Fortification Rapid Assessment Tool (FRAT)
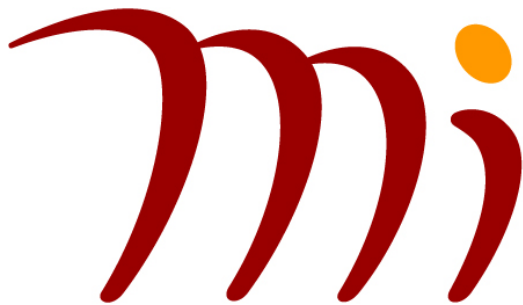
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Food Fortification Rapid Assessment Tool (FRAT)
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1   Introduction

Fortification of foods is one of three strategies used to combat public health problems of micronutrient deficiency. Supplementation and dietary diversification programs can also be implemented for this purpose; however, fortification has several advantages and has been successful in a number of countries. It is usually socially acceptable; it does not require that consumers change their dietary habits; it does not place a burden on the health sector; the fortified food has the potential to reach the target group quickly and effectively because the food is already widely available and consumed; the cost of fortification to governments is relatively low because most costs are borne by industry and consumers; and finally, fortification is an effective medium to long term strategy which can become self-sustaining.

A number of issues need to be considered when developing a fortification program for micronutrient deficiency, including micronutrient deficiency patterns in the country, food habits, processing and marketing of potential food vehicles, government policies, and legislation.[1] The development of a fortification intervention generally involves a continuum of five broad steps that can be represented as an interconnected cycle (Figure 1). The steps may be carried out sequentially or sometimes simultaneously. However, the starting point in the cycle will vary depending on what relevant information already exists in the region or country.

Figure 1. Food Fortification Cycle
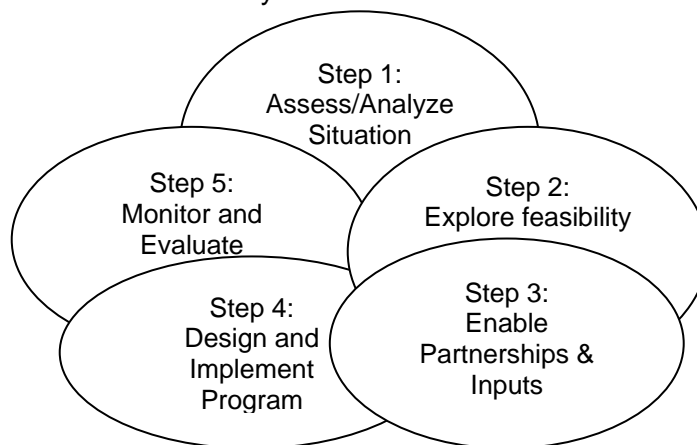
In developing a fortification program, one of the more common constraints encountered is the selection of appropriate food vehicles. Program planners and managers need to be confident that the fortified food will reach the target population before making a decision to establish a fortification program. The Fortification Rapid Assessment Guidelines are designed to help them examine food consumption patterns in order to, first, decide whether fortification could be considered as a viable public health intervention for eliminating micronutrient deficiency in the country, second, to identify potential food vehicle(s), and third, to assess the appropriateness of these vehicle(s) for fortification with micronutrients.

Appropriate food vehicles are those that will result in an effective fortification program. The understanding of what constitutes "an effective fortification program" is changing. The dogma of "one nutrient, one food" is no longer considered valid. An effective fortification program may now be considered simply one, which can deliver the micronutrients in safe and bioavailable

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[1] Micronutrient Fortification of Foods - current practices, research, and opportunities. The Micronutrient Initiative, 1996.

form to a sizable proportion of the target population AND has a large enough market that it can be self-sustaining. Self-sustainability might not be feasible at the outset, but this should not deter consideration for a fortification program. As government commitment and support to the program increases, self-sustainability will become an achievable goal. Target populations will vary depending on the deficient micronutrients but usually include young children and women of childbearing age. It has previously been stated that a single food vehicle should be consumed by greater than 50% of the target population in order to warrant the implementation of a micronutrient fortification program, however, in many situations fortifying multiple food vehicles may be required to achieve such broad coverage.

The selection of an appropriate food vehicle requires knowledge of who is eating the suggested vehicle(s). Not only do you need to know that your target group is consuming the food, but you also need to know the range of nutrient consumption levels that will be achieved by the fortification intervention so that adequate and safe fortification levels can be chosen[2]. If consumption data for these groups exist from previous surveys then they should be used for analyses and it is not necessary to collect this information again. Often, however, such data are not available or else may be incomplete and will need to be collected in a household level survey. To assist in this task, we have developed the "Fortification Rapid Assessment Tool" (FRAT) as part of these Guidelines. The Tool will help collect the information needed to examine consumption patterns among the target population, and therefore to select an appropriate food vehicle(s) for micronutrient fortification. It can also be used to guide the interpretation of previously collected data. The Guidelines will demonstrate how to use the results of the survey to calculate estimated fortification levels for the selected food vehicles(s) to ensure a safe and effective public health intervention.

The Guidelines are organized in the following manner. Chapter 2 discusses how to prepare to use the FRAT, detail about what the FRAT is, how to implement it, and finally what information it will provide. The third chapter deals specifically with data analysis recommendations and chapter 4 provides guidance regarding the desirability of marketing assessment for food fortification. Finally, while these guidelines have been designed with a focus on vitamin A and iron, they can be adapted for fortification with other micronutrients as well, such as zinc, B-12, and folate.

Conducting a fortification assessment and developing a subsequent intervention will require expertise in nutrition surveys and technical knowledge of nutritional issues. It is important to read the entire manual and discuss plans and possibilities with local food and nutrition experts or external consultants before proceeding.

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[2] While intake levels are calculated in relation to recommended nutrient intakes (FAO/WHO, 1988), it is important to recognize that the efficiency of absorption of micronutrients is often dependent on a number of factors, including the health and nutritional status of the consumer.

2 Fortification Rapid Assessment Tool (FRAT)

To assess effectiveness you need to examine consumption data of the groups most vulnerable to micronutrient deficiencies among the target population. Every effort should be made to use existing data to assess the consumption levels among these groups. If the data are available for some or one of the potential vehicles, you can go directly to Chapter 6, which will guide you through the process of analyzing the data in a manner that will help you to select the appropriate vehicles and design an effective fortification program. In most circumstances, however, these data are not available, or are incomplete or inconsistent, and you will need to carry out a FRAT.

2.1 What is FRAT?

The FRAT is a questionnaire, which combines simplified 24-hour recall and food frequency questionnaires, to provide the minimum amount of information about consumption patterns of potential food vehicles that will allow you to make a confident and informed decision about the most appropriate food vehicle(s) for fortification. The FRAT questionnaire has six parts. Part 1 and 2 collects information on background characteristics and consumption patterns of a woman between 16-45 years. Part 3 and 4 collects information on background characteristics and consumption patterns of a child (the child's caretaker (usually the woman in Part 1) answers on the child's behalf). Part 5 collects general information about food availability and storage, which any adult in the household can answer. Part 6 collects information on the calibration measures of food X by the interviewer. The results of the FRAT will also provide data for an initial examination of effective fortification levels, and will answer some questions about use and availability of the food in the household. A sample FRAT questionnaire is provided in Annex 1, which may be adapted for local conditions.

The FRAT collects information at the household level, among a population sample that is representative of the target group for fortification. The FRAT can be implemented as a stand-alone survey, or it can be piggybacked onto an existing survey, for which a sampling plan has been developed and where survey teams have been mobilized (for example a UNICEF multiple indicator cluster survey, MICS, or a Demographics and Health Survey, DHS). Whether the FRAT is piggybacked or is implemented as a stand-alone survey, this section explains the steps necessary to carry out a Fortification Rapid Assessment, including implementing the FRAT questionnaire.

2.1.1 What the FRAT is not

The FRAT does NOT attempt to measure intake of micronutrients, and therefore cannot be used to make estimates of actual risk of dietary inadequacy. Other dietary survey tools, such as the HKI food frequency questionnaire for vitamin A (Rosen et al., 1994), can be used for this purpose.

2.2 In Preparation of FRAT

2.2.1 Determine the prevalence & distribution of micronutrient deficiencies

The first step in developing a fortification intervention is to examine the patterns and prevalence of micronutrient deficiency in your country, in order to locate the target population and determine which micronutrients are needed for fortification. This should be done using existing

micronutrient deficiency prevalence data, which can at times be found at the Ministry of Health or in the published literature.

