Fortification Rapid Assessment Tool and Guidelines

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1 Introduction

In developing a fortification program, one of the more common constraints encountered is the selection of appropriate food vehicles. Programmers 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 programmers work through the steps of examining food consumption patterns in order to, first, decide whether fortification could be considered as a viable public health intervention for eliminating vitamin A deficiency in the country, second, to identify potential food vehicle(s), and third, to assess the appropriateness of these vehicle(s) for fortification with vitamin A. 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", in which a fortified food must be consumed by a large majority of the at risk population, is no longer considered valid. An effective fortification program may now be considered simply one which can deliver the micronutrients to at least some of the target population AND has a large enough market that it can be self-sustaining. It has previously been stated that the food vehicle should be consumed by, for example, greater than 50% of the target population, but in many situations multiple food vehicles may be required to achieve such broad coverage.

In order to select an appropriate food vehicle(s), it is necessary to examine consumption patterns of the potential food vehicle(s) among two distinct groups – children one to three years of age and women of reproductive age (16 to 45 years). If consumption data for these groups exist from previous surveys then they should be used for analyses. Often, however, such data are not available 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 carrier(s) for vitamin A. It can also be used to guide the interpretation of previously collected data. The Tool does NOT attempt to measure intake of vitamin A, and therefore cannot be used to make estimates of actual risk of dietary vitamin A inadequacy. The Guidelines will demonstrate how to use the results of the survey to calculate fortification levels to ensure that the selected food vehicles(s) will result in an effective public health intervention. The FRAT can also be used to evaluate the effectiveness of existing fortification programs.

The Fortification Rapid Assessment Tool and Guidelines will help programmers to make an informed and responsible decision regarding the development of a fortification intervention, and to design a fortification program that will be effective as a public health intervention. While the Guidelines have been designed with a focus on vitamin A deficiency, the general principles can be applied to fortification with other micronutrients, such as iron, iodine, or zinc. In Annex 4 the modifications necessary for applying FRAT to other fortificants are described.

Conducting a fortification assessment requires expertise in nutrition surveys. It is important to read the entire manual and discuss plans and possibilities with local food and nutrition experts or external consultants before proceeding.

2 Overview of vitamin A fortification

2.1 Why Fortify?

Successful national programs to eliminate vitamin A deficiency as a public health problem may contain a combination of the three basic approaches for increasing vitamin A intake: supplementation, fortification and dietary diversification. 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; and fortification will increase the nutrient intake of many different age groups within the at-risk population. In addition, the cost of fortification to governments is relatively low because most costs are borne by industry and consumers. Overall, food fortification provides an effective medium- to long-term intervention, with greater sustainability and generally lower cost than supplementation and diet improvement programs.

While fortification of salt with iodine has been successfully used to combat iodine deficiency disorders in many countries and fortification of flour with iron is increasingly common, fortification with vitamin A has seen limited success, largely because of the difficulty of identifying appropriate vehicles. Fortification is generally considered to be effective and feasible if the food that is fortified is eaten regularly by all population groups at risk of deficiency, and if the food is centrally processed in a small number of sites. A number of different foods could be fortified with vitamin A. Up to now, foods most commonly fortified with vitamin A include sugar and oil. Alternative vehicles exist, including rice, monosodium glutamate, wheat, dairy products, margarine, tea, and certain beverages[1], however the fortification technology is still being developed for these foods. While a number of potential vehicles have been tried in small scale pilot studies, their use on a larger scale has been limited, often because of a lack of knowledge of consumption patterns of the potential vehicles.

2.2 Steps in Developing a Food Fortification Program

A number of issues need to be considered when developing a fortification program for vitamin A deficiency, including vitamin A deficiency patterns in the country, food habits, processing and marketing of potential food vehicles, government policies, and legislation.[2] These issues are summarized in Box 1.

