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CENTER FOR DIETARY ASSESSMENT

**SURVEY GUIDANCE DOCUMENT**

# **Guidance for the Use of Standard and Non-Standard Recipes in Quantitative 24-Hour Dietary Recall Surveys: The Simple Ingredient Method**

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## List of Abbreviations

FCDB	food composition database
FRIL	food, recipe, and ingredient listing
g	gram(s)
LMICs	low- and middle-income countries
PSEM	portion size estimation method
SD	standard deviation

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## Definitions and Usage of Terms

**Base standard recipe:** When different variations of ingredients are used in a mixed dish, it may be necessary to create more than one standard recipe. The base standard recipe is the version of the standard recipe that includes the greatest number of supplementary ingredients. Primary data collection (e.g., cooking sessions) is recommended to derive average ingredient proportions for a base standard recipe. In dietary surveys, the name of the base standard recipe should indicate which core and supplementary ingredients are included. For example, the mixed dish, “maize porridge”, could have the base standard recipe name “maize porridge with milk and sugar” as it is composed of maize flour, milk, and sugar.

**Core ingredients:** The primary constituent ingredients of a mixed dish. Core ingredients make a significant nutritional contribution to a mixed dish. In dietary surveys, the name given to a standard recipe should indicate the core ingredients of the mixed dish (as well as the supplementary ingredients included). For example, the core ingredient of “maize porridge with milk and sugar” is maize flour.

**Edible portion:** The parts of a food that are typically consumed after all inedible parts are removed, if the food has any. For example, the part of the avocado left after the peel and pit have been removed.

**Edible portion factor:** A numeric value needed during data processing to account for any inedible parts of a food (e.g., bones, seeds, pits, or peels). During data processing, the edible portion factor is used to convert the amount of food reported as consumed into its equivalent edible weight in grams (i.e., “grams consumed” or “grams of ingredient used”). The edible portion factor is calculated as the ratio of the edible portion of a food to the entire food (i.e., the edible portion factor = edible portion ÷ [the edible portion + inedible portion]). The edible portion factor is a value between 0 and 1; it is equal to 1 when the entire food is edible (i.e., there are no inedible parts). Each food in the food, recipe, and ingredient listing (FRIL) should have an associated edible portion factor listed in the portion size estimation method (PSEM) conversion factor database.

**Flavorings:** Spices and condiments that may or may not be included in a mixed dish depending on choice and availability. These ingredients are usually added to a mixed dish in small quantities that are judged inconsequential to the overall energy and nutrient content of the dish. The name of the standard recipe for a mixed dish does not have to indicate which flavorings are included.

**Food density:** Mass per unit volume (e.g., gram/ml). Used in dietary assessment to convert the weight of a proxy material (such as playdough, raw rice, Kinetic Sand®) and the pre-determined volume of a calibrated household utensil into the estimated amount (in grams) of food or mixed dish consumed.

**Food:** A food that is not mixed with other foods (e.g., banana, groundnuts). For simplicity in language, in this document, we use the term “food” broadly to also refer to beverages. Composite foods, such as bread and cakes, which are prepared with multiple ingredients but are often included in a food composition table as a single food item may also be treated as a single food in the FRIL for the purpose of dietary data collection.

**Food item:** A term used to refer collectively to foods, beverages, and mixed dishes consumed, as well as to the ingredients used to prepare a mixed dish.

**Food, recipe, and ingredient listing (FRIL):** A comprehensive list of all foods, beverages, recipes, and ingredients—and their relevant descriptive details—that are likely to be encountered during the 24-hour dietary recall interviews carried out across all geographic areas where the survey will be implemented and for all demographic groups that will be included in the survey. The FRIL should list each food, recipe, and ingredient in the state (e.g., raw, boiled, steamed, grilled, fried), form (e.g., whole, sliced, diced, mashed, pureed), and presentation mode (e.g., served with or without inedible parts) in which it is consumed.

**Homogenous mixed dish:** A mixed dish in which all ingredients are more or less evenly distributed. Any serving from a mixed dish contains similar proportions of the constituent ingredients.

**Inedible portion** (also called “inedible part” or “non-edible part”): The parts of a food that are typically included in the food when served but are not consumed. Examples of foods that are commonly served with inedible parts

include chicken, fish, and other meat served with bone; groundnuts in the shell; maize on the cob; and fruits with inedible seeds, pits, or peels.

**Ingredient:** A food that is used in a mixed dish. To facilitate the selection of types of standard recipes that need to be created for a given mixed dish (i.e., base and variant standard recipes), we broadly group the ingredients used in a standard recipe into three main categories: core ingredients, supplementary ingredients, and flavorings.

**Ingredient proportion** (in a recipe): Refers to the proportion of a prepared mixed dish that is composed of a given ingredient. For example, if the weight of an ingredient used to prepare a mixed dish is 60 g and the total weight of the prepared mixed dish is 200 g, the ingredient proportion for that ingredient is 0.30 (60 / 200).

**Ingredient proportion “gram to gram ratio”:** An ingredient proportion in which both the amount of the ingredient used in a mixed dish and the total amount of the prepared mixed dish are weighed and expressed in grams of food. A “gram to gram ratio” is used in recipe calculations for standard recipes and non-standard recipes when different PSEMs are used to estimate the amount of mixed dish prepared and the amount of mixed dish consumed by the respondent.

**Ingredient proportion “gram to PSEM ratio”:** An ingredient proportion in which the amount of the ingredient used in a mixed dish is expressed in grams of food, but the total amount of the prepared mixed dish is expressed in grams of a proxy material used as a PSEM for estimating the amount of mixed dish prepared (e.g., raw rice). A “gram to PSEM ratio” is used in recipe calculations for non-standard recipes when the same PSEM is used to estimate the amount of mixed dish prepared and the amount of mixed dish consumed by the respondent.

**Mixed dish:** A dish, usually with a specific culinary name, that is prepared using two or more ingredients. Exceptions are usually made for food items where the second ingredient is a flavoring (e.g., salted nuts, fruit with sugar). Fried foods, such as fried potatoes, are typically considered a single food item even though they constitute a mixture of two different foods (i.e., oil and potatoes). Long-established composite foods such as bread and cakes, which are prepared with multiple ingredients, are often also treated as a single food item. Composite baked goods such as these can be found in the food composition tables of many different countries.

**Non-homogenous mixed dish:** A mixed dish in which ingredients are not evenly distributed. Any serving from a mixed dish does not necessarily contain similar proportions of the constituent ingredients. Typically, non-homogenous mixed dishes refer to dishes in which the ingredients that are not evenly distributed in the mixture are nutrient-dense (e.g., chunks of red meat, fish, or poultry in a stew).

**Non-standard recipe** (also called a “household recipe” or “unique recipe”): A recipe derived from data collected in a household during a 24-hour dietary recall interview. During the interview, the respondent, or the cook of the mixed dish, provides the details of the mixed dish consumed by the respondent; these include a detailed description of the ingredients and the amounts used, the total amount of the mixed dish prepared, and the amount of the mixed dish consumed.

**Nutrient retention factor:** A factor that is used to account for the nutrient content retained after food preparation, processing, or other treatment. When using the simplified ingredient recipe calculation method, a nutrient retention factor is applied to the nutrient content of each ingredient included in the prepared mixed dish. Retention factors can be expressed as values between 0 and 1 or as a percentage of retention (0 to 100%). When no food preparation, processing, or other treatment is applied to a mixed dish (e.g., fruit salad), then the nutrient retention factor is set to 1 or 100%.

**Recipe:** A description of a mixed dish that provides the list of ingredients used to prepare the mixed dish, along with a detailed description of all ingredients used (including any processing and cooking methods applied to each ingredient before adding the ingredient to the mixed dish). The cooking methods applied to the mixed dish itself (if the dish is cooked) are also included as part of the recipe information. In dietary surveys, a recipe includes information on the quantity (in grams) of each ingredient used to prepare the mixed dish (in the form added to the mixed dish, which is typically raw) and the final quantity of the mixed dish once it is fully prepared (e.g., cooked).

**Recipe calculation:** A procedure for calculating the energy and nutrient value of a recipe and/or its constituent ingredients. When using the simplified ingredient recipe calculation method, only the energy and nutrient values of ingredients are calculated; the energy and nutrient values of the mixed dish as a whole are not calculated. The simplified ingredient recipe calculation method requires the following information to be available: the amount of each ingredient used to prepare the mixed dish; the total amount of the mixed dish prepared; the preparation method applied to each mixed dish ingredient and to the mixed dish (to inform the appropriate use of nutrient retention factors); and the nutrient composition of those ingredients.

**Remaining mixture:** The part of a non-homogenous mixed dish that remains after the nutrient-dense ingredients (e.g., chunks of red meat, fish, or poultry in a stew) have been removed (e.g., the remaining broth, sauce, or rice mixture).

**Simplified ingredient method:** In the context of dietary surveys, *Intake* recommends using the Simplified Ingredient Method as the recipe calculation method to apply to the data collected. The method disaggregates the recipe data to the ingredient level for use in data analysis. When using this method, the amount of each ingredient consumed by the respondent and the associated energy and nutrient contributions are calculated.

**Standard recipe:** An “average” recipe that aims to reflect the way that a mixed dish is usually prepared by respondents in a survey area. Standard recipes can be used for mixed dishes that are known to be prepared similarly across a defined survey area (in terms of the ingredients used, the relative proportion of each ingredient used in the mixed dish, and the preparation methods for those ingredients and for the mixed dish itself). Standard recipes are also typically used when survey respondents report consuming mixed dishes prepared outside the home (e.g., by vendors or in restaurants). In dietary surveys, the name of the standard recipe should indicate which core and supplementary ingredients are included.

**Standard recipe database:** A standard recipe database is the compilation of the standard recipes (including base and variant standard recipes) that have been selected for use in a given survey. A standard recipe database includes the following information for each standard recipe: a descriptive recipe name, core and supplementary ingredients and their relevant descriptive details, and information on “average” ingredient proportions for that standard recipe.

**Supplementary ingredients:** Ingredients that make a significant nutritional contribution to the mixed dish. Supplementary ingredients are different from core ingredients in that they do not define a mixed dish. The use of supplementary ingredients in a given mixed dish depends on the availability of the ingredients and personal preference. In dietary surveys, the name given to a standard recipe should indicate the supplementary ingredients included (as well as the core ingredients of the mixed dish). For example, “maize porridge with milk and sugar” includes the core ingredient maize and the supplementary ingredients milk and sugar.