Depending on the distribution of the micronutrient deficiencies in the country, a fortification program can be designed to target the whole country, or it can focus on specific regions where the deficiency is endemic or/and distinctly severe. The decision of where to target a fortification intervention should be based on both micronutrient deficiency patterns in the country, as well as on a preliminary investigation of food processing and consumption patterns, as described below.

2.2.2 Who Are the Target Groups for Fortification?

Typical target groups are summarized in Box 2, but this will vary depending on the micronutrient that will be used for fortification and the country's particular epidemiologic profile. While fortification will improve the quality of diet in a community, it may not be an adequate strategy alone to eliminate severe micronutrient deficiencies in the area. In this case, supplementation may be needed to complement fortification efforts for specific target groups with greater micronutrient requirements.

Box 1. Target groups for fortification

Target Group	Reason for selection[3]
6- 24 months	To target infants and children with increased requirements for growth and for whom breastfeeding no longer provides a significant proportion of recommended micronutrient intake.
25 – 59 months	To target pre-school going children who have increased micronutrient (mainly VA and iron) requirements for growth and development.
Women between 16-45 years	To represent women of child-bearing age who will have increased micronutrient requirements during pregnancy and lactation.

(The range of ages given are guidelines only)

The target groups for fortification in areas of vitamin A deficiency would be children between the ages of 6-59 months and women of childbearing age since these groups have increased requirements for growth and development. In addition to fortification, it is recommended that children receive vitamin A supplements at least once every 6 months to ensure that they meet their dietary requirements for proper growth and development, however, this is not always possible and many will have the opportunity to receive only one capsule per year. Also, since fortification efforts generally target all women of childbearing age, supplementation is recommended for postpartum lactating women who have increased vitamin A requirements.

For iron deficiency, target groups include children 6-59 months and in particular those between 6-24 months, and women of childbearing age. The children of these age groups are at particular risk of iron deficiency as their iron stores from birth are rapidly depleting and breast milk no longer provides a solely adequate source to meet the child's iron needs. Complementary foods should be introduced in the diet at this time, but these foods are often insufficient, without fortification, to meet the dietary needs of iron for this age group. Also, in

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[3] Recommended daily intake for the principal micronutrients may be found in FAO/WHO's publication: Human Vitamins and Mineral Requirements, Report of a joint FAO/WHO expert consultation, Bangkok, Thailand, WHO/FAO, Rome, 2002

addition to fortification efforts, iron supplementation is recommended for women before and during pregnancy, in order to help compensate for its high nutritional costs, which result in depletion of maternal iron stores.

2.2.3 Identify potential food vehicles

How do you know which foods to consider for fortification? A detailed list of criteria for selecting food vehicles is presented in Box 4. While all of these criteria are important in the eventual selection of appropriate food vehicle(s), other than the obvious requirement that the vehicle under consideration is technologically fortifiable with a bioavailable form of the nutrient(s) in question, the identification of potential food vehicles should be guided at a minimum by the following criteria:

1.   Be consumed by a large number of individuals at risk of micronutrient deficiency;
2.   Be consumed regularly throughout the year; and
3.   Be centrally processed at a small number of sites

In some cases, foods are not processed in the country and items such as sugar, oil, and flour are imported from other nations. These potential vehicle(s) should still be considered for fortification if the other two criteria are satisfied, as it would be possible to reach an agreement with food providers to fortify such products, especially when the number of providers is limited.

Ideally, a potential food vehicle(s) for fortification will be centrally processed at a small number of sites so that fortification is convenient, cost-effective and practical. Central processing facilitates large scale, and large impact programs, whereas, small-scale fortification, when it is feasible, requires a greater effort to reach the same number of people. However, while the outreach of small-scale processing is less broad, it may be more effective in reaching key target groups who are at greatest risk of deficiency than centrally processed foods. For example, consumers from rural poor populations often do not have access to centrally processed foods and depend on small-scale milling to process their staple cereals like wheat, maize, sorghum and millets. Therefore, you will need to consider what the best avenue is for fortification to reach the target group(s).

Box 2: Criteria for selecting food vehicles

CONSUMPTION	TECHNICAL FEASIBILTY	PROCESSING/STORAGE/ MARKETING
• Consumed by a high number of at-risk population • Regular consumption throughout the year, in relatively constant amounts • Consumption not restricted by low socio-economic status	• Stability of added micronutrient • Minimum segregation of the fortificant and vehicle • Appropriate serving size so that vehicle can carry a significant part of micronutrient requirement in one serving. • No change in quality or consumer acceptability after fortification	• Centrally processed • Labeling according to prescribed standards • Micronutrient loss is minimized by appropriate packaging and high turnover rate from "factory to plate"

A preliminary investigation of food processing and consumption patterns in the country should guide the selection of potential food vehicles, based on these minimum criteria. Per capita consumption data (see the Food and Agricultural Organization's Statistical Database website:

http://apps.fao.org/) can often be used to identify potential vehicles. If you are able to identify one or more potential vehicles that satisfy the minimum criteria, then fortification is a possible option for a public health nutrition intervention to reduce micronutrient deficiency in your country.

The specific foods for which the fortification technology is available, or under development, varies for different nutrients. Ongoing food technology research is continually expanding the list of fortifiable foods, so before choosing the foods to consider with FRAT you should consult with a fortification expert to see if there are any new possibilities. Generally, staple foods are a desirable choice for fortification when feasible because these foods are widely available and often the least expensive to purchase, which will result in broader dissemination in the population.

Table 1 provides a list of food groups and the micronutrients with which they have been fortified (++), whether pilot trials are currently underway (+), whether more trials are needed to determine if fortification is feasible (0), and whether it is not possible to fortify the food vehicle(s) with iron or vitamin A (X). There are a few generalizations that can guide your decision-making. For many of these foods, testing has been done for only singly or doubly fortified foods. The possibilities for fortifying with all micronutrients simultaneously may be limited by adverse interactions between the nutrients, and by the amount of micronutrient that the vehicle can carry.

Table 1. Opportunities for Fortification

Food Vehicle	Vitamin A	Iron/Folate
Staple Foods		
Processed vegetable oils (oil, lard, ghee, vanaspati, margerine)	++	0
Sugar	++	++
Salt	0	+
Flours (wheat, corn, maize, barley, rice)	++	++
Rice	+	+
Basic Foods		
Dairy products (Milk, cheese, butter, yogurt)	++	0
Powdered foods (infant formula and cereals)	++	++
Extruded foods (pasta, snack foods)	++	++
Value-added Foods		
Juices	0	++
Powdered beverages	++	++
Snacks	++	++
Condiments		
Soya Sauce	0	++
Bouillon cubes	0	0

++ = possible, + = pilot trials ongoing, 0 = trials needed

2.3 What Information will FRAT Provide?

The FRAT will collect representative quantitative data on the consumption of potential food vehicles among target groups. The FRAT will also collect a limited amount of qualitative data on the use and availability of potential vehicle(s) at the household level. This information will be necessary in later stages of developing a fortification program, and will be useful to adequately address issues such as the stability of fortificant in food at the household level. Key questions answered using the FRAT are outlined in the following Box.

Box 3: Key questions answered using the FRAT Survey

CONSUMPTION	USE	AVAILABILITY
Potential Effectiveness: • Do young children and women of childbearing age consume the candidate food? • What is the range of consumption levels? • Is consumption restricted by low socioeconomic status?	Storage: • Will there be significant losses of the fortificant as a result of storage method in the household?*	Current availability at household level: • What proportion of households have it at the time of the survey?** • Are there socioeconomic barriers to its use?
Regional variations: • Are there major regional variations in consumption patterns?	Food preparation methods: • Is there a possibility of significant losses during processing or food preparation?*	

* Loss of micronutrients due to storage or cooking methods varies between different foods and micronutrients. For example, iodine loss increases with increasing exposure to air, with temperature having a small effect. Loss of vitamin A from cooking oil increases with temperature, but exposure to air has little effect.

** In some regions where food is purchased one day at a time and consumed as purchased, the availability in the household will not be meaningful, nor will storage practices be important.

2.4 FIVE STEPS OF FRAT

The Five Steps of FRAT are outlined below:

> **STEP 1 - Define the Survey Area and Select the Sampling Areas**
> **STEP 2 - Select and Train the Interviewers**
> **STEP 3 - Adapt & Translate the FRAT Questionnaire and Calibrate Household Measures**
> **STEP 4 - Pretest and Finalize the FRAT Questionnaire**
> **STEP 5 – Select Households & Conduct the Survey**

2.4.1 STEP 1 - Define the Survey Area and Select the Sampling Areas

Sampling is quite a complicated matter, and therefore should be performed by, or under the close guidance of, a person with prior experience in conducting surveys or with training in sampling techniques. Since the purpose of the FRAT is to determine if fortification of selected foods could be an effective response to a micronutrient deficiency problem in a given area, the survey area should be first defined according to patterns of micronutrient deficiency.