Box 1. Conditions for the success of fortification programs

- political support
- industry support
- adequate application of legislation
- appropriate fortification level
- good bioavailability of the compound
- no inhibitory effect of the common diet
- human resource training at industry and marketing levels
- consumer acceptability
- no cultural or other objection to fortified foods
- adequate monitoring and evaluation
- no constraint regarding procurement of micronutrients

It is unlikely that you will be able to determine whether all of these suggested conditions hold in your country (it would be an ideal and unusual situation where all of them were satisfied!), and you should not try to assess all of them at once. The steps outlined in Box 2 will help you to assess the conditions for

[1] Sommer, A., & West, K.P. Vitamin A Deficiency - Health, survival, and vision. Oxford University Press, 1996, p421.
[2] Micronutrient Fortification of Foods - current practices, research, and opportunities. The Micronutrient Initiative, 1996.

fortification in a systematic manner. Steps 1, 2, and 3 should be carried out early on in the process of developing a fortification program, because you should know which foods are being consumed by the target population, and therefore could be considered as potential vehicles for fortification, before spending a lot of time and money dealing with the processing and marketing of specific foods. Experience has shown that it is often Steps 3 and 5 which presents the greatest constraint to developing a fortification program; the FRAT has been designed to help programmers get beyond these critical steps.

Box 2. Steps in developing a food fortification program

1. determine the prevalence & distribution of vitamin A deficiency
2. select potential food vehicles
3. **obtain consumption data for potential vehicles (FRAT)**
4. seek government and food industry support
5. **assess processing industry chain of potential vehicles**
6. choose fortificants and set the levels of fortification
7. develop fortification technology
8. determine stability and bioavailability of fortified food
9. conduct field trials to determine efficacy and effectiveness
10. develop standards, legislation, and regulation for mandatory compliance
11. define final product and packaging and labeling requirements
12. promote campaigns to improve consumer acceptance

2.3 The Need for a Fortification Rapid Assessment Tool (FRAT)

The selection of an appropriate food vehicle requires a 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 consumption levels among the population that will be reached by the fortification intervention so that adequate fortification levels can be chosen[3].

An effective fortification program may be considered one which can deliver the micronutrients to a large proportion of the micronutrient deficient population, *or* delivers micronutrients to at least some of the target population AND has a large enough market that it can be self-sustaining.

Ideally a fortified food reaches all segments of society, as micronutrient deficiencies are found throughout all age-sex groups and socioeconomic strata. However, it is most important that the food is consumed by those with the highest prevalence of micronutrient deficiency, which in the case of vitamin A is usually young children. Women of reproductive age are a second critical target group, as they are often vitamin A deficient and have additional vitamin A requirements during pregnancy and lactation that must be met to ensure healthy children.

To assess effectiveness, therefore, you will need to determine the range of intakes of potential food vehicles among these two distinct groups of your target population. You may be able to find this information from existing data. Unfortunately, however, more often than not such age-disaggregated

[3] 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 retinol is dependent on a number of factors, including the health and nutritional status of the consumer.

consumption data for the food(s) in question simply do not exist, or the data are inconsistent or incomplete. If you are unable to assess effectiveness using existing data, you will need to carry out a household level survey. The FRAT has been designed for this purpose: to help you determine consumption patterns of selected food items among young children and women of reproductive age so that you can assess the potential effectiveness of these foods as carriers of vitamin A.

3 The Fortification Rapid Assessment Tool (FRAT)

3.1 What is FRAT?

The FRAT combines simplified 24-hour recall and food frequency questionnaires, and is designed 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 appropriate food vehicle(s) for a vitamin A fortification program. 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 population 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 or a District Health survey). This would greatly reduce the costs of a FRAT survey. Whether the FRAT is piggybacked or is implemented as a stand-alone survey, Chapter 4 of these Guidelines explains the steps necessary to carry out a Fortification Rapid Assessment, including implementing the FRAT questionnaire.

3.1.1 What the FRAT is not

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

3.2 Who Are the Target Groups for FRAT?

The FRAT is designed to provide information on the effectiveness of potential food vehicles. It is of interest, therefore, to measure the intakes of the sex-age groups that are at greatest risk of deficiency. In the case of vitamin A, the FRAT focuses on:

1. children between 12 and 36 months (when breastfeeding no longer provides a significant portion of vitamin A intakes)
2. women between 16 and 45 years (representing women of child-bearing age)

The range of ages are guidelines only and may be changed if (1) weaning takes place before one year, or when breastfeeding is not done at all, and (2) if pregnancy frequently happens at less than 16 years of age.