**Variant standard recipe:** When different variations of ingredients are used in a mixed dish, it may be necessary to create more than one standard recipe. The base standard recipe is the version of the standard recipe that includes the greatest number of supplementary ingredients. Variant standard recipes can be developed to reflect other combinations of supplementary ingredients that are commonly used to prepare that mixed dish. In dietary surveys, the name of the variant standard recipe should indicate which supplementary ingredients are included. For example, maize porridge could have the following variant standard recipe names: “maize porridge plain”, composed of maize flour and water; “maize porridge with sugar”, composed of maize flour, water, and sugar; and “maize porridge with milk”, composed of maize flour and milk.

**Yield factor** (also called “cooking yield factor”): A factor that accounts for weight change after food preparation, processing, or other treatment. Weight change is a result of moisture (e.g., water) and solid (e.g., fat) losses or gains. A yield factor can be calculated as (the weight of the prepared mixed dish) ÷ (the sum of the weight of the ingredients in the form added). Yield factors can be expressed as values between 0 and 1 or as a percentage of weight retention (0 to 100%).



# 1 Introduction

In a quantitative 24-hour dietary recall survey, the consumption of mixed dishes brings additional complexity to the interview and data processing. In dietary assessment, there is typically a need to disaggregate a reported mixed dish into its ingredients to permit food-based dietary analysis. As such, when a mixed dish is reported during a 24-hour dietary recall interview, data processing is required to calculate the amount of each ingredient consumed by the respondent and the associated energy and nutrient contribution.

Several methods have been established for calculating the energy and nutrient content of recipes and/or their ingredients ([Annex 1](#)).<sup>1</sup> These methods differ in the application of the yield<sup>2</sup> and nutrient retention factors<sup>3</sup> at either the ingredient or the recipe level, or a combination of both. Which recipe calculation method is the most appropriate to use depends on the intended purpose of the recipe calculation. In the context of dietary surveys, *Intake* recommends the use of a relatively simple recipe calculation method that allows the disaggregation of the recipe data to the ingredient level for use in data analysis.<sup>4</sup> This method was initially described by Gibson and Ferguson (2008)<sup>5</sup> and later applied by HarvestPlus.<sup>6</sup> While there is no consensus on how to refer to this recipe calculation method, we refer to it as the “**simplified ingredient method**”.

When using the simplified ingredient method for recipe calculation, the weight of each ingredient in the form added (typically raw) is divided by the weight of the prepared mixed dish (typically cooked) to compute the “**ingredient proportions**”. The amount of the mixed dish consumed—estimated during the 24-hour dietary recall interview—is then multiplied by the proportion of each ingredient in the mixed dish to derive the amount of each ingredient consumed. Each ingredient in the mixed dish is linked to the survey-specific food composition database (FCDB), in which nutrient losses due to the preparation are accounted for. The output is the amount of each ingredient consumed and the corresponding energy and nutrient contribution.

A critical step in the simplified ingredient method for recipe calculation is the derivation of ingredient proportions. This requires the collection or estimation of the amount of each ingredient used to prepare the mixed dish and the final amount of the mixed dish once it is fully prepared. When planning a dietary survey, survey planners need to decide whether “average” recipe data collected will be used (referred to as a **standard recipe**) or if these data will be estimated during the 24-hour dietary recall interview with the respondent (referred to as a **non-standard recipe**).

The decision on whether to use a standard or non-standard recipe to collect data for a mixed dish in a dietary survey requires careful consideration of the trade-offs associated with the use of either one. This decision-making process is complex as there are advantages and disadvantages associated with the use of both standard and non-standard recipes in dietary surveys ([Table 1](#)).

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<sup>1</sup> Although mixed dishes can be analyzed in a laboratory, and various food composition tables include analyzed energy and nutrient values for several mixed dishes, data provided by such analyses cannot be disaggregated into individual ingredients, which is typically desirable for the analysis and interpretation of dietary data.

<sup>2</sup> The yield factor accounts for weight changes as a result of moisture (e.g., water) and solid (e.g., fat) losses or gains due to food preparation, processing, or other treatment.

<sup>3</sup> The nutrient retention factor accounts for vitamin and mineral losses due to food preparation, processing, or other treatment.

<sup>4</sup> Several methods have been established for calculating the energy and nutrient content of recipes and/or their ingredients. These methods differ in the application of the yield and nutrient retention factors at either the ingredient or the recipe level, or a combination of both. [Annex 1](#) provides an overview of recipe calculation methods.

<sup>5</sup> Gibson RS, Ferguson EL. *An interactive 24-hour recall for assessing the adequacy of iron and zinc in developing countries*. HarvestPlus Technical Monograph 8. Washington DC and Cali: International Food Policy Research Institute (IFPRI) and International Center for Tropical Agriculture (CIAT); 2008. Page 82, Box 7.3. Available at: <http://www.harvestplus.org/sites/default/files/tech08.pdf>

<sup>6</sup> Hotz, C.; Abdelrahman, L.; Sison, C.; Moursi, M.; Loechl, C. *A Food Composition Table for Central and Eastern Uganda*. (2012) 31 pp. HarvestPlus Technical Monograph 9, ISBN 978-0-9818176-2-0, Available at: <https://www.harvestplus.org/node/562>

**Table 1. Advantages and Disadvantages Associated with the Use of Standard and Non-Standard Recipes**

	Advantages	Disadvantages
<b>Standard Recipes</b>	Simplifies and accelerates 24-hour dietary recall data collection with respondents; can substantially reduce respondent burden	The development of standard recipes requires a substantial investment of time and resources
	Reduces the time required for the daily supervisor review of incoming data	The use of standard recipes requires significant preparatory work in advance of data collection for the survey <sup>A</sup>
	More feasible for enumerators with lower capacity and/or training	Where the quality of data for non-standard recipes is high, standard recipes introduce more errors in 24-hour dietary recall data
	Where the quality of data for non-standard recipes is poor, standard recipes introduce fewer errors	
<b>Non-Standard Recipes</b>	Substantially lowers the burden of pre-survey work before data collection for the survey	High respondent burden as 24-hour dietary recall data collection demands substantially more time, especially when multiple recipes are reported by a respondent
	When the quality of 24-hour dietary recall data is excellent and enumerators are very well trained, more accurately captures variability in the preparation of recipes	Demands more time for the supervisor to review incoming data
		Requires very well-trained enumerators with a high capacity
		Where the quality of non-standard recipe data is likely to be poor, non-standard recipes may result in more errors in 24-hour dietary recall data
		A lack of standard recipes developed in advance may also mean that certain ingredients are not anticipated and are thus not in the food composition databases or the portion size estimation method conversion factor database
		Respondents may not be able to report the ingredients, their quantities, or the preparation method used for mixed dishes prepared outside the home

A For an overview of pre-survey activities for a dietary survey, see Vossenaar M, Arimond M, Deitchler M, Lubowa A, Hotz C, and Moursi M. 2020. *An Overview of the Main Pre-Survey Tasks Required for Large-Scale Quantitative 24-Hour Recall Dietary Surveys in Low- and Middle-Income Countries*. Washington, DC: *Intake* – Center for Dietary Assessment/FHI Solutions. Available at: [Intake.org](https://intake.org).

When a standard recipe is developed for a mixed dish, an “average” recipe that aims to reflect the way that a mixed dish is usually prepared by respondents in a survey area is created. When a standard recipe is used, every respondent who reports consuming the associated mixed dish is assumed to have consumed the preparation of the mixed dish that is reflected by the standard recipe (i.e., the same ingredients and average ingredient proportions). For this reason, it is critically important that any standard recipe used in a dietary survey is an accurate reflection of how that mixed dish is usually prepared by respondents in the survey area.

Standard recipe data are typically compiled in advance of data collection for a survey, but some of the necessary data can also be collated after data collection. The data needed to derive the ingredient proportions for a standard recipe are typically collected during cooking sessions in which individuals residing in the survey area are asked to prepare a set of assigned mixed dishes. For each mixed dish, the survey team collects recipe data for multiple preparations (i.e., replicates). The survey team then uses the data collected across replicates to compile average ingredient proportions for the standard recipe to use for that mixed dish. For some mixed dishes, such as mixed dishes typically prepared outside the home by vendors and restaurants, it may not be possible to organize cooking sessions to collect standard recipe data. Instead, the vendors and restaurants are typically visited and asked to provide the needed recipe information.

When using a non-standard recipe, all recipe details are collected from the household during the 24-hour dietary recall interview and no pre-survey work is required. During the 24-hour dietary recall interview, the respondent is asked to report all the ingredients used to prepare the mixed dish, their quantities, and the total amount of the mixed dish prepared. Respondents are also asked to describe the form in which the ingredients were added to the mixed dish and the preparation method for the mixed dish. When collecting these recipe details, it can be helpful to invite the person who prepared the meal to join the interview so that all relevant recipe details can be provided.

In practice, it is usually not feasible to develop a standard recipe for each mixed dish likely to be reported in a survey. Likewise, it is typically not feasible for enumerators to collect detailed, unique recipe information (i.e., non-standard recipes) for every mixed dish encountered in a survey. The vast majority of quantitative 24-hour dietary recall surveys, therefore, use a combination of standard and non-standard recipes during data collection.