The FRAT can be used to examine consumption patterns at the national level, or in selected regions of the country, depending on the distribution of the micronutrient deficiency. In order to make a judgment on fortification as a national strategy, the sample population should represent as much as possible the diversity in national food consumption patterns. An independent sampling area will be needed for each region in the country, where clinical or sub-clinical micronutrient deficiency is thought to occur, and also where it is suspected that significant differences in consumption of the potential vehicle exist. This is called stratified sampling[4].

Stratification is used to generate data for subgroups living under specific conditions, for example urban slum dwellers versus rural population groups. The number of independent sampling areas for which estimates of intake are needed will depend upon the extent to which dietary patterns differ between regions. Examples of characteristics, which might affect food consumption habits include: area of residence (i.e., urban versus rural or mountainous versus pastoral areas), type of community (i.e., fishing community versus nomadic; ethnic or religious minority groups; wealthy versus poor); and seasonal variations affecting food availability. A review of micronutrient deficiency prevalence patterns may also help you to identify regions in the country where the diet will be different, and where an independent sample should be drawn.

As an example, Country Z has one major urban center, and the remaining population is rural. Among the rural population, vitamin A deficiency is known to exist, and there are major differences in agricultural patterns (and concomitantly in food habits) in mountainous versus river delta areas. Therefore, for each one of these agriculturally distinct areas, one sampling area should be selected. There are also regions of ethnic minorities with distinct food habits (e.g., they are Muslim), so an independent sampling area should be chosen to represent this population group.

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[4] UNICEF. Monitoring progress toward the goals of the world summit for children – A practical handbook for the multiple-indicator surveys. New York, January 1995.

For Country Z, then, we would select a total of 5 sampling areas:

> *urban poor*
> *urban rich*
> *rural-mountainous*
> *rural-river delta*
> *rural-ethnic Muslim*

If an urban sampling area is selected, this should not be restricted to the capital city alone, as there are often other settings, which can fulfill the urban criteria as well. In some cases the urban strata can be quite large and consist of a network of many different towns. Consequently, it would be difficult and impractical, given the limitation on time and resources, to select clusters from each of these towns for the interviews. In such instances, we can assume there is a minimum homogeneity between the administrative units for the given strata. So, by sampling in one or two of the administrative areas, it should be representative of the whole strata. This reasoning is also applicable to other sampling areas, which are too large are far apart for conducting interviews in a timely and practical manner.

If the FRAT is piggybacked onto an ongoing survey, you should feel confident that the existing survey design takes into consideration the factors listed above. If you will be carrying out the FRAT as a stand-alone survey, the choice of survey design will depend on a number of factors, including the available resources and time. We have suggested the "cluster sampling method" as one possibility for the FRAT, and have described it in detail in Annex 2. The sample size required for each sampling area using the FRAT will be 210 households with young children and women of childbearing age (to obtain a 95% confidence interval for the estimate of mean consumption $\pm10\%$, when the minimum expected prevalence of consumption of the potential vehicle of 50%, and a design effect of 2)[5]. A higher minimum expected prevalence (75%) would increase the sample size requirements (n=450), and accepting a less accurate estimate ($\pm$ 20%) would decrease the requirement (n= 50).

The number of sampling areas that can be drawn in your survey design is limitless, however the FRAT should be conducted only in those areas where necessary to capture the variability of intakes of the vehicle in the country or region. The FRAT should be kept as simple, low cost, and rapid as possible, and the cost and complexity of the survey will increase proportionately as you increase the number of sampling areas.

2.4.2 STEP 2 - Select and Train the Interviewers

The training described below should be followed whether you are implementing the FRAT as a stand-alone survey or whether it is being piggybacked onto an existing survey. If you are carrying out the FRAT as a stand-alone survey following the cluster survey design, you will need one group of seven interviewers for each independent sampling area. The interviewers may come from one central location, or they may come from various parts of the country that are near the sampling areas. Regardless of where the interviewers come from, they should all receive the same standardized training, to minimize bias in data collection.

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[5] UNICEF. Monitoring progress toward the goals of the world summit for children - A practical handbook for the multiple-indicator surveys. New York, January 1995.

The supervisor will conduct the training, therefore (s)he should have previous dietary survey experience as well as experience in interview training. The supervisor must also ensure that all logistical arrangements are finalized before training begins, and that adequate resources are available for the survey, including people, space, time, transportation and money.

To select interviewers, the following should be considered:
- education and language - interviewers should be high-school graduates where possible and speak the local language;
- if culturally accepted, it is often preferable to use female interviewers because most caretakers of young children are women, and this will make it easier for the interviewer to develop a rapport with those being interviewed;
- interviewers should understand the importance of following instructions and of remaining neutral when questions are answered.

Interviewers will need a one- or two-day training session just before they collect data. The training should include (*adapted from HKI*[6]):
- an overview of the study: the goals of the survey, how it will be carried out, and how the data will be used;
- how to select households, and to ensure that in each household the respondent and her child are randomly selected;
- detailed instructions on how to carry out the survey, with examples of hypothetical problems that interviewers might encounter (e.g., families will often report that they do not have the food in their household, in the hope that the interviewer will then give them some; conversely, recalled food consumption patterns may be altered to impress the interviewer);
- when to carry out the survey (the time of day and the day of the week should be chosen so that each eligible respondent has an equal chance of being included in the sample, and when it is most likely that mothers or caretakers will be at home and will have time to spend with the interviewer);
- a review of the questionnaire, its purpose and content, and how to adapt it to the survey;
- how to complete the questionnaire, including calculating quantities of the food consumed;
- how to check questionnaires and complete summary forms.

(see Annex 3 for a Recommended Interviewer Training Schedule and a Checklist for Interviewers)

2.4.3 STEP 3 - Adapt & Translate the Questionnaire and Calibrate Household Measures

(**This step may need to be done in each sampling area if the sampling areas have different languages or markedly different food cultures)**

A sample FRAT questionnaire is provided in Annex 1, which should be adapted and translated according to your use. However, the questionnaire has been field-tested as shown, and changes (other than translation) are discouraged.   Adaptations should be made only if problems are identified during the pre-testing of the questionnaire or to adapt response categories for the local setting.

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[6] How to use the HKI food frequency method to assess community risk of vitamin A deficiency. Helen Keller International – Vitamin A Technical Assistance Program. David R. Rosen, Nancy J. Haselow, Nancy L. Sloan. New York, 1994.

Before using the questionnaire, enter the name of the food(s) for which you want intake data and be sure to distinguish between types of foods like brown versus white flour for example. If you are interested in intakes of more than one food vehicle, you may use a separate sheet of paper for each food. We will use the term Food X to indicate a potential food vehicle in the following steps, as the FRAT can be used for any potential food vehicle.

In selecting a potential food vehicle(s) for fortification you may need to collect information about foods/beverages/condiments that are consumed along with the food vehicle(s) of interest, since these can affect the absorption of micronutrients from the diet. Certain foods and food components may enhance while others inhibit the body's uptake of micronutrients. For instance, tea inhibits iron absorption from foods, whereas orange juice will enhance it. Therefore, when identifying food vehicle(s) for fortification you should consider what foods are being eaten along with it and what effect this could have on uptake of the micronutrient.

2.4.3.1 STEP 3(a) - Calibrate local household measures:

The FRAT is designed to give a measure of the amount of food consumed by the respondents. Because it is very difficult for people to estimate the amount of Food X consumed in terms of grams, portion sizes will be reported in terms of household measures, using common household utensils as aids. The interviewers will then transcribe the portion sizes into equivalent gram measures of the raw food vehicle after the interview has been completed. If the food consumed is cooked from raw ingredients (e.g., maize porridge from maize flour), then the interviewer will need to determine the quantity of raw flour, for example, that is present in a portion size of the prepared food. In both cases, household measures must be calibrated so that you know how many grams of the consumed food are contained in different portion sizes. In addition to this, market measures should also be calibrated since many of the consumed foods are bought and you will need to determine the amount of Food X in or added to these items.

The following example shows how to calculate portion sizes of each Food X using a collection of utensils that are used for serving the prepared food. If hands and fingers are used instead of utensils, simply follow the procedure as if the hand was the utensil. Before using these techniques in the field, a demonstration should be done with the supervisor and team of interviewers to ensure that the calibration methods are used correctly.