3.3 What Information will FRAT Provide?

The FRAT will collect representative quantitative data on the consumption of potential food vehicles among children between 12 and 36 months and among women between 16-45 years, in at-risk population 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, for example to allow for issues of stability of the fortificant in the food at the household level to be adequately addressed. Key questions answered using the FRAT are outlined in the following table.

Key questions answered using the FRAT Survey

CONSUMPTION	USE	AVAILABILITY
Effectiveness: • Do young children and women of child-bearing age consume the fortified 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 rice (Ultra Rice™) increase 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.

4 Fortification Rapid Assessment

4.1 Preliminary Assessment

The preliminary assessment described in this section will allow you to determine whether fortification is a realistic option for a public health nutrition intervention to prevent vitamin A deficiency in your country, and to identify potential food vehicles (i.e., the first two steps in Box 2). These steps should be carried out prior to conducting any food consumption surveys.

4.1.1 Determine the prevalence & distribution of vitamin A deficiency

The first step in developing a fortification intervention is to examine the patterns and prevalence of vitamin A deficiency in your country, in order to locate the target population. This should be done using existing vitamin A deficiency prevalence data, which can at times be found at the Ministry of Health or in the published literature. Other times there will be little available data and you need to rely on expert opinion. Note that very accurate data are not necessarily required. Whether the prevalence of vitamin A deficiency is 10%, 50% or 75%, it is a problem of public health magnitude which needs to be addressed with public health measures, such as food fortification. It is not necessary to wait for perfect and complete data. Once it is agreed that vitamin A deficiency is likely to be a public health problem, the next step is to identify potential food vehicles for fortification.

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

4.1.2 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 3. While all of these criteria are important in the eventual selection of appropriate food vehicle(s), the identification of potential food vehicles should be guided by a limited list of criteria. At a minimum, potential vehicles should satisfy the following criteria:

1. be consumed by a large number of individuals at risk of vitamin A deficiency;
2. be consumed throughout the year; and
3. be centrally processed at a small number of sites*.

* Central processing facilitates large scale, large impact programs. Small scale fortification is also feasible (e.g., at village millers) for some micronutrients and some foods, but a greater effort is required to reach the same number of people as large scale programs.

Box 3: 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 SES	• Stability of added vitamin A • Minimum segregation of the fortificant and vehicle • Appropriate serving size so that vehicle can carry a significant part of vitamin A requirement in one serving. • No change in quality or consumer acceptability after fortification	• Centrally processed • Labeling according to prescribed standards • vitamin A 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. National level consumption data, such as data published by the International Sugar Organization[4], or 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. The technology already exists for fortifying a number of foods with vitamin A, as shown in Box 4, and these foods should probably be considered first.

Box 4
Foods that can be fortified with vitamin A include

sugar
wheat flour, corn flour
rice
tea
oil/margarine/butter/lard
MSG
processed cereals and cereal-based products
dairy products
beverages (processed and powdered)

Based on this preliminary investigation, you should be able to identify which foods, if any, could be considered as 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 vitamin A deficiency in your country. The next step is to select appropriate food vehicle(s) from this preliminary list. For this you will need to examine consumption data in more detail, as explained in the next section.

4.2 Selecting Appropriate Vehicles using FRAT

To assess effectiveness you need to examine consumption data of children between 12-36 months, and women in their reproductive years, in the target population. Every effort should be made to use existing data to assess the consumption levels among these two groups in your target population. If the data are available for some or one of the potential vehicles, you can go directly to Chapter 5, 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 food consumption survey. In this case, you should follow the **Five Steps of FRAT** 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 - Conduct the Survey

[4] Patterns and trends in sugar consumption. International Sugar Organization. A paper presented at the International Conference on the Fortification of Sugar with Vitamin A, Guatemala City, March 1996.

4.2.1 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. The objective of the FRAT is to determine whether fortification of selected food(s) could result in an effective public health intervention in an area where vitamin A deficiency is a public health problem. The survey area, therefore, is first defined by patterns of vitamin A 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 vitamin A 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 subclinical vitamin A deficiency exists, and where it is suspected that significant differences in consumption of the potential vehicle exist. This is called stratified sampling[5].

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. Differences in food habits may exist because of agricultural or geographic variations, and because of cultural characteristics. Examples of characteristics which might affect food consumption habits are given in Box 5. A review of vitamin A 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.