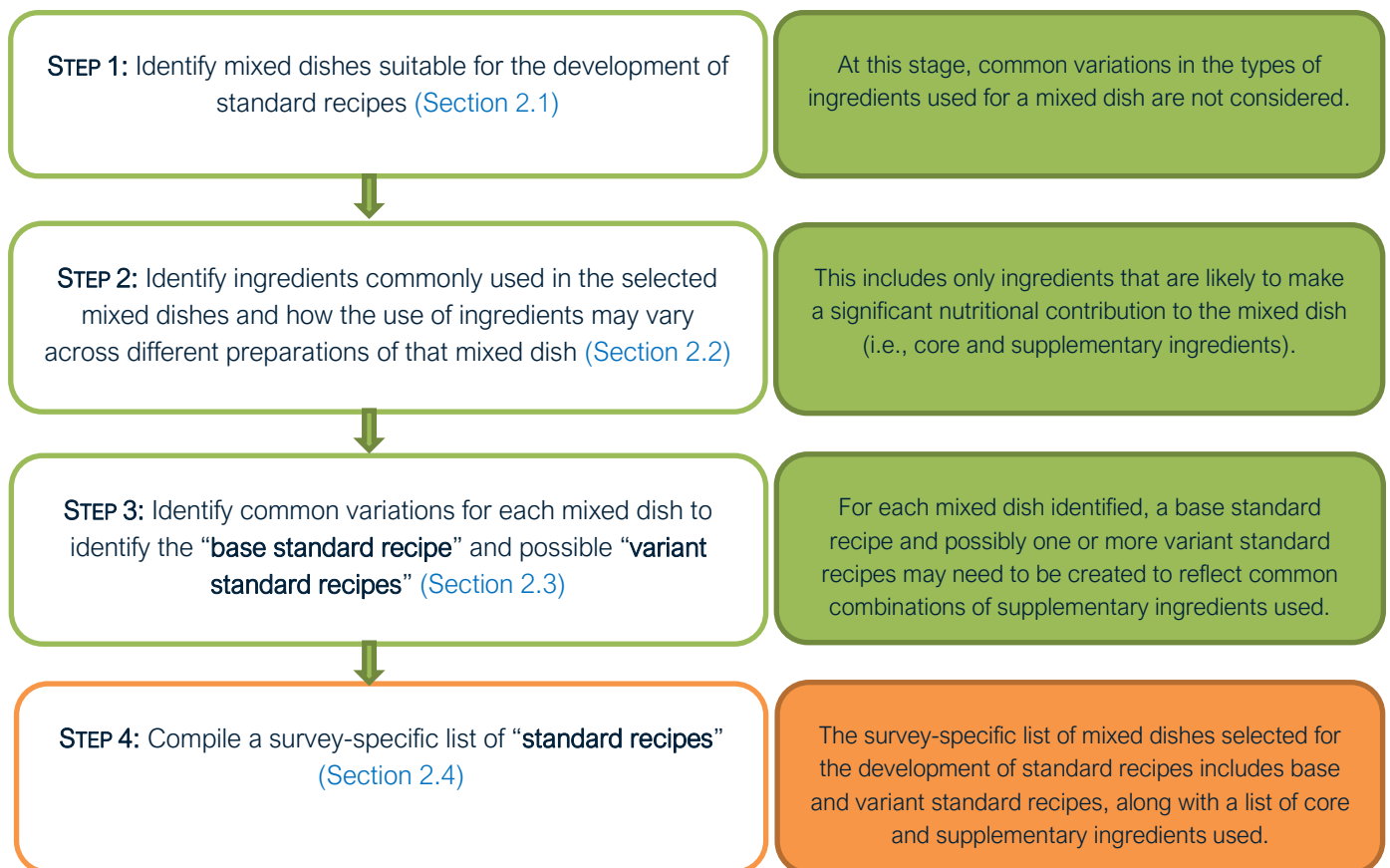
The appropriate use of standard and non-standard recipes in a dietary survey requires detailed planning to enable high-quality collection and analysis of each type of recipe data. This document was prepared to provide guidance for the planning, data collection, and analysis work related to recipe data in the context of a large-scale dietary survey. The document is organized as follows. We first provide guidance on identifying mixed dishes that are appropriate to collect with the use of standard recipes and those that are appropriate to collect with the use of non-standard recipes ([Section 2](#)). We then describe the development and use of standard recipes using the simplified ingredient method, specifically data sources ([Section 3.1](#)), calculation instructions ([Section 3.2](#)), calculation instructions using recipe replicates ([Section 3.3](#)), and the structure of a standard recipe database ([Section 3.4](#)). Finally, we describe the use of non-standard recipes, specifically data sources ([Section 4.1](#)) and the calculation instructions ([Section 4.2](#)) to apply the simplified ingredient recipe calculation method.

## 2 Deciding Between the Use of Standard and Non-Standard Recipes

The selection of a set of mixed dishes for standard recipe development typically begins during the development of the survey-specific food, recipe, and ingredient listing (FRIL) as part of the pre-survey work conducted before the data collection for a survey.<sup>7</sup> The FRIL is a comprehensive list of all foods, mixed dishes, and ingredients—and their respective details—that are likely to be encountered during the survey. Using the FRIL as a starting point, four main steps need to be carried out to prepare the list of mixed dishes for which standard recipes will be developed; these steps are summarized in [Figure 1](#) and detailed in [Sections 2.1 to 2.4](#).

Refer to [Box 1](#) and [Box 2](#) for an explanation of the key concepts and terminology used.

**Figure 1. Flowchart of the Steps Needed to Develop a List of Mixed Dishes Selected for the Development of Standard Recipes**



<sup>7</sup> For an overview of pre-survey activities for a dietary survey, see Vossenaar M, Arimond M, Deitchler M, Lubowa A, Hotz C, and Moursi M. 2020. *An Overview of the Main Pre-Survey Tasks Required for Large-Scale Quantitative 24-Hour Recall Dietary Surveys in Low- and Middle-Income Countries*. Washington, DC: Intake – Center for Dietary Assessment/FHI Solutions. Available at: [Intake.org](https://intake.org).

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## Box 1. Definitions and Use of Terms: Type of Ingredients in Standard Recipes

### CORE INGREDIENTS

Core ingredients are the primary constituent(s) of a mixed dish and often give the dish its name. These are the ingredients that define the mixed dish.

Core ingredients make a significant contribution to the energy and/or nutrient content of the mixed dish and are always included as an ingredient in the mixed dish.

*For example, beef is considered a core ingredient in beef stew.*

### SUPPLEMENTARY INGREDIENTS

Supplementary ingredients also make a significant contribution to the energy and/or nutrient content of the mixed dish but may or may not be included in the preparation of the mixed dish, depending on personal choice and the availability of the ingredient.

Whereas the inclusion/exclusion of core ingredients fundamentally changes the nature of the mixed dish, the inclusion/exclusion of supplementary ingredients does not change the basic nature of the mixed dish.

*For example, if a recipe for beef stew is sometimes prepared with carrots and white potatoes, the carrots and potatoes are considered supplementary ingredients.*

### FLAVORINGS

Flavorings such as spices and condiments are usually added to mixed dishes in small quantities that are judged inconsequential to the overall energy and nutrient content of the dish.

Because flavorings do not typically make a significant contribution to the nutrient content of a mixed dish, it is not as important to distinguish if the respondent consumed a mixed dish defined as a standard recipe with or without flavorings.

*For example, garlic is considered a flavoring in beef stew.*

### HOW TO NAME A STANDARD RECIPE

In dietary surveys, the name given to a standard recipe should indicate the core ingredients of the mixed dish, as well as the supplementary ingredients included (e.g., “beef stew with carrots and white potatoes”). However, the name given to a standard recipe does not have to indicate which flavorings are included.

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## Box 2. Definitions and Use of Terms: Recipes

### RECIPE

A description of a mixed dish that provides the list of ingredients used to prepare the mixed dish, along with a detailed description of all ingredients used (including any processing and cooking methods applied to each ingredient before adding it to the mixed dish). The cooking methods applied to the mixed dish itself (if the dish is cooked) are also included as part of the recipe information.

In dietary surveys, a recipe includes information on the quantity (in grams) of each ingredient used to prepare the mixed dish (in the form added to the mixed dish, which is typically raw) and the final quantity of the mixed dish once it is fully prepared (which is typically cooked).

### STANDARD RECIPE

An “average” recipe that aims to reflect the way that a mixed dish is usually prepared by respondents in a survey area.

Standard recipes can be used for mixed dishes that are known to be prepared similarly across a defined survey area (in terms of the ingredients used, the preparation methods for those ingredients and the mixed dish itself, and the relative proportion of each ingredient used in the mixed dish).

For each mixed dish identified for the development of a standard recipe, one “base standard recipe” and one or more “variant standard recipes” may need to be created to reflect common combinations of supplementary ingredients.

#### BASE STANDARD RECIPE

A standard recipe for a given mixed dish that includes the greatest number of supplementary ingredients for which the selection differs between households.

#### VARIANT STANDARD RECIPE

A variant standard recipe is prepared with the same core ingredient(s) as its base standard recipe but differs in the supplementary ingredient(s) used.

Base and variant standard recipes of a given mixed dish are often called by the same name in the local language. However, for the purpose of collecting dietary data, when a standard recipe is prepared with different supplementary ingredients, the name of the base and variant standard recipe should be different, with the name of each recipe indicating which supplementary ingredients are included.

### NON-STANDARD RECIPE

A recipe derived from data collected in a household during a 24-hour dietary recall interview.

During the interview, the respondent, or the cook of the mixed dish, provides the details of the mixed dish consumed by the respondent; these include:

- a detailed description of the ingredients and the amounts used,
- the total amount of the mixed dish prepared, and
- the amount of the mixed dish consumed.

## 2.1 Step 1: Identify Mixed Dishes Suitable for the Development of Standard Recipes

The selection of mixed dishes for which standard recipes will be developed requires careful consideration and knowledge of the local cuisine. For some mixed dishes, it may not be appropriate to use a standard recipe, whereas for others it may not be feasible to collect non-standard recipe data during the 24-hour dietary recall interview.

The use of standard recipes is recommended for mixed dishes that are:

- Prepared similarly across households;
- Commonly consumed;
- Prepared outside the home (e.g., purchased at a street vendor or restaurant);
- Non-homogenous, for which it is desirable to estimate the amount consumed of nutrient-dense ingredients separately from the remaining homogenous mixture.

These criteria are described in detail below and are summarized in [Figure 2](#).