If different utensils are used in different sampling areas, then the following procedure should be conducted in each independent sampling area:
a. From a site that is not included in the actual sample, but that is close to the training site, select a panel of 5 women who would be eligible respondents for the survey;
b. arrange a convenient time to meet with these women at the training site (approximately 2 hours will be required for the meeting);
c. ask each woman to bring with her standard household utensils that are used for serving each Food X; some of the utensils might be identical or very similar to others; some might be quite different. For example, each woman might have brought a teaspoon, a tablespoon, and a cup or bowl.
d. assign a number to each different type of utensil (e.g., the teaspoon would be #1, the tablespoon would be #2, and the cup #3);
e. give each woman enough empty containers (e.g., cups or bowls) to represent the number of different utensils. Each woman should weigh these cups or bowls and record their empty weights;

f. for each different type of utensil, ask each woman to put a "usual" serving into an empty cup or bowl. Ask her to do this ten times. In the end, each woman will have put ten teaspoons of Food X into one cup or bowl, ten tablespoons of Food X into a different cup or bowl, and ten cups of Food X into a different cup or bowl;

g. weigh the cups or bowls of Food X separately.   You should have five cup or bowls that contain ten teaspoons of Food X, and five cups or bowls that contain ten tablespoons of Food X. Deduct the weight of the empty cup or bowl from the final weight of each cup or bowl of Food X;

h. calculate the average and standard deviation for the weight of Food X in the cup or bowl represented by ten usual teaspoon servings of Food X, and divide this weight of Food X by ten to give you the gram equivalent of one teaspoon of Food X.

i. repeat this calculation with the tablespoon to get the gram equivalent of one tablespoon of Food X.

Once you have a list of each of the household measures used for the each of the foods in the sampling area, enter these on the FRAT Questionnaire (Part 6), with the corresponding weight of the raw ingredient. When you carry out the interview, bring along a sample of each of the different types of utensils, and ask the respondent to estimate consumption in terms of these household measures.

2.4.3.2 STEP 3(b) - Translate the questionnaire

The questionnaire will need to be translated into the local language. Translations must be done before the survey begins, and the translated questions must be pre-tested to ensure that subtle changes in the meaning of the questions have not occurred during the translation. Translation should be done by interviewers during interviewer training. This is one of the best ways for interviewers to become familiar with all components of the questionnaire. In some cases, there will be differences for certain words among regions using the same languages. So, make sure to adapt the questionnaire to the local setting during the translation or else during the pre-test. Before pre-testing the translated version, have a third person translate the questionnaire back into English, and check it against the original English version. If the two versions are similar, proceed to Step 4. If there are significant differences, review and modify the translation with the interviewers.

2.4.4 STEP 4 - Pretest and Finalize the Questionnaire

Pretesting the questionnaire is a critical step and should be done in each independent sampling area. The pretest will identify potential ambiguities or problems with the questionnaire, and will help to answer some of the following questions (adapted from UNICEF[7]):

- are the respondents willing to answer questions in the way you have asked them?
- are any of the questions particularly difficult to answer?
- are the questions well understood by the respondents?
- can the interviewers follow the instructions easily, or do they misinterpret them?
- is the questionnaire designed with enough space for interviewers to enter the responses?
- how long does an interview take?

Pretesting of the FRAT will also verify the usefulness of the household measures that have been calibrated to obtain quantitative measures of intake.

The site for pretesting should be in an area that was not selected for the actual survey, and that is relatively close and comparable to the survey area. Each interviewer should conduct 3 to 4 interviews, and record answers exactly as they are reported. After carrying out the interviews, the interviewer should transcribe household measures to gram measures on the questionnaire form. Any difficulties with using the household measures should be carefully noted.

After pretesting, all questionnaires are reviewed by the supervisor for completeness and accuracy. The supervisor and interviewers of each sampling area should meet as a group after completion of the pretest to discuss the process of the pretesting exercise as well. Then make any changes necessary to the instructions with the interviewers, and if necessary change the wording of the questions provided the meaning of the question does not change.

Once all the changes are made, make copies of the final version of the questionnaire for each sampling area. Be sure to number each questionnaire sequentially for each sampling area, and indicate the sampling area, before distributing the questionnaire forms to the interviewers.

2.4.5 STEP 5 – Select Households and Conduct the Survey

In Step 1 we explained how to define the sample area for FRAT. Step 5 will take you through the process of conducting the survey to correctly implement the FRAT. All days of the week should be proportionately included in the survey, therefore interviews must be conducted proportionately on each day of the week. If this is not possible, then proportionately sample on weekend/weekday, market-day/non-market-day, or whatever division may be expected to reflect dietary differences.

2.4.5.1 STEP 5(a) – Select the households

Selecting households is the first step in conducting the survey. To collect information to develop a vitamin A or iron fortification program, eligible households for the FRAT are those with at least one woman of child bearing age and/or one child 6-59 months. In the specific case of iron, preference should be given to those households with a child 6-24 months of age.

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[7] Monitoring progress toward the goals of the world summit for children: A practical handbook for multiple-indicator surveys. UNICEF, New York, 1995.

If FRAT is being piggybacked onto an ongoing survey, then the selection of households will be done according to the sampling method of the ongoing survey. However households selected for the ongoing survey may not necessarily be eligible households for the FRAT, and you may have to visit additional households to reach a sufficient number that are eligible.

On the other hand, if you are implementing the FRAT as a stand-alone survey, to facilitate the selection of households, try to obtain a listing of all eligible households (from local census data or the local health post). If there is no such list available for children, try to obtain clinic cards for all children under 5 years of age (or under 2 years of age in the context of iron deficiency) from the health centers. If possible, map out where the eligible households are located. This will help you to locate them when conducting the survey.

The **Random Walk** method is one method that can be used to select households and can be adapted depending on whether or not you have a list of eligible households.

If you have a List of Eligible Households

In the random walk method, you first randomly select a household (from the list of eligible households in the sampling area). This is your "starting point", or the first household to be visited. The next household to be visited is selected by going to the house which is on the list of eligible households, and whose front door is closest to that house which has just been visited. You carry on this way, from household to household, until a sufficient number of households with a child of an age within your target group(s) and a sufficient number with a woman between 16-45 years (who may be, but are not necessarily, from the same households) have been interviewed.

If you do not have a List of Eligible Households

If you do not have a list of eligible households, use a list of all households in the sampling area to randomly select the "starting point". Subsequent households are selected in the same manner as above, but the difference is that you will probably end up visiting a number of households where there are no children between 6-59 months. In order to avoid wasting time, the first question in every household should be "are there any children between 6-59 months living in this household?", for example. If the answer to this question is yes, begin the interview. If the answer is no, move to the next household. Also, you should ask a person from the village to accompany you on your walk (but not to the interviews), so that (s)he can assist you in locating the eligible households.

2.4.5.2 STEP 5(b) - Conduct the survey

Each interview should take less than an hour (the pre-test will tell you more accurately how long the interview will take). It is a good idea to bring along a local health worker who can treat minor cases or give referrals for micronutrient deficiency.

Interviewer Responsibilities:
Before going to the households, the interviewer should write the name of the sample area, the cluster identification number, and the date on the questionnaire forms that (s)he will be using that day.
To implement the FRAT carry out the following steps in each household visited:
i.   select the "starting point" as described above.

ii. if you do not have a list of eligible households, ask whether there are any children between 6-59 months living in the household. If the answer is yes, go to step (iii). If the answer is no, go to the next household whose front door is closest to where you are.

iii. Ask the first question on the questionnaire: "what are the names of the women present in the household between 16-45 years?", and enter these (if any) on the questionnaire.

iv. Ask each eligible woman if she has any children between 6-59 months, or if she is the primary caretaker of a child between 6-59 months.

v. if only one woman present has a child (or is the primary caretaker of the child) between 6-59 months, then select her as the respondent. If more than one woman present has a child between 6-59 months, randomly select one of these women to be the respondent. If there is no woman between 16-45 years in the household, then the caretaker of the child(ren) between 6-59 months will be the respondent. If the selected respondent cares for more than one child between 6-59 months, select the youngest child only.

vi. Interview the mother or caretaker about herself (if she is between 16-45 years), and the selected child only. Each questionnaire form has questions about the mother (or caretaker) and the child.

vii. Repeat steps ii-vi until you have obtained information on a sufficient number of children between 6-59 months. If you have not interviewed as many women between 16-45 years, continue visiting households to interview women only until you have the same number of women interviewed as children.

viii. After completing a questionnaire, calculate gram equivalents of the food consumed for the woman and the child.

ix. Keep a record of how many households had to be visited in order to reach the total number of respondents.

