification Programme in Mozambique (NFFP):** A Government of Mozambique mass fortification programme, focused on the fortification of staple foods. According to the Mandatory Food Fortification Decree of March 2016, the vehicles of micronutrients in the programme are:

- Wheat flour (for bread)—with iron, folic acid, complex B vitamins and Zinc
- Vegetable oil—with vitamin A
- Sugar—vitamins A and D
- Maize flour—iron, folic acid, complex B vitamins and zinc
- Salt iodisation has been included under this Decree, although it is already mandatory.

## COVERAGE OF THE NATIONAL FOOD FORTIFICATION PROGRAMME

**Coverage** of the National Food Fortification Programme: Conceptually, the coverage of the National Food Fortification Programme is the interaction between the Food Fortification Programme and the target households for which it is designed. It measures the reach of the programme regarding the target households.

**Coverage definition and measurement:** In this study, coverages are defined as potential and actual coverage, in a four-stage model, following the five-stage Tanahashi (1978) framework to evaluate the health service coverage. The Fortification Assessment Coverage Toolkit (FACT) surveys inspired the framework and the measurement of coverage of this study, which made some adaptations to the definition of the stages. The coverage rate measurements used data from a specific household survey and the consumption rates are their proxies. The rates are defined, in each stage, as the number of households that consume respective vehicles out of the total households of the country. Specific coverage rates in each stage—for subgroups such as rural/urban residence and vulnerability groups—consider the numerator and denominator of the specific groups.

**Coverage assessment framework:** The framework for this study considered four stages of the programme divided into two groups: potential coverage and actual coverage, according to the consumption of the vehicles by the households.

**Potential coverage** refers to the households that consume vehicles independently of the fortification condition. The stages are defined according to households that consume:

1. Vehicles chosen for fortification, denominated here as **vehicles from any source**. It reflects the **availability coverage**, meaning the degree of consumption of the chosen vehicles by the households.
2. Vehicles chosen for fortification that are from **fortifiable** in large or median scale source. They refer to households that consume industrialised vehicles; it reflects the **accessibility coverage** to the vehicle. In terms of maize flour, both industrialised flours and home-grown grain that were ground at community mills are considered fortifiable vehicles par.

**Actual coverage** are households that consume fortified vehicles. The stages are defined according to household that consumes:

1. Fortified vehicles with nutrient concentration at any level. This reflects the **contact coverage** of the households, meaning the contact they have with the output of the programme—that is, fortified vehicles found in the market. Throughout the report the vehicles are denominated **fortified at any level**.
2. Fortified vehicles that meet the national standards of food fortification regarding the minimum concentration of micronutrients in the vehicles. This reflects the **effectiveness coverage** of the NFFP, meaning consumption of the Programme's output—that is, fully fortified vehicles—by the population. Throughout this report, the vehicles of this stage are considered **fortified**.

### Coverage of specific groups:

**Benefit incidence:** As defined by WFP, benefit incidence represents the population groups that have had the benefit of consuming fortified vehicles. This is measured, for each stage of the coverage model, as the number of households in a specific group that consume fortified vehicles out of the total number of households in the specific group.

The benefit incidence of the NFFP was estimated from the point of view that the coverage should reach regions and segments of the population targeted by the programme or beyond that, as such coverage levels were measured for rural areas. It also attempts to show how vulnerable population groups with low capability to acquire and consume fortified foods are reached. In that context, the estimation relied on calculating the programme's coverage among different population groups classified by their degree of vulnerability, in order to show the groups that are being benefited from the programme.

**Assessment of vulnerable groups:** A multidimensional method was employed to assess vulnerable groups, using 13 variables. Nine of them refer to the capability of people to acquire fortified foods and four to the hindrances. The concept of vulnerability in this study relies on the basic assumption that the segments of the population that might benefit from the NFFP are associated with the: 1) **capability** of people to acquire, adequately handle and consume nutrient vehicles; and 2) **hindrances** to the adequate intake of micronutrients by requiring higher consumption or jeopardising the absorption of the micronutrients. The 'Grade of Membership' method of assessment allows for the classification of continuous levels and composition of vulnerability.

**Grade of Membership (GoM):** A model based on fuzzy sets where the elements of the sets have degrees of membership to multiple subsets. In this case, one household has grades of memberships to two extreme profiles (very high vulnerability and very low vulnerability) estimated by the model.

The combination of the grades of membership allows for a classification of the household in a continuum of vulnerability in a multidimensional approach between those two extreme profiles

## MICRONUTRIENT INTAKE OF THE HOUSEHOLD

**Micronutrient intake:** Micronutrient intake is the intake of dietary components, often referred to as vitamins and minerals, which enable the body to produce enzymes, hormones and other substances essential for proper growth and development, disease prevention, and wellbeing. Micronutrients are not produced in the body and must be derived from the diet.