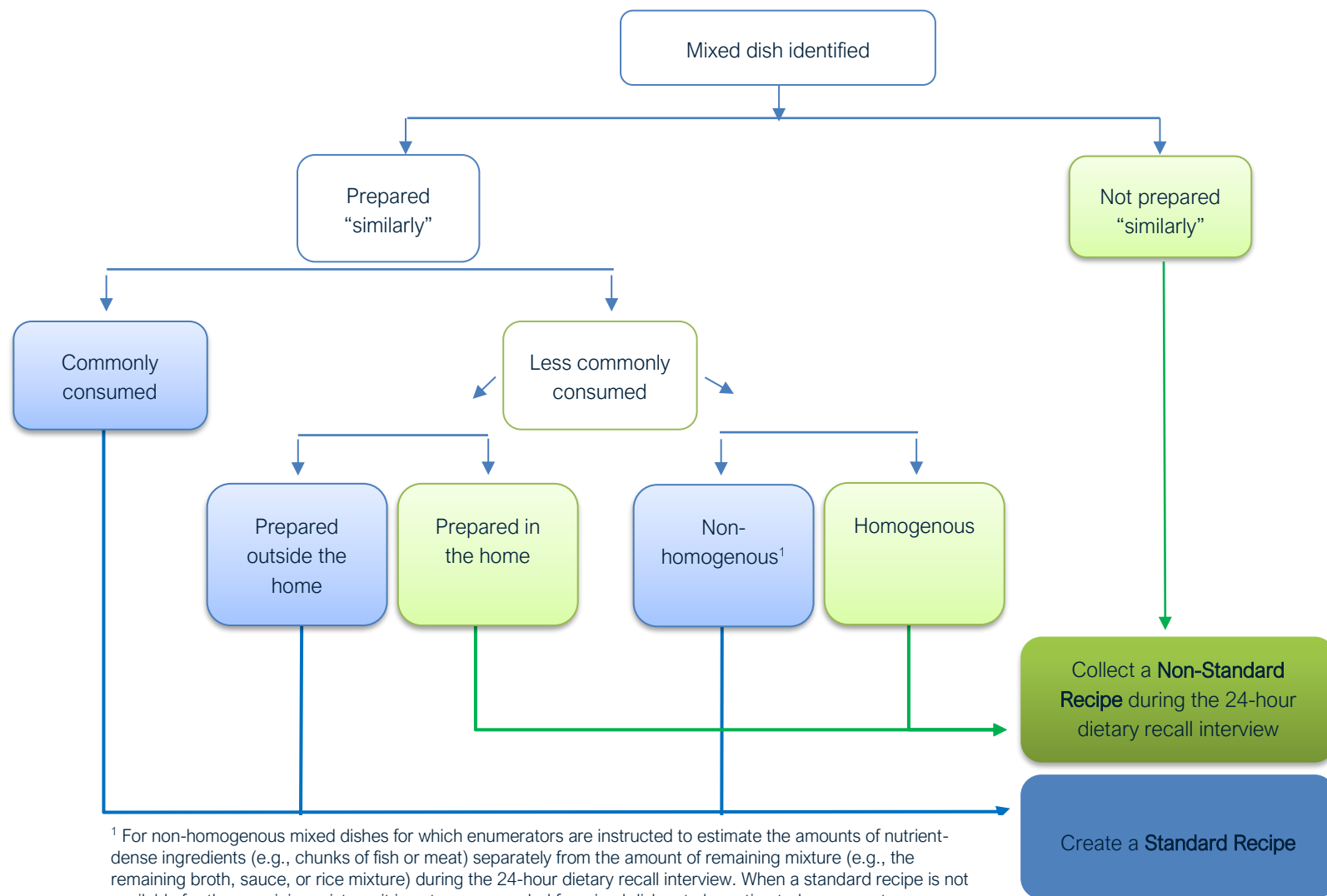
***Prepared similarly across households:*** The most important consideration is that the mixed dish is prepared similarly across households in geographic areas to which the standard recipe applies. A standard recipe represents an average of how a given mixed dish is commonly prepared; if there is too much variation in how a mixed dish is prepared, then an average recipe cannot provide meaningful information. A mixed dish is considered to have been prepared “similarly” when there is limited variation in the types of core and supplementary ingredients used, the relative amounts of core and supplementary ingredients used, and the preparation methods used across households.

***Commonly consumed:*** A further important consideration is that the mixed dish is commonly consumed in the survey area. A commonly consumed dish is likely to be encountered frequently during the 24-hour dietary recall interviews, making the effort of developing a standard recipe worthwhile.

***Prepared outside the home:*** It is also useful to prioritize the development of standard recipes for mixed dishes for which it is challenging to collect non-standard recipe data during the 24-hour dietary recall interview, even if the mixed dish is not commonly consumed. For example, the collection of non-standard recipe data can be especially challenging for mixed dishes that were not prepared by a person in the household, such as those purchased from various commercial outlets (e.g., restaurants, fast food outlets, delis, street food vendors, school meals). When mixed dishes are prepared outside the home, the respondent is unlikely to be able to provide details on the full set of ingredients used, their amounts used, the total amount of the mixed dish prepared, and any preparation/cooking methods applied to the ingredients and the mixed dish.

***Non-homogenous:*** The use of standard recipes is also recommended for non-homogenous mixed dishes. These are mixed dishes that include nutrient-dense ingredients that can be picked out (e.g., large pieces of chicken prepared in a rice mixture, whole hard-boiled eggs in a curry sauce, or a large fish stewed with broth and vegetables). When these mixed dishes are served, the nutrient-dense portion is not always proportional to the amount of broth or sauce prepared. In contexts where survey planners decide that the amount consumed of nutrient-dense ingredients should be estimated separately from the amount consumed of the remaining homogenous part of the mixed dish (e.g., the remaining broth, sauce, or rice mixture), the collection of non-standard recipe data is not recommended. This is because the respondent may not be able to estimate the amounts prepared for the separate components (e.g., the amount of fish and the amount of remaining mixture). If, on the other hand, a standard recipe is used for the remaining mixture, it is straightforward to calculate the amount of each ingredient consumed, while still accounting for the non-homogenous nature of the mixed dish.

**Figure 2. Flowchart to Inform the Selection of Mixed Dishes for the Development of a Standard Recipe (Step 1)**





## 2.2 Step 2: Identify Ingredients Commonly Used in the Selected Mixed Dishes

Once the mixed dishes for which standard recipes will be developed have been identified, the next step is to identify the core and supplementary ingredients commonly used to prepare each selected mixed dish. Flavorings do not need to be identified.

Different approaches can be used to identify the core and supplementary ingredients commonly used for a given mixed dish. Some common approaches include reviewing existing databases, conducting expert consultation meetings with key informants, undertaking market surveys, and carrying out facilitated group discussions with residents in the survey area.<sup>8</sup>

## 2.3 Step 3: Identify Variant Standard Recipes

Next, it is essential to consider if there are variations in how each mixed dish is prepared that warrant the creation of more than one standard recipe for a given mixed dish. When the core and supplementary ingredients for a given mixed dish vary, the survey team has three choices:

- Develop an additional base standard recipe.
- Develop one or more variant standard recipe(s) for the existing base standard recipe.
- Decide that the development of a standard recipe for that given dish is not feasible and instruct enumerators to collect non-standard recipe data during the 24-hour dietary recall interview.

The decision on which of these options is most appropriate depends on two factors: (i) whether the ingredients that differ define the mixed dish and (ii) the contribution that the different ingredients make to the energy and/or nutrient content of the mixed dish.

[Box 3](#) provides guidance on how the nature of the ingredients that vary in a mixed dish determines the need to develop additional base standard recipes or variant standard recipes. A flowchart summarizing these criteria is shown in [Figure 3](#). Note, however, that some ingredients commonly added to mixed dishes require special consideration; these are discussed in [Box 4](#).

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<sup>8</sup> For detailed guidance on the use of facilitated group discussions, see Moursi M, Vossenaar M, Arimond M, Hotz C, and Deitchler M. 2020. *Facilitated Group Discussions for Dietary Pre-Survey Work in Low- and Middle-Income Countries: Guidance for the Design, Implementation, and Use of Data Collected*. Washington, DC: Intake – Center for Dietary Assessment/FHI Solutions. Available at [Intake.org](https://intake.org).

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### Box 3. How to Determine the Need for Additional Base Standard Recipes and Variant Standard Recipes

#### *DIFFERENCES IN CORE INGREDIENTS REQUIRE THE DEVELOPMENT OF ADDITIONAL STANDARD RECIPES*

Sometimes the variations in how a given mixed dish is prepared change how the mixed dish is culturally perceived and how it is referred to.

Mixed dishes that are prepared with one or more different core ingredients require the development of a new base standard recipe to represent each core ingredient.

Each base standard recipe must have a different name that refers to the core ingredient(s).

For example, “maize porridge with sugar” prepared with rice instead of maize would constitute a new base standard recipe, i.e., “rice porridge with sugar”.

#### *DIFFERENCES IN SUPPLEMENTARY INGREDIENTS REQUIRE THE DEVELOPMENT OF VARIANT STANDARD RECIPES*

Mixed dishes that are prepared with one or more different supplementary ingredients do not require the development of a new base standard recipe. Instead, variations of the standard recipe can be created. “**Variant standard recipes**” are prepared with the same core ingredient(s), but with different supplementary ingredient(s).<sup>A</sup>

Variant standard recipes have similar names, with the name specifying which supplementary ingredients are included in the variant standard recipes.

For example, maize porridge may or may not have added milk or sugar. Variant standard recipes would need to be created for the survey.

Some ingredients make a significant contribution to the nutrient content of a mixed dish, even if the amounts added appear small (e.g., sugar, fats, oils); such ingredients should be classified as supplementary ingredients, and preparations of the mixed dish in which the use of these supplementary ingredients vary would require the development of different variant standard recipes.