Supervisor's Responsibilities:

When conducting the survey, the team supervisor will have certain responsibilities over and above those of the interviewers. Some of the responsibilities of the supervisor are listed here (adapted from UNICEF[8]):

- contact local authorities in every cluster beforehand, get their approval and support, and hire local guides if necessary;
- supply the interviewers with questionnaires and other materials (e.g., scales for quantifying household measures);
- conduct demonstration for calibration of household and market measures;
- assign clusters to interviewers;
- observe the first 5-10 interviews in the pre-test to correct or eliminate interviewers, and one out of every 20 interviews and provide feedback to interviewers as necessary;
- review questionnaires as they are completed;
- ensure that interviewers are not avoiding households which are difficult to reach;
- change interviewing times if it is inconvenient for respondents or if potential respondents are too often absent;
- keep the team on schedule;
- tabulate responses with the interviewers and feed back information to the community;
- collect all completed questionnaires and maintain clean records.

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[8] Monitoring progress toward the goals of the world summit for children: A practical handbook for multiple-indicator surveys. UNICEF, New York, 1995.

2.5 Resources Required

Resources required to implement the FRAT include people, materials, and time. You do not need to be an epidemiologist or a nutritionist to implement the FRAT, however at least one person on the survey team should have advanced training and previous experience in conducting population-based dietary surveys and in training field-workers to conduct dietary interviews. The data collectors need to be motivated and literate, but not necessarily have previous experience in surveys. An adequate training session can make even inexperienced people capable of collecting useful data. The resources needed will depend on the number of sampling areas in your survey design. As previously discussed, the costs can be minimized by linking the FRAT to an ongoing survey (for example a UNICEF Multiple Indicator Cluster Survey). Adding the FRAT questionnaire to an ongoing survey would greatly reduce the costs of implementing FRAT, while it would not likely over-burden the ongoing survey.

We have indicated below the time it will take for one team of 7 interviewers to implement FRAT, as a stand-alone survey, in one sampling area following the cluster design (i.e., 210 households and 30 clusters per sampling area). As the number of sampling areas increases, and the number of foods under consideration increases, so will the amount of time and the number of people needed increase (and therefore the costs). There are usually about 3 potential food vehicles for consideration and this will be used for the estimating the time required to implement FRAT as indicated below. As a larger geographical area is covered, and the distance between the sampling areas increases, transportation costs will increase.

Time required for one sampling area, with a team of 7 interviewers, considering 3 food vehicles:
- One interview takes approximately one hour to complete. If the team of 7 interviewers simultaneously works in the same cluster, the total time needed to complete interviews for that cluster is about 1 hour.
- After completing the interviews for one cluster, the whole team will travel to the next cluster, which must also be added to the estimate. Therefore, one team of seven interviewers can usually complete 5-6 clusters in one day, but this may vary depending on the distance between clusters.
- Using this estimate, one sampling area made up of 30 clusters can be surveyed in **5-6 days**.
- Another **2 days** will likely be needed for all of the following: traveling to the main town of the sampling area, contacting local authorities to inform them about what is happening, performing household and market measure calibrations for serving sizes, conducting and discussing results of the pretest and finally traveling to the first cluster to begin the interviews.
- An additional **2 days** should be allocated to account for any delays between clusters, and finally **1 day** is needed to return home.
- Therefore the **total time** required to implement the FRAT for one sampling area, will be approximately **10-11 days**.

In terms of person/days, each sampling area will take 7 persons x 6 days = 42 person/days. As you increase the number of sampling areas, you can choose to increase the size of your team (so that they can survey simultaneously in different sampling areas), or you can increase the time required to complete the survey. Either way, each sampling area will require 42 person/days, and the cost for human resources increases proportionately as the number of sampling areas increases.

In addition to the time required for sampling, 2 days will also be required for training of the interviewers at the central level prior to heading out to the field. Additional training will also take place during Steps 3 & 4 (Adapting the questionnaire; Pre-testing the questionnaire).

Table 2. Approximate costs of conducting the FRAT survey

Item	Approximate cost as percent of total budget
Transportation	
Fuel, rental of vehicles, bus, air tickets	32%
Room rentals and teaching aids	
Training room rental fees and teaching aids (e.g., flip chart, markers, pens, pencils, clipboards)	1%
Personnel	
Salaries/per diems (supervisors, fieldworkers, car drivers, data entry clerks)	50%
Training fees for fieldworkers, including coffee	4%
Other	
Household and market calibration; Survey of street food recipes	1%
Scales for weighing foods	4%
Photocopying of questionnaire forms	6%
Miscellaneous (guides, translator, survey of street food recipes)	2%
Total	100%

The cost of conducting the FRAT survey (including planning, training, data collection, data entry and analysis) and disseminating the results for 4-5 sampling areas in West Africa are estimated to be between US $15,000 - 17,000. These estimates do not include costs for the market assessment component and additional costs should be allocated for it.

3 Analyzing and Presenting Results

3.1 Quantitative Results

Step 1 of this section explains how the data from the FRAT will help you to determine whether the potential food vehicle can be fortified to serve as an effective public health intervention, by determining the percentage of the population at risk who are regularly consuming the food. Step 2 will guide you through calculating effective levels for fortification.

Before beginning the data analysis, create two tables following the examples given below. The tables should have one column for each of the independent sampling areas in your sampling plan. The last column will be used for intakes of the total sample population for each age group (i.e., the aggregate of all sample areas).

In our example (Country Z, section 2.4.1) to target a micronutrient deficiency problem, we have 5 sampling areas. We will number them 1-5.
Food X: _____

Estimated Distribution of Food Vehicle Use
CHILDREN 6-59 months

	SAMPLE AREA					
	1	2	3	4	5	ALL AREAS
% CHILDREN consumed the food in last 7 days						
Estimated Usual Intake all Children 6-59 months						
5th percentile						
Median						
95th percentile						

Food X: _____

Estimated Distribution of Food Vehicle Use
WOMEN 16-45 years

	SAMPLE AREA					
	1	2	3	4	5	ALL AREAS
% WOMEN consumed the food in last 7 days						
Estimated Usual Intake by Consumers						
5th percentile						
Median						
95th percentile						

3.1.1 Step 1 - Calculate the proportion of households consuming the food

For each sampling area, calculate the proportion of households where Food X was consumed in the last 7 days by children 6-59 months. Also calculate the proportion of households where the food was consumed by women 16-45 years in the last 7 days. This is done by dividing the number of households where the child or woman consumed Food X, by the total number of households surveyed. Enter this proportion, for each sampling area, in the first row of the tables.

Calculate the overall proportion of households where Food X was consumed in the last 7 days for each age group, for the total population sampled (i.e., the aggregate of all sampling areas). Since the sampling areas vary in their population sizes, it is necessary to weigh the data to account for these differences when calculating overall consumption levels. This can be done by multiplying the proportion of the population who consumed Food X in a given sampling area by the total population size of that sampling area. Add each of these values together for the five sampling areas to determine the total number of people consuming Food X. This value can then be divided by the total population size of all the sampling areas to get the total proportion of people consuming Food X for all the areas. Enter this value in the last column of the first row. The following can be used as a guideline in determining the feasibility of fortification of Food X.

- Food X is consumed by > 90% of target group(s):
    - Definitely fortify, and if all food X in the region is fortified with one or more micronutrients, it will be able to nearly eliminate the deficiency(ies) single-handedly.
- Food X is consumed by 30 to 90% of target group(s):
    - Fortify Food X, but fortification of other vehicles, or other public health interventions, will also be required.
- Food X is consumed by < 30% of target group(s):
    - A more carefully considered decision is required. Other vehicles or interventions may be more appropriate.

Please note that these are guidelines, and not firmly held rules. It may be feasible to consider fortifying different foods in different regions, according to consumption patterns.

3.1.2 Step 2 - Calculating effective fortification levels

You will need to calculate the median (mid point, or 50th percentile) intakes and the 5th and 95th percentile intakes for each sampling area, and for each age group. Pool data to obtain the percentile distributions for the consumers only in each age group. A variety of software packages can be used for this including spreadsheets (e.g. Excel, Quattro), and statistics/data management software (Epi Info, SPSS, SAS).