BOX 5
Factors affecting food habits:
geography (e.g., mountainous, pastoral)
urban/rural
wealthy/poor
fishing communities (e.g., coastal)
nomadic
cash crop areas
subsistence areas
ethnic minorities
religious practices
season

If you are interested in fortification in one or a few selected regions only, where vitamin A deficiency is endemic, then your sampling will be limited to the region(s) of interest. Whether you are looking at a national or regional program, stratification of the sample for the FRAT should take into account the factors in Box 5.

The FRAT uses simplified 24-hour recall and food frequency questionnaires to estimate usual intakes of a selected food item(s) among two distinct sex-age groups. In an ideal situation, you will be able to add the FRAT to an ongoing survey. This will greatly reduce the cost of the survey, because the survey design will be already defined, and health workers will have been trained. It is unlikely that adding the FRAT to

[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.

an ongoing survey will overburden the survey. Note, however, that the existing survey design must be appropriate for the FRAT, as described in this section.

If the FRAT is piggy-backed 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 (to obtain a 95% confidence interval for the estimate of mean consumption ±10%, when the minimum expected prevalence of consumption of the potential vehicle of 50%, and a design effect of 2)[6]. A higher minimum expected prevalence (75%) would increase the sample size requirements (n=450), and accepting a less accurate estimate (± 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.

As an example, Country Z has one major urban center, and the remaining population is rural. Among the rural population, where VAD is known to exist, 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.

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

4.2.2 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 piggy-backed 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 six interviewers for every 2-3 independent sampling areas. 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.

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

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

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);
- 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*[7]):

- 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)

4.2.3 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)

The following activities must be carried out whether the FRAT is conducted as a stand-alone survey or whether it is piggy-backed onto an ongoing survey.

The questionnaire has three parts. Part 1 concerns the diet of a woman between 16-45 years. Part 2 concerns the diet of a child between 12-36 month (the child's caretaker (usually the woman in Part 1) answers on the child's behalf). Part 3 asks general questions about food availability and storage, which any adult in the household can answer. A sample FRAT questionnaire is provided in Annex 1 which can be adapted and translated for your use. However, the questionnaire has been field-tested as shown, and changes (other than translation) are discouraged. If adaptations are to be made, they should be made only if in pre-testing of the questionnaire problems are identified.

[7] 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. 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 sugar as an example of a potential food vehicle in the following steps, but remember that the FRAT can be used for any potential food vehicle.

4.2.3.1 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 sugar, for example, 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 we know how many grams of the consumed food are contained in different portion sizes.

The following example shows how to calculate portion sizes of sugar from household utensils. The same procedure can be used to calculate portion sizes of any food, 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.

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 sugar; some of the spoons might be identical or very similar to others; some might be quite different. For example, each woman might have brought a teaspoon and a tablespoon.
d. assign a number to each different type of utensil (e.g., the teaspoon would be #1, and the tablespoon would be #2);
e. give each woman enough empty containers (e.g., cups) to represent the number of different utensils. Each women should weigh these cups and record their empty weights;
f. for each different type of utensil, ask each woman to put a "usual" serving into an empty cup. Ask her to do this ten times. In the end, each woman will have put ten teaspoons of sugar into one cup, and ten tablespoons of sugar into a different cup.
g. weigh the cups of sugar separately. You should have five cups that contain ten teaspoons of sugar, and five cups that contain ten tablespoons of sugar. Deduct the weight of the empty cup from the final weight of each cup of sugar;
h. calculate the average and standard deviation for the weight of sugar in the cup represented by ten usual teaspoon servings of sugar, and divide this weight of sugar by ten to give you the gram equivalent of one teaspoon of sugar.
i. repeat this calculation with the tablespoon to get the gram equivalent of one tablespoon of sugar.

N.B. If there are more than two different types of household measures, the above steps should be followed for each one, in order to obtain the gram equivalent of each of the different types of household measures in that sampling area.

Once you have a list of each of the household measures used for the food in the sampling area, enter these on the FRAT Questionnaire (page iv), 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.

4.2.3.2 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. 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.