#### *DIFFERENCES IN FLAVORINGS HAVE NO CONSEQUENCE*

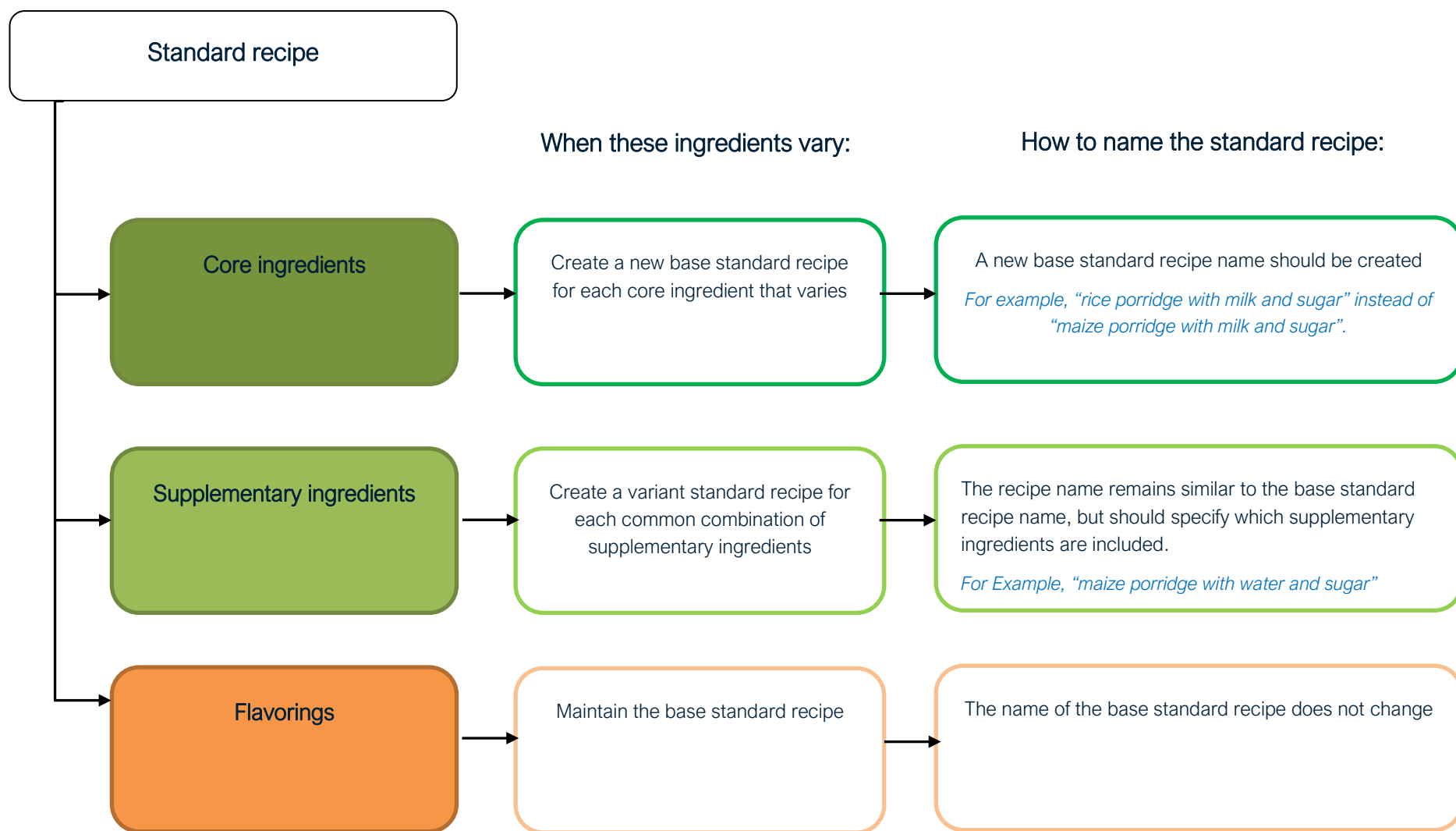
A variation in the use of flavorings for a standard recipe does not require the development of a new base standard recipe or a variant standard recipe. This is because these ingredients have a negligible influence on the energy and nutrient content of the recipe. A given standard recipe could be made with any combination of flavorings or no flavorings.

For example, a common recipe may include small amounts of saffron and sage as flavorings. Regardless of the combination of these ingredients used, the same standard recipe could be used, and the name of the standard recipe would not need to indicate the flavorings included.

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A And possibly also different flavorings, although flavorings are not consequential and therefore are not typically listed as a recipe ingredient and are not typically specified in the recipe name.

**Figure 3. Flowchart to Inform the Need to Develop Additional Base Standard Recipes or Variant Standard Recipes (Step 3)**



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## Box 4. Ingredients that Require Special Consideration When Developing Standard Recipes

### *INGREDIENTS THAT MAY HAVE LARGE VARIABILITY IN THE AMOUNT ADDED*

The use of a standard recipe is generally only appropriate when a mixed dish is prepared “similarly” across households. However, for some ingredients for which consumption is difficult to estimate using 24-hour dietary recall data (e.g., sugar, oils), survey planners may still opt to create standard recipes even when the amounts of core and supplementary ingredients added are expected to vary. The disadvantage of using a standard recipe for these mixed dishes is that the inter-household variation in the amount of these ingredients used will not be captured by the dietary data collected. The decision on whether to develop standard recipes should be guided by the consideration of the dietary data required to achieve the specific objectives of the survey.<sup>A</sup>

### *INGREDIENTS THAT MAY BE FORTIFIED*

The development of standard recipes for mixed dishes that include ingredients that may or may not be fortified (e.g., sugar, oils, salt, bouillon cubes) also requires special consideration.<sup>B</sup> To account for fortified varieties of an ingredient, survey planners can choose from three options:

**Option 1:** Develop variant standard recipes for mixed dishes prepared with fortified varieties of these ingredients and mixed dishes prepared with non-fortified varieties of these ingredients. However, this can lead to an impractical number of standard recipes being developed.

**Option 2:** Create a standard recipe and then probe for details about fortification, record the data accordingly, and adjust the nutrient calculations, as appropriate, during data processing.

**Option 3:** When neither of these options is feasible, the collection of non-standard recipes may be required to account for the different variations that exist for such ingredients.

Regardless of the option selected, during the 24-hour dietary recall interviews, it is always necessary to probe specifically for the use of ingredients that could be fortified and the brand used (in most settings, the brand of the ingredient added can be used to make assumptions about fortification levels) if there is a desire to report nutrient intake as part of the survey results.

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A Quantification of such ingredients is of increasing importance in LMICs in the context of the nutrition transition towards diet-related chronic diseases.

B Quantification of fortified ingredients is of increasing importance in LMICs in the context of the design and evaluation of large-scale food fortification programs.

## 2.4 Step 4: Develop a Survey-Specific List of Mixed Dishes for Standard Recipe Data Collection

Once steps 1 thru 3 are completed, the outputs from these steps should be compiled. This will result in a survey-specific list of mixed dishes that have been selected for the development of standard recipes, along with the core and supplementary ingredients that are typically used to prepare each selected mixed dish (flavorings should not be included). This list should include all base and variant standard recipes.

If survey planners decide to estimate amounts of non-homogenous dishes consumed as separate components (i.e., the amount of each nutrient-dense ingredient and the amount of the remaining mixture), then the standard recipe for the remaining mixture for each non-homogenous should also be included in this compiled list of standard recipes identified for data collection.

Two separate lists should then be prepared: one to list the mixed dishes commonly prepared in homes and one to list the mixed dishes commonly prepared outside the home. Dividing the list of standard recipes to be collected according to where the dish is commonly prepared helps to plan the time and resources required for field work, given that the data collection methods used for collecting standard recipes that are commonly prepared in the home differ from those typically used for collecting standard recipes prepared outside the home.

The compiled list of standard recipes should also specify the planned data source (primary data collection or derived using calculations) for calculating the average ingredient proportions needed for each standard recipe calculation.

An example of how such a compiled list might look is provided in the last three columns of [Table 2](#).

**Table 2. Examples of Mixed Dishes Identified for the Selection of Standard Recipes**

STEP 1: MIXED DISH	STEP 2: INGREDIENTS		STEP 3: STANDARD VARIATIONS		STEP 4: STANDARD RECIPE LIST <sup>A</sup>		
	CORE INGREDIENTS	SUPPLEMENTARY INGREDIENTS THAT VARY	BASE STANDARD RECIPES	VARIANT STANDARD RECIPES	RECIPE NAME	CORE AND SUPPLEMENTARY INGREDIENTS	PRIMARY DATA COLLECTION <sup>B</sup>
maize porridge	maize flour	milk, sugar	maize porridge with milk and sugar	NA	maize porridge with milk and sugar	maize flour, milk, sugar	Yes
			NA	maize porridge plain (no milk or sugar)	maize porridge plain (no milk or sugar)	maize flour	No
				maize porridge with sugar (no milk)	maize porridge with sugar (no milk)	maize flour, sugar	No
				maize porridge with milk (no sugar)	maize porridge with milk (no sugar)	maize flour, milk	No
fried rice	rice	mushrooms	fried rice with mushrooms	NA	fried rice with mushrooms	rice, mushrooms, oil	Yes
			NA	fried rice	fried rice	rice, oil	No
bean sauce	fermented black beans	tomato, oil	bean sauce with tomato, no oil	NA	bean sauce with tomato, no oil	fermented black beans, tomato	Yes
			NA	bean sauce plain	bean sauce plain	fermented black beans	No
green leafy vegetable stew	amaranth/ cowpea leaves	pumpkin leaves, amaranth leaves, cowpea leaves	green leafy vegetable stew with pumpkin leaves	NA	green leafy vegetable stew with pumpkin leaves	pumpkin leaves, onion, tomato, palm oil	Yes
			NA	green leafy vegetable stew with amaranth leaves	green leafy vegetable stew with amaranth leaves	amaranth leaves, onion, tomato, palm oil	No
				green leafy vegetable stew with cowpea leaves	green leafy vegetable stew with cowpea leaves	cowpea leaves, onion, tomato, palm oil	No

A This is an excerpt of a survey-specific list of mixed dishes selected for the development of standard recipes. This list includes a descriptive recipe name, all core and supplementary ingredients that are typically used to prepare each selected mixed dish, and the data source (primary data collection, or derivation by calculation) for estimating the average ingredient proportions. This example is limited to a list of mixed dishes commonly prepared in homes. A separate list would be needed for mixed dishes commonly prepared outside the home.

B Primary data collection refers to the data collection needed to compute average ingredient proportions; these data are collected during cooking sessions or from vendors and restaurants. For variant standard recipes, it is sometimes possible to derive average ingredient proportions using calculations with data collected for the associated base standard recipe (as described in [Section 3.2.1](#)).

## 2.5 Contextual Considerations when Selecting Mixed Dishes for the Development of Standard Recipes

There is no formula for arriving at an appropriate number of standard recipes to collect. The cost and effort required to develop standard recipes should be weighed against the time required to (i) collect detailed recipe information during the 24-hour dietary recall interview and (ii) process non-standard recipes after data collection when standard recipes are not available. These decisions should be guided by the local context, the resources available, and the specific objectives of the survey.