**Recommended nutrient intake:** Recommended nutrient intake (RNI) is the daily intake which meets the nutrient requirements of almost all (97.5 per cent) apparently healthy individuals in an age and sex-specific population group. Daily intake corresponds to the average over a period of time. This study used the RNI table by age, sex, lactating and postmenopausal women, from FAO/WHO (1978).

**Adequacy of micronutrient intake at the households.** The adequacy of the micronutrient intake of each household was determined by comparing the household daily intake of the micronutrient—the concentration of the micronutrient as determined by laboratory test multiplied by the daily amount of the vehicle consumed by the household—with the expected total recommended intake in a household that has similar characteristics of age, sex and presence of lactating and post-menopausal women to those in the RNI table.

The expected household recommended intake was calculated by multiplying, for each sex, the number of persons in the household in a specific age group and women in special conditions by the respective RNI and adding them together. This was considered the expected household intake.

The ratio of the actual daily intake was divided by the expected intake, assessing the proportion of the contribution that the NFFP has to the adequate nutrient intake, for each household.

## METHODOLOGY TO DETERMINE NUTRIENTS CONCENTRATION IN FOOD SAMPLES

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

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

**iCheck Fluoro** was used for the measurement of vitamin A in sugar. iCheck Fluoro quantitatively determines the concentration of vitamin A in food based on the measurements of the auto-fluorescence of vitamin A (retinol). Results are displayed in the measuring device iCheck Fluoro in  $\mu\text{g}$  retinol equivalents/L. This method has been validated against the reference method—HPLC (4).

**iCheck Iron** is a single wavelength photometer that measures absorption of a solution at 525 nm. The iCheck Iron reagents vials contain chemicals that react with iron present in food and turn red. The chemical composition is bathophenanthroline in organic solvent, reducing and chelating agents. The intensity of red colour correlates with the concentration of iron in the sample. When the reaction is complete, the vial is placed in the iCheck photometer, the absorption is measured at 525nm and the concentration is displayed in mg (Fe)/L.

## EXECUTIVE SUMMARY

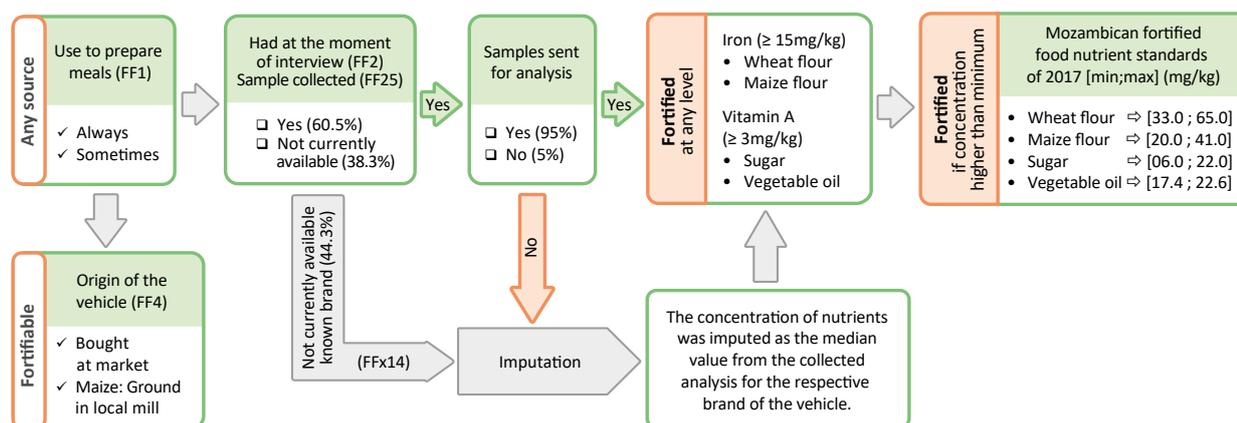
The main objective of this study is to evaluate the coverage of the National Food Fortification Programme (NFFP) in Mozambique regarding iron-fortified wheat and maize flours and vitamin A-fortified sugar and vegetable oil, as well as the benefit reach across population groups. A population-based cross-sectional household survey and laboratory tests to determine nutrient intake in food samples collected at households are the main source for the analysis.

The following research questions were addressed:

1. To what extent is the Mozambican population covered by fortifiable and fortified wheat flour, maize flour, vegetable oil, and sugar?
2. What is the benefit incidence of the NFFP, meaning the reach of the programme across vulnerable groups in the following dimensions: socioeconomic, rural-urban place of residence, health and nutritional status?
3. To what extent does the food fortification in Mozambique contribute to the recommended nutrient intake (RNI) of micronutrients through their respective vehicle?