4.2.4 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[8]):

- 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 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 process of the pretesting exercise should be discussed as a group with the supervisor and all the interviewers. 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. Number each questionnaire sequentially for each sampling area, and indicate the sampling area, before distributing the questionnaire forms to the interviewers.

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

4.2.5 STEP 5 - 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.

Selecting households is the first step in conducting the survey. Eligible households for the FRAT are those with at least one child between 12-36 months. 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 36 months of age 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. If you cannot obtain a list of eligible households, 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.

The **Random Walk** method is one method that can be used to select households. In the random walk method, you first randomly select a household (from the list of eligible households in the sampling area, if you have one). 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 between 12-36 months 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, 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 12-36 months. In order to avoid wasting time, the first question in every household should be "are there any children between 12-36 months living in this household?". If the answer to this question is yes, begin the interview. If the answer is no, move to the next household.

If FRAT is being piggy-backed 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 for the FRAT.

Each interview should take 25-30 minutes (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 vitamin A deficiency. This person can also show you where the "starting point" is, and where subsequent eligible households are located. However this person should not be present during the interviews.

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 conduct the survey (i.e., 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 12-36 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 12-36 months, or if she is the primary caretaker of a child between 12-36 months.
v. if only one woman present has a child (or is the primary caretaker of the child) between 12-36 months, then select her as the respondent. If more than one woman present has a child between 12-36 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 12-36 months will be the respondent. If the selected respondent cares for more than one child between 12-36 months, select the oldest 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 12-36 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.

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[9]):

- 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);
- 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.

4.3 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

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

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.

Costs of the survey will include:
- scales for weighing foods
- photocopying the questionnaire forms
- transportation (fuel, rental of vehicles, bus, air tickets)
- teaching aids (e.g., flip chart, markers)
- pens, pencils, clipboards
- salaries/per diems
- food and drinks

We have indicated below the time it will take for one team of 6 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). 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 6 interviewers, considering 2 foods:
- One interviewer can complete 7 interviews (i.e., one cluster) in 3-4 hours.
- A team of six interviewers can complete 6 clusters simultaneously in approximately the same amount of time.
- Therefore, with one team of six interviewers, about 12 clusters can be completed in one day, depending on the distance between clusters.
- This means that one sampling area made up of 30 clusters can be surveyed in about three days.
- Adding a day for Adapting and Pre-testing the questionnaire, travel, and normal contingency (Steps 3 & 4), the FRAT will take about 4 days per sampling area.

In terms of person/days, each sampling area will take 6 persons x 3 days = 18 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 18 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, 1-2 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; Pretesting the questionnaire).

During the field-testing of FRAT in 1999, the dietary survey (including planning, training, data collection and analysis) cost US$1500-2500 per 30 cluster sample in Bangladesh and Burkina Faso and US$6000 per 30 cluster sample in Brazil.

5 Analyzing and Presenting Results

5.1 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 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), we have 5 sampling areas. We will number them 1-5.

Estimated Distribution of Food Vehicle Use
CHILDREN 12-36 months

	SAMPLE AREA					
	1	**2**	**3**	**4**	**5**	**ALL AREAS**
% CHILDREN consumed the food in last 7 days						
Estimated Usual Intake all Children 12-36 months						
5th percentile						
Median						
95th percentile						

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						

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

For each sampling area, calculate the proportion of households where sugar was consumed in the last 7 days by children 12-36 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 sugar, 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 sugar was consumed in the last 7 days for each age group, for the total population sampled (i.e., the aggregate of all sampling 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:
  Definitely fortify, and if all food X in the region is fortified, it will be able to nearly eliminate vitamin A deficiency single-handedly.
- Food X is consumed by 30 to 90% of target group:
  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:
  A more carefully considered decision is required. If the potential market for fortified Food X is sufficiently large to exist as a self-sustaining product in the market, then fortify. If continued public expenditure would be required, then other vehicles or interventions should be considered.

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.

5.1.2 Step 2 - Calculating effective fortification levels

You will need to calculate the median (mid point, or 50^{th} 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 sugar 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. The points below outline some of the important issues in setting fortification levels for vitamin A. The final choice should also take into consideration the possibility of losses of vitamin A incurred during the normal shelf life and cooking of the food, and this will vary from food to food.