In order to obtain a visual representation of the distribution and range of intakes, you should generate histograms for the intakes of each age group in each sampling area, and for the total population (i.e., aggregate of all sampling areas) in each age group. The histograms should have Food X intakes on the x-axis, and % of women or children on the y-axis. The histograms will give an idea of uniformity or diversity between sampling areas, and can assist in determining the best approach for fortification (e.g., to cover all regions surveyed versus local programs).

In order to calculate an effective fortification level, it is important to examine the distribution of intakes among both children and women. While the exact level of fortification will ultimately be set by an expert, certain basic considerations should guide this decision and provide an

estimate. As an example, the bullet points below outline some of the important issues in setting fortification levels for vitamin A. This can be adapted to set levels for other micronutrients by modifying the target groups and nutrient requirements as necessary. The final choice should also take into consideration the possibility of losses of micronutrients incurred during the normal shelf life and cooking of the food, and this will vary from food to food.

- The most vulnerable to long-term effects of vitamin A deficiency are children up to five years old, as discussed in Section 2.2.2. We have surveyed children between 6-59 months; their daily vitamin A requirement is 400 RE[9]. Also vulnerable are women of reproductive age; their requirements are 500 RE (600 RE if pregnant, 850 RE if lactating).

- An appropriate level of fortification would be one that meets 25-30% of the needs of the target individual with the largest "nutrient gap", that is, the gap (difference) between intake and requirements. This is done based on the average consumption of the target group at the highest risk of deficiency. By fortifying at this level, you can ensure that those with lower consumption of the fortified product can still have some of their requirements met, while preventing any problem for those that consume much more than the average, and thus eliminating the risk of exceeding their requirements (vitamin A is only toxic at extraordinarily high levels that would not be reached through consuming fortified food.). Alternatively, you can set the fortification level by the criteria that the fortified food will satisfy at least 50% of the recommended nutrient intake of at least 50% of all the children in the target area.

The example shown in Table 3 uses the 5th and 50th percentile for vitamin A intake from children and women who consumed the food in the last 24 hours, to calculate the fortification level. The table indicates the fortification level that would be needed to satisfy 25% or 50% of the nutrient requirement for each group.

Table 3. Calculated fortification levels of vitamin A for children and lactating women

	A. Intake (g/d)	**B.** Requirements (RE/d)*	**C.** Fortification level (RE/g) to meet 25% requirement **C = (B/4)/A**	**D.** Fortification level (RE/g) to meet 50% requirement **D = (B/2)/A**
Child, 5th percentile	5	400	20	40
Child, 50th percentile	25	400	4	8
Lactating woman, 5th percentile	20	850	10.63	21.25
Lactating woman, 50th percentile	100	850	2.13	4.25

*FAO/WHO (1988) Normative requirements (recommended).

The shaded cell (8 RE/g) represents the results of the equation often used in decision-making (that is, 50% of the requirement of the median child). However, this may be so low as to not be of benefit for the low-end consumers. A case can be made to use the equations represented in any of the other cells.

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[9] FAO/WHO. Requirements of Vitamin A, Iron, Folate and Vitamin B12. Food and Nutrition Series No. 23. Rome, 1988.

3.1.3 Step 3 - Is consumption strongly related to socioeconomic status?

The assumption that micronutrient deficiencies *only* affect the lower income groups is unfounded.

While the poorest are almost always going to be at the highest risk of micronutrient deficiency, and therefore they will be the primary target group of a fortification program, all sectors of the population can benefit by consuming fortified food. Therefore, to evaluate the full effectiveness of the food, compare its intake in the richer versus poorer regions. A food that is consumed by both rich and poor would be more likely to succeed because (1) the poor, who are in greater need of micronutrients, consume it, and (2) the rich, who will also benefit from eating the fortified food, would increase the market size, making the fortified food a more viable, self-sustaining product.

3.2 Qualitative Results

The survey questionnaire includes questions and observations, which provide qualitative information on the use and availability of the food vehicle in the household. It is important that these survey questions are filled in correctly and completely so that the information can be useful in developing the food fortification program. The following sections illustrate how this information can be summarized so that it will be most useful when issues of marketing, distribution, and stability are being examined.

3.2.1 Use

Information obtained from FRAT on use of food includes home storage, preparation, and dietary practices. This information will be important in setting fortification levels for the vehicle of choice, because the stability of the micronutrient in the fortified food may be affected by storage and processing conditions (e.g., exposure to air and light), and by the cooking method. The FRAT will give information on the factors affecting stability at the household level, which will need to be taken into consideration when setting fortification levels. In addition, if you have adapted your questionnaire to take into account the effect of iron inhibitors, this information is necessary to estimate the effect on micronutrient absorption.

You may find that the food is almost always consumed in the same way (e.g., sugar in coffee for adults or mixed with water for children); or you may find that in different regions, the food is used very differently. The table below suggests one way of presenting the information by sampling area, so that you can more easily visualize regional differences and similarities.

Household Use of the Food Vehicle

Sample Area:				
How many days in previous week did you eat food X?		How is food X eaten or processed/prepared?	How is food X stored?	What inhibitors are eaten with Food X
days/wk	% women			
0				
1-2				
3-5				
6-7				
days/wk	% children			
0				
1-2				
3-5				
6-7				

3.2.2 Availability

If the selected food vehicle is present in the household, then we can assume that it is available in the market. If it is not available in a significant proportion of households, then we would like to know why not. The FRAT questionnaire includes a question that will help to assess reasons why the food is not present, if it is not.[10] The following table is provided as an example of how to present information obtained from the FRAT on availability of the food. Only one table is necessary for all sampling areas. The last column should be used if a significant number of people are reporting that they don't have the food in the house because it is too expensive. This information will be key in defining pricing and marketing strategies for the fortified food, especially if a number of households have reported that they do not have the food in their household because they cannot afford it.

Household Availability of the Food Vehicle

Sample area ID	# (%) households with the food vehicle **not** available	# (%) households for which cost was given as the reason

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[10] It is important to remember that people may tend to report that they do not have the food, even if they do, anticipating that they may be more likely to get a free sample from the survey team.

4 Market Assessment

4.1 Why do a market assessment?

After completing the preceding steps, you will know whether the foods you considered were consumed widely and frequently enough that they would be effective in reducing micronutrient deficiency. This work, the characterization of food X consumption, is an important step in the launch of a food fortification program. However, in addition to identifying foods, which can be fortified and are widely consumed, the market conditions must be such that the fortification is logistically feasible (or, be able to be changed to make fortification logistically feasible). Following these guidelines will allow you to characterize the food X industry and decide if fortification is feasible from the industrial and commercial standpoint. These guidelines are less structured than the dietary component, and require the ability to conduct and extract relevant information from open-ended interviews, with an understanding of the local business environment, and an appreciation for the information that needs to come out of the interviews.

4.2 Objectives of Market Assessment

The primary objective is to gain an overall understanding of the manufacture and distribution of each food item under review (Food X).

4.3 Methods

The specific methods for collecting these data may vary by region, and will depend on the situation in your country. In some instances publicly available documents may have all or much of the required information (the internet is becoming an increasingly useful source of information). In most situations there will be little formally documented information and you will have to collect the data directly from the industry through interviews with key players. Open-ended, in-depth interviews with representatives of various levels of the industry can be used to gather the needed information. Interviews should be conducted with representatives (Owners, General Managers, Production Managers, etc) of:

- Manufacturers/Processors of Food X;
- Distributors/Wholesalers of Food X;
- Retailers of Food X.

In these interviews, you need to learn about a broad range of issues, outlined below.

1. The key players in the Food X industry:
   - Who are the growers, importers, producers/processors, shippers and distributors, retailers, and what are the approximate market shares of the major players.
   - Who are the regulators and governing bodies of the Food X industry, for example, government ministries (food, health, trade, agriculture…), industrial organizations (e.g., national and international food industry associations), and what are the legislative requirements, if any, to allow a fortified food to be produced and sold.

2. The movement of Food X from the grower or importer through to the consumer, the distribution system, the turnover rate, the coverage by regions.

3. Understanding the manufacturing processes for Food X (quantity and storage of ingredients, processing methods, and storage of finished products) will help to identify appropriate points for fortification. The appropriate point of fortification varies from food to food, and may be done during the mixing of the dough (for extruded products), after drying (for salt) or refining (for oils), or in mixing just before packaging (for sugar and flours).

4. The technical capacity of the industry to fortify food X at the point(s) identified in 3 and what technical/industrial improvements would be required to make the industry fortification-ready. (Again, this is food specific. The fortificant may be added to salt with a sprayer, and to oils, sugar, flours and extruded products in mixing vats/blenders).