A structured questionnaire was the instrument used to collect information regarding the consumption of the vehicles and other socioeconomic, nutritional and demographic information. The sample consisted of 1,500 households, randomly chosen in a three-stage design. In all the households, whenever available, samples were collected of 50gr of wheat flour, maize flour and sugar, and 50ml of vegetable oil. The 3,209 collected samples were analysed for the concentration of micronutrients. For maize and wheat flour, the iron content was determined by the iCheck Iron method; to test for vitamin A in sugar samples, iCheck Fluoro was used; and for vitamin A in vegetable oil, the method used was iCheck Chroma 3.

The classification of the vehicle in fortifiable and fortified followed the diagram



Note: (FFxx) refers to the questionnaire item.

In this study, coverages are defined as potential and actual coverage, in a four-stage model, following the five-stage Tanahashi (1978) framework to evaluate the health service coverage. The Fortification Assessment Coverage Toolkit (FACT) surveys inspired the framework and the measurement of coverage of this study, which made some adaptations to the definition of the stages. FACT was developed by the Global Alliance for Improved Nutrition (GAIN) and has been profusely employed in assessing the coverage of food fortification programmes (Aaron et al. 2017; NBS 2015).

The stages of the study framework are:

**Potential coverage** refers to the households that consume vehicles independently of the fortification condition.

The stages are defined according to households that consume:

1. Vehicles chosen for fortification, denominated here as **vehicles from any source**, it reflects the **availability coverage**, meaning the degree of consumption of the chosen vehicles by the households.
2. Vehicles chosen for fortification that are from **fortifiable** in large or median scale source. They refer to households that consume industrialised vehicles; it reflects the **accessibility coverage** to the vehicle. For maize flour besides industrialised flours the household grown grains that were ground at community mills were also considered.

**Actual coverage** are households that consume fortified vehicles. The stages are defined according to households that consume:

1. Fortified vehicles with nutrient concentration at any level, it reflects the **contact coverage** of the households, meaning the contact they have with the output of the programme that is fortified vehicles in the market. Throughout the report the vehicles are denominated **fortified at any level**.
2. Fortified vehicles that meet the national standards of food fortification regarding the minimum concentration of micronutrients in the vehicles. This reflects the **effectiveness coverage** of the NFFP, meaning consumption of the Programme's output—that is, fully fortified vehicles—by the population. Throughout the report the vehicles of this stage are considered as **fortified**.

Coverage rates of vehicles from any source and those fortifiable and fortified at any level and fortified according to Mozambican standards for each of the vehicles, by urban and rural areas as well as households classified according to four profiles of vulnerability, have shown that the consumption of wheat flour was considerably lower than that of the other three vehicles. This fact reflects the design of the research, which focused on the household consumption of the wheat flour that was purchased, whereas most of the fortified flour consumption could be from derived products, such as pasta or bread. For maize flour, sugar and oil, the consumption of fortifiable foods was very high, meaning that there is good potential for an almost universal coverage of the NFFP, since the population is consuming vehicles from sources that allow large- and medium-scale fortification.

The effectiveness of the programme so far has been very low as per consumption of fortified foods classified in accordance with the 2017 Mozambican standards, if compared to the consumption of the respective fortifiable vehicle. The contact coverage as consumption of fortified foods regardless of the concentration (i.e. including fortified vehicles that do not meet the national standards) has been much closer to the consumption of fortifiable and has surpassed some of the population access goals set by WFP in their interventions to support the NFFP.

These patterns of consumption have shown that the access to fortified foods was not a problem. The problem lied in the fact that the population was ingesting nutrients at a significant level below Mozambican standards. Many questions have been raised:

- Why is it that even with high consumption of fortifiable foods and moderate consumption of foods fortifiable at any level in a mandatory NFFP, do the levels of nutrients consumed not meet the country's established nutritional standards?
- Where in the production chain (from factory to households) resides the problem?

- Are the imported products in accordance with the Mozambican standards?
- Is it too early to have total compliance from producers?

The main recommendation is to implement a system of continuous monitoring and evaluation of the components of the production chain. Other recommendations are to implement a surveillance system and a dissemination campaign regarding the importance of the fortified foods and the proper way to handle and store them.

A specific survey to assess the fortification coverage of wheat flour in derived products such as bread and pasta.

About 45 per cent of urban households reach at least 50 per cent of the RNI of vitamin A from vegetable oil or sugar and 23.92 per cent reach the same RNI threshold (50 per cent) of iron from wheat or maize flour. Rural settlements presented proportions of 25.43 per cent and of 20.36 per cent, respectively. As for results observed for vulnerability profiles, the share of households that reach half of the RNI for low vulnerable groups is about twice the share for the highly vulnerable groups for the intake of both vitamin A and iron.

However, considering that the NFFP has so far focused on the urban and peri-urban areas, the lower value for the rural areas and highly vulnerable groups should not be overlooked, because it represents a spread of the benefits of the programme, as well as a sign of the possibility of a universalisation of the benefits.





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