1. The most vulnerable to long-term effects of vitamin A deficiency are children up to three years old, as discussed in Section 3.2. We have surveyed children between 12-36 months; their daily vitamin A requirement is 400 RE[10]. Also vulnerable are women of reproductive age; their requirements are 500 RE (600 RE if pregnant, 850 RE if lactating).

2. An appropriate level of fortification would be one that meets the needs of the individual with the largest "nutrient gap", that is, the difference between intake and requirements. Alternatively, you may fortify so that a low end consumer (woman or child) receives 100% of their requirements. There will be no problem for those that exceed their requirements. (Vitamin A is only toxic at extraordinarily high levels that would not be reached through consuming fortified food.)

- The 5th and 50th percentile intake from children and women who consumed the food in the last 24 hours, are used to calculate the fortification level, as shown in the examples below.

	A. Intake (g/d)	**B.** Requirements (RE/d)*	**C.** RE/g to meet 50% **B** = **(B/2)/A**	**D.** RE/g to meet 100% **B** = **B/A**
child, 5th centile	5	400	80	160
child, 50th centile	25	400	16	32
woman, 5th centile	20	850	42	60
woman, 50th centile	100	850	9	12

*FAO/WHO (1988) Normative requirements (recommended).
Shaded cell (16 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.

5.1.3 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 vitamin A, 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.

5.2 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. 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 in the context of developing a food fortification program.

5.2.1 Use:

Information obtained from the FRAT on the use of the food includes home storage and preparation practices. This information will be important in setting fortification levels for the vehicle of choice,

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

because the stability of the vitamin A 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.

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?**
days/wk	% women		
0			
1-2			
3-5			
6-7			
days/wk	% children		
0			
1-2			
3-5			
6-7			

5.2.2 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.[11] 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**

[11] 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.

6 Market Assessment

6.1 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.

6.2 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).

6.3 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 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.

6.4 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 favourable 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.

7 Results of FRAT Field Trials

Nepal

FRAT was first developed in 1997-8, and pre-tested in Nepal in 1997 by Org-Marg Nepal. They considered instant noodles, sugar and cooking oil in six districts of Nepal. Cooking oil was considered the best candidate for fortification, being consumed on the previous day by 81% of the mothers (average = 25ml) and 67% of the children (average = 9ml), with a large segment of the market being centrally processed in modern facilities. Sugar was consumed less often than oil (35% of the mothers (average = 25g) and 30% of the children (average = 27g) on the previous day), but was also considered suitable for fortification, as there were only a few sugar mills. Noodles were consumed infrequently and in small amounts and not considered suitable for fortification. In 1998 it was reported that FRAT was integral in mobilizing initial interest, and developing the necessary political support to move ahead with fortification. Pilot programs for sugar and cooking oil to be fortified with vitamin A are imminent.

Bangladesh

In 1999 Org-Marg-Quest Bangladesh field tested the draft FRAT guidelines, considering sugar, salt, wheat flour, oil, and milk powder in four regions – urban rich, urban, slum, rural and tribal. They found that fortification of oil (consumed on previous day by 99% of women and 75% of children), sugar (consumed by 50% of women and children) salt (100%) would be feasible and effective. Currently, salt is iodized in Bangladesh, and if the salt could be doubly-fortified it would certainly have a broad reach. It would be difficult to get complete fortification of sugar and oil (which includes both imported soya oil and local mustard oil), as they are highly fragmented markets, however widespread, albeit incomplete, coverage is feasible and worth pursuing. In the field testing, it was noted that including five foods in the survey was too many, as it made for very long interviews.

Burkina Faso

Helen Keller International and the Association Burkinabè pour la Nutrition et la Sécurité Alimentaire au Burkina Faso) lead a field test of FRAT in 1999, considering sugar, magi cubes and wheat flour. Sugar and magi cubes were consumed by approximately 70% of the target groups, and would be suitable vehicles, despite some regional and seasonal variation. The market conditions for sugar fortification were quite promising, with one producer meeting approximately 70% of the country's demand (30% is imported), and the producer is interested in pursuing fortification, as this is a possible means of increasing domestic sugar market share. The fortification of magi cubes would be complicated by the fact that its production is under license by an international company, and the local industry cannot independently modify the cube's ingredients. The population of Burkina Faso is sensitized to the benefits of fortified foods, and these would be the preferred choice as long as the cost remains competitive.