Some high-level considerations include:

- Where the preparation of a mixed dish is likely to differ substantially across geographic areas, specific demographic groups (e.g., infants and young children, adolescents), and/or the season(s) included in the survey, it is advisable to collect separate standard recipe data for each geographic area, sub-group, and/or season, as needed. When specific recipe data are collected, the recipe name should indicate the geographic area, population group and/or season with which it is associated (e.g., bean soup for northern districts).
- For mixed dishes for which the different combinations of ingredients are too numerous, it may not be feasible to develop all relevant variant standard recipes. Survey planners may decide that the development of standard recipes for that given dish is not feasible and instruct enumerators to collect non-standard recipe data during the 24-hour dietary recall interview.
- The development of base standard recipes requires primary data collection (i.e., during cooking sessions or from vendors and restaurants), whereas variant standard recipes can be derived using calculations using data collected for the associated base standard recipe (as described in [Section 3.2.1](#)).
- For non-homogenous mixed dishes, it is only feasible to estimate the amounts of nutrient-dense ingredients (e.g., chunks of fish or meat) separately from the amount of the remaining mixture (e.g., the remaining broth, sauce, or rice mixture) if a standard recipe is available for the remaining mixture. When a non-homogenous mixed dish is not commonly consumed, and a standard recipe is not available for the remaining mixture, it is recommended to collect a non-standard recipe during the 24-hour dietary recall interview and to estimate the mixed dish as a whole (i.e., not as separate components with the nutrient-dense ingredients separated from the amount of the remaining mixture).
- The total cost and duration of the work required to develop standard recipes will largely depend on (i) the number of mixed dishes identified for standard recipe data collection, (ii) the data collection procedures (e.g., the number of replicates that will be collected for each mixed dish), (iii) the number and location of geographic areas where the standard recipe data will be collected, and (iv) the number of field teams carrying out the work.

## 3 Standard Recipes

### 3.1 Data Required to Calculate Standard Recipes

The data requirements for the simplified ingredient recipe calculation method are relatively minor, which is a major advantage of this method. The data requirements for standard recipes include:

- i. Primary data collection for the amounts of ingredients used and the amount of the mixed dish prepared to calculate **average ingredient proportions**. These data are typically collected during cooking sessions in which local cooks are asked to prepare mixed dishes that reflect how these dishes are commonly prepared; or, for mixed dishes normally prepared outside the home, these data are collected from vendors and restaurants.<sup>9</sup> (see [Section 3.1.1](#))
- ii. Primary data collection from the survey respondent during the 24-hour dietary recall interview to provide an estimate of the **amount of the mixed dish consumed**. The amount is estimated using a pre-determined PSEM, and a PSEM conversion factor is required for each standard recipe. (see [Section 3.1.2](#))
- iii. A combination of primary data collection and the use of secondary data sources to compile the data needed to undertake the recipe calculations. These include “edible portion factors”, needed to account for inedible parts of ingredients, as well as “nutrient retention factors” and “food composition data”, needed to derive the **energy and nutrient contribution of each ingredient** used in the mixed dish. (see [Section 3.1.3](#))

These standard recipe data requirements are summarized in [Table 4](#) and are described in detail below.

#### 3.1.1 Data Needed to Calculate Average Ingredient Proportions (gram to gram ratio)

When standard recipes are developed for a dietary survey, primary data collection is needed to derive the average ingredient proportions for each standard recipe. The ingredient proportions for a given standard recipe are typically used in recipe calculations for many survey respondents and could therefore have a substantial influence on the energy and nutrient intake distribution estimated for the survey population. As such, high-quality data must be collected and several data points (i.e., recipe data replicates) should be used to calculate the average ingredient proportions that are used in a given standard recipe.

When average ingredient proportions are calculated for a standard recipe, both the amount of each ingredient used and the total amount of the prepared mixed dish are expressed in grams. The ingredient proportion, in this case, is therefore referred to as a “gram to gram ratio.”

The data collection methods for mixed dishes commonly prepared at home differ substantially from those commonly prepared outside the home. Whereas standard recipe data for mixed dishes prepared at home are typically collected with home cooks in cooking sessions organized by the survey, for mixed dishes that are commonly purchased and therefore prepared outside the home, the data collection methods are different. This is because it is rarely possible for a vendor or restaurant cook to prepare a mixed dish in a cooking session organized by a survey in the way that this is typically done with home cooks.

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<sup>9</sup>When resources are limited, the use of secondary sources can be considered. When using existing data sources, survey planners must ensure that adequate procedures were used for data collection to ensure high-quality data (e.g., a sufficient number of replicates per standard recipe) and that all data needed are available (e.g., the weight of the prepared mixed dish). [Annex 2](#) lists the requirements that an existing data source should be able to fulfill if it is to be considered as potentially suitable for providing standard recipe data for a given survey.



Table 3 provides an overview of some of the key differences between the data collection methods recommended for mixed dishes prepared at home and those commonly used for mixed dishes prepared outside the home. Detailed guidance for carrying out data collection using each method is provided below.

**Table 3. Data Collection Procedures for Mixed Dishes Commonly Prepared at Home vs Outside the Home**

Data Collection Procedure	For Mixed Dishes Commonly Prepared at Home	Mixed Dishes Commonly Prepared Outside the Home
How data are collected	Data are collected during cooking sessions with “typical” cooks	Data are collected from vendors and restaurants
Number of replicates per standard recipe collected	For each standard recipe, the dish is prepared 6-10 times <sup>A</sup>	For each standard recipe, recipe data are collected from 5-6 vendors and/or restaurants <sup>B</sup>
Data collection for the amount of each ingredient and prepared mixed dish	Amounts are weighed accurately using dietary scales	Amounts are weighed if feasible; often, amounts are estimated

A Depending on the extent of variability expected for the preparation of each mixed dish, this minimum number of independent data collection points may need to be increased.

B The ideal number depends on the complexity and expected variability of the mixed dish.

#### **DATA COLLECTION FOR MIXED DISHES COMMONLY PREPARED AT HOME**

The recipe data needed to derive average ingredient proportions for standard recipes commonly prepared at home are collected during cooking sessions in which cooks are asked to prepare mixed dishes that reflect how these dishes are commonly prepared for households in the target area of the planned survey.

These standard recipe data collection sessions are organized with small groups of cooks (e.g., 6 cooks per half-day session). The individuals who are selected to prepare recipes for mixed dishes prepared at home can be selected purposively, on a convenience basis, to reflect “typical” cooks in households in the target area of the planned survey. The selected individuals should be residents of the community and the primary cooks in their homes. It is advisable to select cooks from a range of ages to capture any variation that may occur in cooking practices across generations. If the survey will include infants and young children for whom special recipes may be prepared, the individuals selected to prepare those recipes should be selected from among those who typically cook food for children. It is important to avoid selecting professional cooks because although they may be very knowledgeable about local recipes, their method of preparation may not reflect how mixed dishes are prepared in typical households.

During a cooking session, each participating cook is asked to prepare an assigned set of mixed dishes in the same way these dishes are commonly prepared in their household. Only those cooks who are familiar with a given dish should be asked to prepare it. All ingredients (including flavorings), cooking materials, and fuel should be provided by the survey team. Cooks should be instructed to use the core and supplementary ingredients previously identified as commonly added to a given mixed dish, but the use of flavorings depends on their preference. Although an ample quantity of all ingredients should be available for use during the cooking session, cooks should be advised to use the same amount of each ingredient as they normally use at home. Data recorders should be instructed to record the details and amounts of all ingredients used, even if they are used in small amounts (such as flavorings).

A recipe prepared by a cook represents a single data point to be included in the calculation of the average ingredient proportions for the standard recipe developed for that mixed dish. During a cooking session, a single cook can be expected to cook between 3 and 4 recipes; therefore, 6 cooks would create between 18 and 24 data points in one cooking session.

Depending on the resources available and the geographic variability expected in recipe preparation, during a cooking session, each cook can be asked to prepare the same set of 3-4 different mixed dishes as other participating cooks, or each cook can be asked to prepare a set of mixed dishes that are different from those of all other participating cooks. Of these two options, it is generally recommended to ask each cook to prepare a different set of mixed dishes from other participating cooks. This allows for data for a given standard recipe to be collected across several different cooking sessions in different geographic locations, thereby providing a greater opportunity to capture geographic variation in the recipe data collected. However, the logistics of procuring the relevant ingredients for each mixed dish to be prepared at each cooking session can be more challenging when organizing cooking sessions in this way.

For each standard recipe created for a survey, a minimum of **6-10** independent data points should be collected (i.e., the number of times a given mixed dish is prepared across cooking sessions). However, depending on the extent of variability expected for the preparation of each mixed dish, this minimum number of independent data collection points may need to be increased.

For detailed guidance on how to conduct cooking sessions, refer to [Annex 3](#).

#### *DATA COLLECTION FOR MIXED DISHES COMMONLY PREPARED OUTSIDE THE HOME*

For mixed dishes prepared outside the home, it is typically not feasible to ask commercial vendors/chefs to participate in formal cooking sessions. As such, an alternative method for collecting standard recipe data is required. The exact procedures to follow to collect standard recipe data for mixed dishes prepared outside the home may vary across settings and may require improvisation. When considering the most appropriate data collection methods to use in a particular setting, the following points can be useful to bear in mind.

- While collecting data from vendors/chefs, their time is being taken away from their business activities.
- It is usually difficult to incentivize vendors/chefs to come to a central location to prepare food in a cooking session given the opportunity cost to them.
- Sitting with vendors/chefs as they prepare the food may not be possible if the food is prepared in a remote location or at odd hours (e.g., at 4 am).
- Some vendors/chefs might be protective of their recipes and may consider them as proprietary information.

Because of these challenges, when collecting data on recipes from vendors and restaurants, the vendor/chef should typically be interviewed in the place where s/he prepares the dishes for sale. A description of the ingredients and any characteristics of the ingredient that influence its energy and nutrient content should be recorded (e.g., processing or preparation state, part of the food used to prepare the mixed dish). If feasible, the ingredients used to prepare mixed dishes should be weighed. If this is not feasible, then estimates of ingredient amounts should be obtained from the vendor/chef. Many vendors/chefs may be able to state the amount of each ingredient used by weight or otherwise may be able to describe quantitatively the amounts commonly used in a recipe (e.g., 3 cups).

The weight of the final cooked mixed dish obtained from those ingredient amounts must also be collected. In many cases, the vendor/chef might be able to explain, for example, that a pastry recipe yields a batch of 20 individual pastries; in this case, the data collection team can determine the average weight of an individual pastry by directly weighing a sample of individual pastries prepared by that vendor to derive the weight of the entire batch of 20 pastries. If the vendor/chef cannot recall the total quantity produced by the recipe given, the data collection team will need to cook that mixed dish.