5. The range of prices of the various brands or types of Food X that are most often consumed by the various sectors of the population. Seasonal fluctuations in price, availability and sales.

Sample Size

A guideline for choosing sample size is to continue interviewing more representatives until little new information is learned from the interview (or, when there are only a few players, until all are interviewed). Satisfactory results have been achieved through interviews of as few as 3 and as many as 16 manufacturers, 2 to 6 wholesalers, and 2 to 30 retailers. Note that a single company may play more than one of these three roles.

4.4 Analyzing Results

The results of the market survey will guide subsequent decisions and actions for fortification of Food X.

In an *ideal* market scenario for the launch of a new fortification program the following characteristics would prevail:

- there would be only a few, centrally located and motivated players, controlling a large part of the market for Food X throughout the entire region.
- the Food X industry would be state-of-the-art, and able to easily incorporate fortification technology into their production line.
- the turnover of Food X (from fortification point to consumption) would be less than six months, to minimize loss of the fortificants during storage.
- the responsible government organization would be supportive of fortification of Food X, and be willing to enact and enforce appropriate legislation, and be willing to negotiate tax breaks or other incentives for industry participants.
- the price of fortified Food X can be set equivalent to or lower than unfortified Food X.

Rarely, if ever, would the market scenario be as described in the ideal. This should not discourage you! Salt fortification has proceeded in numerous countries, where the salt industry was highly fragmented, used crude production technology and had unknown turnover. The only favorable condition was supportive government and international organizations willing to work to change the market conditions. In fact, no matter what the state of the market, it is possible to work towards changing the market situation to facilitate fortification. The market analysis will indicate the level of effort required to initiate fortification, and it will provide a rough idea of the cost-effectiveness should the fortification program proceed (e.g., highly centralized industry will

likely be more cost-effective than village-level industry), but there are few results from a market assessment that would absolutely close the door to further consideration of fortification.

References

Arroyave, G., & Dary, O. Manual for sugar fortification with vitamin A – Part 1 – Guidelines for the development, implementation, monitoring, and evaluation of a vitamin A sugar fortification program. OMNI/USAID/INCAP, Guatemala, 1996.

Cervinskas, J., Lotfi, M. Vitamin A Deficiency: Key resources in its prevention and elimination. The Micronutrient Initiative, 1996.

FAO/WHO. Human Vitamins and Mineral Requirements, Report of a joint FAO/WHO expert consultation, Bangkok, Thailand, WHO/FAO, Rome, 2002.

FAO/WHO. Requirements of vitamin A, iron, folate and vitamin B12. Food and Nutrition Series No. 23. Rome, 1988.

Gibson, R.S. Principles of Nutritional Assessment. Oxford University Press. New York, 1990.

Guidelines for the development of a simplified dietary assessment of identify groups at risk for inadequate intake of vitamin A. A report of the International Vitamin A Consultative Group (IVACG). July 1989.

Kennedy,E., Mannar,V.,& Iyengar,V. Alleviating Hidden Hunger: Approaches That Work. IAEA Bulletin 45/1, Vienna, 2003.

Lemeshow, S., Lwanga, S.K. Sample size determination in health studies – A practical manual. World Health Organization, Geneva, 1991.

Mannar, V. Food Fortification. Encyclopaedia of Food Sciences and Nutrition, 2nd Edition. Academic Press, 2003.

Merx,R., Mahshid,L., Naber-van den Heuvel,P., Mannar,V. Micronutrient Fortification of Foods: Current Practices, Research, and Opportunities. The Micronutrient Initiative, Ottawa, 1996.

The Micronutrient Initiative (MI) and The International Agricultural Centre (IAC). Unpublished Report of the Food Fortification Technical Experts Training Course, March 18 - 26, Wageningen, The Netherlands.

Opportunities for Micronutrient Interventions (OMNI), Roche, & USAID. Food Fortification Basics: Choosing a Vehicle. Factsheet.

Rosen,D.R, Haselow,N.J., & Sloan, N.L. How to use the HKI Food Frequency Method to Assess Community Risk of Vitamin A Deficiency. HKI International, New York, 1994.

Sommer, A., & West, K.P. Vitamin A Deficiency – Health, survival, and vision. Oxford University Press, 1996, p421.

UNICEF. Monitoring progress toward the goals of the world summit for children – A practical handbook for the multiple-indicator surveys. New York, January 1995.

WHO. Guidelines on Food Fortification with micronutrients for the control of micronutrient malnutrition. Draft March 2003 – unpublished.

WHO. Monitoring immunization services using the Lot Quality Technique. Global program for vaccines and immunization – vaccine research and development. World Health Organization, Geneva, 1996.

WHO. The EPI coverage survey – training for mid level managers. Expanded Program on Immunization. World Health Organization, Geneva, 1991.

WHO/MI Safe vitamin A dosage during pregnancy and lactation: Recommendations and report of a consultation, 1998.

WHO/UNICEF. Indicators for assessing vitamin A deficiency and their application in monitoring and evaluating intervention programs. Geneva, 1994.

5 ANNEXES[i]

5.1 Annex 1 - Fortification Rapid Assessment Tool

What are the names and ages of the women in the household between 16-45 years old?

	Name	Age (years)	# children between 12-36 months?
Woman #1			
Woman #2			
Woman #3			
Woman #4			

Note to the interviewer:
Select the woman with at least one child between 12-36 months to be the Respondent. If there is more than one woman with a child or children between 12-36 months, randomly select one to be the Respondent. If there are no women with child(ren) between 12-36 months, randomly select any women between 16-45 years to be the Respondent. If there are no women between the ages of 16-45, then the Respondent will be the caretaker of a child between 12-36 months.

PART 1:
Questions about the Respondent:

Ask the following questions only to women aged 16-45 years:
1.1 Since you got up yesterday morning, what was the first food or beverage you consumed that was prepared with Food X?

   a) How was the food/beverage prepared?

   b) How much did you eat/drink on that occasion?

   c) What was the next food or beverage you consumed that was prepared with Food X?

→ Continue through the day and night, until the respondent woke up this morning. Use Table 1 to record the results.

   d) Was intake unusual in any way? If yes, in what way?

1.2 If you did not consume anything prepared with Food X yesterday, why not?

1.3 How many days, in the last 7 days, did you eat foods/beverages prepared with Food X?

1.4 In which season(s) do you eat Food X?

Question No:_____   Date:_____
Sample Area:_____   Food(s):_____
Interviewer Name:_____

PART 2:
Questions about the child:

Ask the following questions to all Respondents:
2.1 What are the names and ages of the children between 12-36 months that you care for?

	Name	Birth date (month/year)	Age (months)
Child #1			
Child #2			
Child #3			

Note to the interviewer:
Randomly select one child from the list above.
Interview the mother or caretaker about the selected child only.

2.2 Since your child got up yesterday morning, what was the first food or beverage (s)he consumed that was prepared with Food X?

      a) How was the food/beverage prepared?

      b) How much did (s)he eat/drink on that occasion?

      c) What was the next food or beverage (s)he consumed that was prepared with Food X?

  $\rightarrow$ Continue through the day and night, until the respondent woke up this morning. Use Table 1 to record the results.

      d) Was intake unusual in any way? If yes, in what way?

2.3 If the child did not consume anything prepared with Food X yesterday, why not?

2.4 How many days, in the last 7 days, did (s)he eat foods/beverages prepared with Food X?

2.5 In which seasons does (s)he eat Food X?

Question No:_____   Date:_____
Sample Area:_____   Food(s):_____
Interviewer Name:_____

PART 3:
General Questions:

Ask the following questions to all Respondents:
3.1 Do you have any Food X in the house right now? (yes/no)

      If yes, can I see it?
      (observe relative quantity and how it is stored; is it exposed to light/air?)

      If no, why not?

How do you usually store Food X (exposed to light/air)?

Table 1. Dietary intake for Woman and/or Child

Foods consumed yesterday containing Food X		
Time of consumption	Prepared how	Amount consumed (household measures)
Woman aged 16-45 years:		
Daily Intake (calculated):		
Child aged 12-36 months:		
Daily intake (calculated):		

Question No:_____   Date:_____
Sample Area:_____   Food(s):_____
Interviewer Name:_____

Table 2. Calibrating Household Measures

5.2 *Food*	Household Measure (usual portion)	Weight of usual portion of consumed food	Weight of raw Food X in usual portion*

∗ **Note that this figure will be the same as the weight of the usual portion for foods such as sugar and oil, but will differ for foods such as maize porridge, where the usual portion contains ingredients other than Food X (see section 2.4.3.1 of FRAT Guidelines).**

Question No:_____   Date:_____

Sample Area:_____   Food(s):_____

Interviewer Name:_____

5.3 Annex 2 - Cluster Survey

The following describes the standard "cluster survey" methodology[11], and is provided as an example of one possible sampling methodology to implement the FRAT as a stand-alone survey.