Brazil

The Federal University of Pernambuco, Laboratory of Biochemical Nutrition, led a field-test of FRAT in the state of Pernambuco considering rice. Rice is consumed nearly every day by more than 90% of mothers (median = 100g/d) and children (median = 60g/d). Most of the rice in Pernambuco is imported through a few companies, and all contacted have expressed interest in fortifying their rice. In Brazil, a relatively large upper class, who would be interested in fortified rice and could afford a cost premium, may be able to carry the market, and allow a cheaper fortified brand to be available to the lower classes. PATH Canada is leading efforts to launch fortified Ultra Rice™ in Pernambuco in 2000.

The reports from these field trials are available from PATH Canada or the Micronutrient Initiative.

8 Additional Reading

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9 ANNEXES

9.1 Annex 1 - Fortification Rapid Assessment Tool

9.2 Annex 2 - Cluster Survey

The following describes the standard “cluster survey” methodology[12], 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[13], 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 carry out 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 5 independent sampling areas, using the cluster design the sampling plan will be:

- 5 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 taken.

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

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

[13] 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.

in a third column, list the cumulative population total associated with each cluster, that is, the sum of the population of that cluster plus the populations of all clusters above it in the table.

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.

9.3 Annex 3 - Interviewer Training Schedule & Checklist for Interviewers

Recommended Interviewer Training Schedule[14]		
Day 1	Morning	Explain survey objectives, survey procedures, and survey calendar. Articulate expectations. Discuss financial arrangements and logistical arrangements for the training and survey.
	Afternoon	Review survey instrument. Discuss survey questions. Translate questionnaire.
	Evening	Review questionnaire at home.
Day 2	Morning	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.
	Afternoon	Practice interviews with each other, role-play, peer review, and critique role-play.
	Evening	Conduct mock interviews on family members, especially mothers.
Day 3	Morning	Conduct field test in a community that is near, but not part of, the communities to be surveyed.
	Afternoon	Discuss, make final refinements, and reproduce questionnaire.

Checklist for Interviewers:

- Greet the mother (or caretaker) warmly. 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.

[14] 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.

9.4 Annex 4 Adapting FRAT for Other Micronutrients

FRAT was designed specifically for identifying and evaluating foods for use as vehicles to carry vitamin A. However, with few modifications it could be applied to other micronutrients as well. Two of the factors to consider for adapting FRAT are Potential Vehicles and Target Group, considered below.

Potential Vehicles:
The specific foods for which the fortification technology is available, or under development, differs 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. There are a few generalizations that can guide your decision-making. Below are listed food groups and the micronutrients with which they have been (or likely could be) fortified (✓), and have not been (and probably could not be) fortified (×). 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.

Processed vegetable oils (oil, margarine, lard, ghee, vanaspati, mayonnaise.):
- ✓ fat soluble vitamins (A, D and E)
- × minerals (iron, zinc, calcium, iodine)

Dairy products (milk, cheese, butter, yogurt):
- ✓ all vitamins and minerals

Flours (wheat, corn, maize, barley, rice)
- ✓ all vitamins and minerals (except, perhaps, vitamin C)

Extruded Foods (pasta, Ultra Rice™, snack foods)
- ✓ all vitamins and minerals

Powdered Foods and Beverages (including infant formula and cereals)
- ✓ all vitamins and minerals

Sugar
- ✓ vitamin A, iron, iodine
- × B vitamins

Salt
- ✓ iron, iodine
- × B vitamins, vitamin A

Target Group
With vitamin A deficiency we are most concerned with women and young children, although vitamin A deficiency can exist at any age. With other micronutrients, the target group may be women and children, or other age groups. The groups that should be included in the dietary survey for various micronutrients are listed below:

Micronutrient	Target Group and Required Intakes
Vitamin A	WRA (600RE) U3s* (400RE)
Folate	WRA (400 ug)
Vitamin B12	Elderly (1 ug)
Iron	WRA (24 mg), U3s (6 mg), adolescent girls (20 mg)
Zinc	Children (5mg), adolescents (10 mg)
Iodine	Children, WRA (200 ug)

*WRA = Women of reproductive age. U3s = children under 3