Multiple vendors and restaurants should be interviewed to develop the standard recipe for a given mixed dish. The ideal number will depend on the complexity and expected variability in the mixed dish, but ideally, a minimum of 5-6 replicate observations (i.e., recipe data from a minimum of **5-6** different vendors and/or restaurants) for each mixed dish should be collected for a given geographic area. However, when collecting data for a mixed dish prepared by a large commercial chain, it may be sufficient to visit a single vendor at a single location as the mixed dish is likely to be prepared similarly across the survey area.

The food vendors and restaurants identified for standard recipe data collection can be selected purposively to reflect “typical” vendors in the target area of the planned survey. Vendors and restaurants that are not commonly frequented should not be selected for standard recipe data collection.

### 3.1.2 Data Needed to Estimate the Amount of a Mixed Dish Consumed by the Respondent

The amount of a mixed dish consumed by the respondent is estimated during a 24-hour dietary recall interview. When a mixed dish is reported, and the enumerator has identified a suitable standard recipe that adequately represents that mixed dish, the respondent is asked to estimate the amount of the mixed dish consumed using a pre-determined PSEM. A PSEM conversion factor for the mixed dish is then needed to derive the amount of the mixed dish consumed in grams. The use of proxy weight (e.g., playdough, raw rice) and calibrated household utensils (e.g., spoons, scoops, and ladles) as a PSEM require determining the density of the mixed dish<sup>10</sup> to derive the PSEM conversion factor.<sup>11</sup>

The compilation of PSEM conversion factors for mixed dishes always requires primary data collection. Cooking sessions to collect standard recipe data can also provide an excellent opportunity to collect data on the density of the mixed dishes prepared. To obtain the density of the mixed dish, a measuring cup or large container with a known volume is filled with the mixed dish and the weight is measured on a digital dietary scale. The density of the mixed dish is calculated by dividing the weight of the mixed dish by the volume of the cup or container filled. Depending on the amount of mixed dish prepared, and the container in which it was prepared, the density can be measured (i) for the entire mixed dish in the container it was prepared in (e.g., pot or pan) or (ii) for a sample of the mixed dish in a measuring cup. The density of each recipe preparation should be determined independently (i.e., the density of the mixed dish should be measured separately for each **6-10** data points collected for a given standard recipe). Detailed procedures for how to collect density data for mixed dishes prepared during standard recipe cooking sessions are described in [Annex 3](#).<sup>12</sup>

For non-homogeneous mixed dishes for which a standard recipe is developed for the remaining homogenous mixture, density data are required for the remaining mixture only. Although the entire mixed dish should be prepared during the cooking sessions, only the remaining mixture requires the collection of density data. Therefore, once the mixed dish is prepared, all nutrient-dense ingredients should be removed; at which point, data can be collected based on the density of the remaining mixture.

For mixed dishes commonly prepared outside the home for which recipe data are collected from vendors and restaurants, the mixed dishes will need to be purchased from the respective vendor or restaurant to collect a

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<sup>10</sup> In addition, the density of the proxy material is required, but this is typically not collected during cooking sessions.

<sup>11</sup> Depending on the PSEM used, additional data will need to be collected (e.g., the volume of household utensils when using calibrated household utensils as the PSEM and the weight of a standard unit when using standard unit as the PSEM). However, these PSEMs are not commonly used to estimate the amount of mixed dish consumed.

<sup>12</sup> For additional guidance on the collection of density data for mixed dishes and proxy materials, see [Annex 1](#) in Vossenaar M, Hotz C, Arsenault J, Deitchler M, Moursi M, Lubowa A, and Arimond M. 2022. *How to Compile a Portion Size Estimation Method Conversion Factor Database for a Quantitative 24-Hour Dietary Recall Survey*. Washington, DC: Intake – Center for Dietary Assessment/FHI Solutions. Available at [Intake.org](https://intake.org).

density measurement for the mixed dish. If it is not feasible to purchase the mixed dish from the recommended number of 5-6 vendors; the average density can be calculated using fewer data points.

### 3.1.3 Data Needed to Process Standard Recipe Data

When calculating average ingredient proportions, edible portion factors are needed for ingredients that are added to the mixed dish with inedible parts that are not removed during preparation (e.g., whole fish, meat with bones, corn on the cob). To account for these inedible parts, an edible portion factor is applied at the ingredient level rather than at the recipe level. It is more accurate to apply an edible portion factor at the ingredient level than at the recipe level because ingredients typically have different edible portion factors and usually most ingredients in a recipe will have no inedible parts. The edible portion factor should relate to the food in the form added to the mixed dish, which is typically raw. Primary data collection can be used for edible portion factor data, however, in some cases, secondary data may also be appropriate to use.<sup>13</sup>

To use the standard recipe data collected in data analysis requires the use of nutrient retention factors and food composition data for each ingredient used. Nutrient retention factors are generally collated from existing data sources because deriving these values is complex.<sup>14</sup> For foods or nutrients for which there are no losses due to preparation or processing, the nutrient retention factor is set to 1 or 100%.

Nutrient retention factors can be applied to the ingredients during data processing. Alternatively, the FCDB can be adapted so that the ingredients listed have the energy and macronutrient content of the ingredient in the form added (typically raw), but the micronutrients content reflects nutrient losses during preparation, processing, cooking, or other treatment by applying nutrient retention factors. The recipe ingredients added to the FCDB for the survey should be only used for this purpose and should be labeled distinctly from the corresponding raw form of the ingredient (e.g., using a separate variable or a distinguishing factor in the food code variable).

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<sup>13</sup> Data sources for edible portion factors can be downloaded from the *Intake* online resource library, available at [Intake.org](http://Intake.org).

<sup>14</sup> Data sources for nutrient retention factors can be downloaded from the *Intake* online resource library, available at [Intake.org](http://Intake.org).

**Table 4. Data Requirements and Sources for Standard Recipe Calculations**

Data requirements	Recommended data sources	Details related to the data collection method
Data needed to derive average ingredient proportions		
The weight of each ingredient in the form in which it is added to the mixed dish (usually raw) <sup>A</sup>	Primary data collection	Data are typically collected as part of the pre-survey work before data collection for the survey, but may also be collected after survey data collection to help fill in gaps in the mixed dishes reported. <sup>B</sup>
The weight of the entire prepared mixed dish (usually cooked)		For mixed dishes commonly prepared at home, cooking sessions are organized with local cooks.  For mixed dishes commonly prepared outside the home, recipe data are collected from vendors and restaurants.
Data needed to estimate the amount of a mixed dish consumed by the respondent		
Estimated amount of the mixed dish consumed by the respondent	Data collection during the 24-hour dietary recall interview	The respondent is asked to estimate the amount of the mixed dish consumed using a pre-determined PSEM.
PSEM conversion factor for the mixed dish	Primary data collection	Data are typically collated as part of the pre-survey work before data collection for the survey. <sup>C</sup>
Data needed to process standard recipe data		
Edible portion factors for food items for which the inedible parts are not removed during the preparation of the mixed dish	Primary data collection and/or existing data sources	Data are typically collated as part of the pre-survey work before data collection for the survey. Data gaps are filled during and after the data collection. <sup>D</sup>
Nutrient retention factors for each ingredient to reflect nutrient losses during cooking <sup>E</sup>	Taken from published data	Data are typically collated as part of the pre-survey work before data collection for the survey. Data gaps are filled during and after the data collection. <sup>F</sup>
Food composition data for all ingredients <sup>G</sup>	Compiled using various data sources	

- A The weight of water used as an ingredient does not need to be estimated. However, the amount of water used as an ingredient can be recorded if used for other purposes.
- B The data collection procedures needed to derive average ingredient proportions are as described in [Section 3.1.1](#).
- C For detailed guidance on how to compile PSEM conversion factors, see Vossenaar M, Hotz C, Arsenault J, Deitchler M, Moursi M, Lubowa A, and Arimond M. 2022. *How to Compile a Portion Size Estimation Method Conversion Factor Database for a Quantitative 24-Hour Dietary Recall Survey*. Washington, DC: *Intake* – Center for Dietary Assessment/FHI Solutions. Available at [Intake.org](http://Intake.org). Some data needed to derive PSEM conversion factors can be collected during cooking session (e.g., density of mixed dishes needed when proxy weight or calibrated household utensils are used as PSEM).
- D The recommended procedure on how to collect edible portion factors is provided in [Annex 2](#) in Vossenaar M, Lubowa A, Hotz C, Deitchler M, Moursi M, Arimond M, Crispim S, and Arsenault J. 2020. *Considerations for the Selection of Portion Size Estimation Methods for Use in Quantitative 24-Hour Dietary Recall Surveys in Low- and Middle-Income Countries*. Washington, DC: *Intake* – Center for Dietary Assessment/FHI Solutions. Available at: [Intake.org](http://Intake.org).
- E Nutrient retention factors relate to the proportion of the nutrient remaining in the cooked food in relation to the nutrient originally present in the raw food and take values >0 and ≤1 or >0 and ≤100%.
- F Developing a FCDB for a dietary survey can be a complex task. Extensive guidance is available from the Food and Agriculture Organization's (FAO) INFOODS website (<http://www.fao.org/infoods>), including criteria for inclusion of values in the database and guidance on imputation.
- G These ingredients should have the energy and macronutrient content of raw foods, but the micronutrient content should be adjusted to reflect nutrient losses during cooking by applying nutrient retention factors.

## 3.2 Standard Recipe Calculations

Standard recipe calculations using the simplified ingredient method require several steps.

- Step 1. Calculate the average ingredient proportions for the standard recipe.
- Step 2. Calculate the amount of each ingredient consumed by the respondent.
- Step 3. Calculate the energy and nutrient content of each ingredient.
- Step 4. Calculate the amount of each ingredient consumed in the form consumed.

Each of these steps is done at a different stage of the survey. Step 1 is typically carried out as part of the pre-survey work conducted before data collection for the survey. Steps 2-4 are carried out after data collection is completed, as part of the dietary data processing work. Instructions for carrying out steps 1-4 are described below. An example of a standard recipe calculation using the simplified ingredient method is provided in [Box 5](#).

### *STEP 1. CALCULATE THE AVERAGE INGREDIENT PROPORTIONS*

#### *STEP 1A. DERIVE THE WEIGHT OF THE EDIBLE PORTION OF EACH INGREDIENT*

When recipe data are collected for the development of standard recipes, the weight of each ingredient is measured in the state and form in which it is added to the mixed dish. Some mixed dishes are prepared with ingredients that include inedible parts (e.g., whole fish, meat with bones, corn on the cob). If these inedible parts are not removed before the preparation of the mixed dish, the weight recorded for these ingredients will include these inedible parts.