Cluster surveys are used to obtain representative information by random selection of sub-sets or "clusters" of people to represent larger population groups. Cluster sampling will result in higher rates of precision (more aggregation and therefore less error) and lower costs than simple random surveys, but in less representativeness than simple random samples. The "clusters" will be small administrative units, such as villages in the rural setting or wards in the urban setting. The survey will select 30 clusters from each sampling area (this allows for a reliable and representative estimate to be made for a population group while minimizing logistical requirements). Each sampling area will have a total sample size of 210 households[12], and the number of households per cluster will be 7 (210 divided by 30). Therefore, if you have 4 sampling areas, the total sample size will be (4 x 210 = 840); if you have 5 sampling areas, the total sample size will be (5 x 210 = 1050), and so on. As the number of sampling areas increases, so does the cost and time required to implement the survey, therefore the number of sampling areas selected should be balanced against the time and money available to carry out the survey.

As an example, in a survey that has 6 independent sampling areas, using the cluster design the sampling plan will be:
* 6 independent sampling areas
* 210 households per sampling area (therefore a total sample size of 1260 households)
* 30 clusters per sampling area
* 7 households per cluster (210 divided by 30)
* 1 woman-child pair per household

A two-stage design is used to select the clusters, following a "probability proportionate to size" sample selection method, as outlined below. Sampling with probability proportional to size means that sampling areas with larger populations will have a proportionately greater chance of containing a selected cluster than smaller areas. Selection of clusters must be done independently for **each sampling area** selected.

To select clusters in **each** independent sampling area:
* construct a table with three columns. In the first column, construct a listing (e.g., alphabetical) of villages or other administrative units ("clusters") located within the sampling area, and number each cluster (these numbers become the "cluster identification numbers"). There should be more than 30 clusters in each sampling area; if there are fewer, a universal sampling of villages should be done.

* in the second column, list population figures for each cluster from the most recent census data or other reliable population figures

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[11] UNICEF. Monitoring progress toward the goals of the world summit for children - A practical handbook for the multiple-indicator surveys. New York, January 1995.
[12] Based on a level of confidence of 95%, a precision of 10%, a minimum expected prevalence of consumption of the potential vehicle of 50%, and a design effect of 2.

- calculate the total population of the sampling area from the list of clusters. (e.g., 1,000,000)

- calculate the **"sampling fraction"** by dividing the total population by the number of clusters to be drawn (30). (e.g., 1,000,000 / 30 = 33,333). A sampling fraction shows what proportion of a total population will be included in the study.

- select a random "first number" number which is between 1 and the "sampling fraction". This can be done by using a table of random numbers (e.g. 2,200).

- find the cluster whose cumulative population just exceeds this random number. This is the "first cluster" for inclusion in the sampling plan. (e.g., cumulative population of cluster #? = 2,350 from table)

- add the "sampling fraction" to the "first number" (33,000 + 2,200 = 35,533). Find the cluster whose cumulative population just exceeds this number. This cluster is the "second cluster" for inclusion in the sampling plan. (e.g. from the table)

- add the sampling fraction to the second number (33,000 + 35,533 = 68,533). Find the cluster whose cumulative population just exceeds this number. This is the "third cluster" for inclusion in the sampling (e.g., from table).

- identify the location of each subsequent cluster by adding the sampling fraction to the number which located the previous cluster. Continue this process until you have selected 30 clusters.

5.4 Annex 3 - Interviewer Training Schedule & Checklist for Interviewers

<table>
<tr><td colspan="3" align="center">Recommended Interviewer Training Schedule[13]</td></tr>
<tr><td rowspan="3">Day 1</td><td>Morning</td><td>Explain survey objectives, survey procedures, and survey calendar. Articulate expectations. Discuss financial arrangements and logistical arrangements for the training and survey.</td></tr>
<tr><td>Afternoon</td><td>Review survey instrument. Discuss survey questions. Translate questionnaire.</td></tr>
<tr><td>Evening</td><td>Review questionnaire at home.</td></tr>
<tr><td rowspan="3">Day 2</td><td>Morning</td><td>Review first day of training. Discuss sampling, with emphasis on proper selection of the child and woman within each household. Discuss proper recording of responses. Demonstrate probing techniques for unclear responses. Demonstrate a correct interview. Review checklist for interviewers.</td></tr>
<tr><td>Afternoon</td><td>Practice interviews with each other, role-play, peer review, and critique role-play.</td></tr>
<tr><td>Evening</td><td>Conduct mock interviews on family members, especially mothers.</td></tr>
<tr><td rowspan="2">Day 3</td><td>Morning</td><td>Conduct field test in a community that is near, but not part of, the communities to be surveyed.</td></tr>
<tr><td>Afternoon</td><td>Discuss, make final refinements, and reproduce questionnaire.</td></tr>
</table>

Checklist for Interviewers:
➢ Greet the mother (or caretaker) warmly. Explain why you are there and how the information that you are collecting will be used. Ask her permission to conduct the interview.
➢ Be presentable, relaxed, and non-judgmental. Work efficiently to avoid taking too much of the mother's (or caretaker's) valuable time.
➢ Ask questions exactly as they are written, in the order they appear on the questionnaire.
➢ Always read the question exactly as written. If the respondent is unable to answer the question the first time, repeat the question exactly as written. Never acknowledge surprise, agreement, or disagreement with answers by facial, verbal, or other expressions.
➢ Ask all questions. Never skip questions unless instructed to do so. Never skip a question and come back to it later.
➢ Never leave a question blank. Always write a 0 when the answer in "none" or "on no days last week". Write "don't know" when the respondent says they do not know.
➢ Always review the completed questionnaire to ensure that all questions are answered and properly coded.
➢ Always thank the respondent for her (or his) time and cooperation.

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[13] How to use the HKI food frequency method to assess community risk of vitamin A deficiency. Helen Keller International – Vitamin A Technical Assistance Program. David R. Rosen, Nancy J. Haselow, Nancy L. Sloan. New York, 1994.

5.5 Results of FRAT Field Studies in four countries of West Africa: Burkina Faso, Mali, Niger, and Guinea

FRAT studies were successfully conducted in four countries of West Africa to identify potential food vehicles for fortification. The studies looked at the potential fortification three or four food vehicles, including sugar, cooking oil, wheat flour, and bouillon cubes, in each of the countries. The results of these studies are summarized below.

Burkina Faso

In Burkina Faso, FRAT was implemented in September 1999 to target groups of children between the ages of 12-36 months (N=838) and women of childbearing age (N=838). The survey area consisted of four sampling areas, each containing 30 clusters with 7 interview households. The food vehicles assessed for potential fortification with vitamin A were sugar, wheat flour, and bouillon cubes. The results showed that sugar was consumed by more than 45% of women and more than 50% of children. Similarly for wheat flour, more than 60% of urban women and children consumed this food.

Mali

In Mali, FRAT was conducted in November 1999 among children between the ages of 12-71 months (N=276) and also women of reproductive age (N=646). Four food vehicles (sugar, cooking oil, wheat flour, and bouillon cubes) were assessed for possible fortification with vitamin A in four sampling areas. These four foods were widely consumed with at least 45% consumption among women and children in the survey areas.

Niger

In Niger, the FRAT study was done in March 2001. Target groups consisted of children aged 12-59 months (N=838) and women of reproductive age (N=840) in five sampling areas. Consumption data were collected for the following foods: sugar, cooking oil, and bouillon cubes. Again, these foods were widely consumed by the target populations.

Guinea

The implementation of FRAT in Guinea took place during September 2001 in five sampling areas. Information was collected for women of childbearing age (N=1051) and children between 12-36 months of age (N=1051). The potential food vehicles in consideration for fortification with vitamin A included sugar, cooking oil, and wheat flour. Results indicated that consumption of sugar was greater than 40% in women and children. Consumption cooking oil and wheat flour was greater than 55% and 60% among these groups in urban areas.

Overall, the results from the FRAT studies suggest that any of the potential food vehicles for vitamin A fortification (sugar, cooking oil, wheat flour, and bouillon cubes), would be a sound choice in countries where the studies were conducted. These foods are already widely available, accepted, increasingly consumed, and have the potential to reach more than 50% of the target populations.