To account for these inedible parts, an edible portion factor is applied to each respective ingredient. The edible portion factor should relate to the ingredient in the form added to the mixed dish, which is typically raw. The weight of each ingredient is multiplied by its corresponding edible portion factor. For ingredients that do not include inedible parts, the edible portion factor is set to 1.

#### *STEP 1B. CALCULATE THE INGREDIENT PROPORTIONS*

For each ingredient, an ingredient proportion is calculated as the weight of the edible portion of the ingredient used in the state and form that it was added to the dish (which is typically raw) divided by the weight of the prepared mixed dish (which is typically cooked). When water is added as an ingredient, it is not necessary to calculate an ingredient proportion for water. This is because water has no energy or nutrients and because the simplified ingredient recipe calculation method accounts for water loss during recipe preparation.

The sum of the ingredient proportions for a mixed dish will often deviate from 1.0. For recipes where excess cooking water or broth is added, the sum of these proportions should be <1.0 (e.g., soups and stews). For recipes where no cooking water is added or the water fully evaporates, the sum should be >1.0.

The calculation steps required to derive average ingredient proportions using recipe replicates (e.g., recipe data collected from several cooks during cooking sessions) are described in [Section 3.3](#).

### *STEP 2. CALCULATE THE AMOUNT OF EACH INGREDIENT CONSUMED*

#### *STEP 2A. CALCULATE THE AMOUNT OF MIXED DISH CONSUMED*

The amount of a mixed dish consumed by the respondent is estimated during the 24-hour dietary recall interview using a pre-determined PSEM for the mixed dish. The amount is recorded in the relevant units (e.g., grams of food replica, grams per standard unit, grams of proxy material, volume of the selected utensil, or grams of size depicted), according to the PSEM used for estimating the amount consumed. This unit is multiplied by the PSEM conversion factor to derive the weight of the mixed dish consumed in grams.

Deriving density data for a mixed dish or the remaining mixture of a non-homogenous mixed dish requires using recipe replicate data (e.g., recipe data collected from several cooks during cooking sessions). The steps for using recipe replicate data to derive density data are straightforward. First, potential outliers are identified and removed. Outliers include recipes identified in step 1B during the calculations of average standard recipes as well as outliers in density measurements (using the procedures described in [Section 3.3](#)). Once outliers have been excluded, an average recipe density (or average density of the remaining mixture of a non-homogenous mixed dish) is computed using the remaining data points for a given standard recipe.

#### *STEP 2B. CALCULATE THE AMOUNT OF EACH INGREDIENT CONSUMED IN THE FORM ADDED TO THE MIXED DISH*

For each standard recipe ingredient, the weight of the ingredient consumed is calculated by multiplying the average ingredient proportion for that standard recipe by the weight of the prepared mixed dish estimated as consumed by the respondent (in grams).

#### *STEP 3. CALCULATE THE ENERGY AND NUTRIENT CONTENT CONSUMED FOR EACH INGREDIENT*

##### *STEP 3A. ADJUST THE NUTRIENT CONTENT OF RAW INGREDIENTS IN THE FOOD COMPOSITION DATABASE*

Given that the simplified ingredient method estimates the amount of the ingredient consumed in the form in which that ingredient was added to the mixed dish (typically raw), it is important to link the estimated amount of each ingredient to the energy and nutrient values of the food in the same form. It is also essential to account for nutrient losses (generally vitamins, minerals, and trace elements) influenced by preparation, processing, or other treatment (e.g., cooking).

To account for nutrient losses, each nutrient value for each ingredient is multiplied by a nutrient retention factor (expressed as a value between 0 and 1 or as a percentage of retention from 0 to 100%). Nutrient retention factors can be applied to ingredients during data processing. Alternatively, separate lines can be created in the FCDB for the version of that ingredient with nutrient retention factors applied. When different cooking methods applied to a given ingredient require different nutrient retention factors, then multiple additional rows will be needed to accommodate the different resulting nutrient values for that ingredient. Ingredients in standard recipes should be linked to these ingredients.

##### *STEP 3B. CALCULATE THE ENERGY AND NUTRIENT CONTENT CONSUMED FOR EACH INGREDIENT*

The energy and nutrient contribution from each ingredient in the amount of mixed dish consumed is calculated by multiplying the weight of the ingredient in the form added to the mixed dish by the energy and nutrient content of the ingredient (with nutrient values adjusted for nutrient loss) and then dividing by 100 (because energy and nutrient values are presented per 100 g).

#### *STEP 4. CALCULATE THE AMOUNT OF EACH INGREDIENT CONSUMED IN THE FORM CONSUMED (OPTIONAL)*

When the simplified ingredient recipe calculation method is used, amounts of ingredients consumed are expressed as grams of the ingredient in the form in which it was added to the dish, which is typically raw. For energy and nutrient intake estimations needed to assess the nutrient adequacy of the diet, no further conversions are needed.

However, for all food and food group-based analyses, where the interest is in the amount of food or food group in the form “as consumed”, there is a need to convert raw amounts to prepared amounts. For example, dietary guidelines are sometimes expressed in servings per day of the food in its prepared form, and dietary metrics may have gram thresholds for scoring that represent amounts of food groups “as consumed”. As such, an additional step is required to convert the amount of the ingredient in the form it was added to the dish to the form it was consumed using yield factors.



## Box 5. Example of Recipe Calculations Using the Simplified Ingredient Method for a Standard Recipe

*Example scenario:* During the 24-hour dietary recall interview, “jollof rice with tomato” is reported as consumed by the respondent. Since a standard recipe was developed for this mixed dish in advance of the data collection, the enumerator simply confirms that the core and supplementary ingredients listed for the standard recipe correspond to the ingredients included in the mixed dish consumed by the respondent. Once this is confirmed, the enumerator asks the respondent to estimate the amount of the mixed dish consumed using raw rice as the PSEM.

The example below shows the steps when using the simple ingredient method to calculate the amount of thiamin consumed, as provided by a single ingredient (i.e., basmati rice) in the standard recipe. These same calculations would be applied for all other ingredients and energy and nutrients of interest.<sup>A</sup>

### STEP 1 - Calculate ingredient proportions

#### STEP 1a - Derive the weight of the edible portion of each ingredient

The amount of raw basmati rice added to the mixed dish is 680 g

The edible portion factor for raw basmati rice is 1

The weight of the edible portion is calculated as:

$$680 \text{ g} \times 1 = 680 \text{ g}$$

#### STEP 1b - Calculate the ingredient proportions

The amount of prepared jollof rice with tomato is 1688 g

The ingredient proportion for basmati rice is calculated as:

$$680 \text{ g} / 1688 \text{ g} = 0.40$$

### STEP 2 - Calculate the amount of each ingredient consumed

#### STEP 2a - Calculate the amount of mixed dish consumed by the respondent

The amount of jollof rice with tomato consumed is estimated during the 24-hour dietary recall interview using raw rice as the PSEM; the amount of raw rice weighed is 500 g

The PSEM conversion factor for jollof rice with tomato is 0.64

The amount of jollof rice with tomato consumed is calculated as:

$$500 \text{ g} \times 0.64 = 320 \text{ g}$$

#### STEP 2b - Calculate the amount of each ingredient in the form added to the mixed dish

The ingredient proportion for basmati rice in jollof rice with tomato is 0.40 (calculated in step 1b)

The amount of jollof rice with tomato consumed is 320 g (calculated in step 2a)

The amount of raw basmati rice consumed is calculated as:

$$0.40 \text{ g} \times 320 = 129 \text{ g}$$

### STEP 3 - Calculate the energy and nutrient content consumed for each ingredient

#### STEP 3a - Adjust the nutrient content of the raw ingredients in the food composition database

Raw basmati rice contains 0.020 mg of thiamin per 100 g

The nutrient retention value for thiamin for cooked basmati rice is 0.8

The adjusted nutrient value of thiamin in cooked basmati rice is calculated as:

$$0.020 \text{ mg} \times 0.80 = 0.016 \text{ mg}/100 \text{ g}$$

#### STEP 3b - Calculate the energy and nutrient content consumed for each ingredient

The amount of raw basmati rice consumed is 129 g (calculated in step 2b)

The adjusted nutrient value of thiamin in cooked basmati rice is 0.016 mg/100 g (calculated in step 3a)

The thiamin content of the basmati rice consumed is calculated as:

$$129 \text{ g} \times 0.016 / 100 = 0.02 \text{ mg}$$

### STEP 4 - Calculate the amount of each ingredient consumed in the form consumed (optional)

The amount of raw basmati rice consumed is 129 g (calculated in step 2b).

The yield factor used to convert the amount of raw rice into the amount of cooked rice is 3.

The amount of cooked basmati rice consumed is calculated as:

$$129 \text{ g} \times 3.0 = 387 \text{ g}$$

- A Example calculations for all ingredients and a single nutrient (thiamin) are shown in an Excel spreadsheet in [Supplementary Material 1 \(tab 1\)](#).
- B The PSEM conversion factor is calculated as the “PSEM-specific factor” X the “edible portion factor”. In this example, the PSEM-specific factor is calculated as the “density of jollof rice (g/ml) ÷ density of raw rice (g/ml)” and the edible portion factor = 1.



### 3.3 Calculating Average Ingredient Proportions Using Recipe Replicates

When developing standard recipes for a survey, average ingredient proportions (calculated as described in [Section 3.2, Step 1](#)) are typically calculated using multiple data points (i.e., multiple preparations of a mixed dish). In this section, we describe how to calculate average ingredient proportions using primary recipe data collected during cooking sessions or from vendors and restaurants (see [Section 3.3.1](#)). We then describe how to derive average ingredient proportion through calculations using recipe data collected for the associated base standard recipe (see [Section 3.3.2](#)). Finally, we describe how to calculate average ingredient proportions for the remaining mixture of non-homogenous mixed dishes (see [Section 3.3.3](#)).

#### 3.3.1 Calculating the Average Ingredient Proportions for Homogenous Mixed Dishes Using Primary Data

Primary data collection is required for base standard recipes and variant standard recipes for which average ingredient proportions cannot be derived using calculations.

Deriving the average ingredient proportions for a standard recipe using primary data involves four key steps:

1. Identify and remove potential recipe outliers;
2. Calculate the total weight of the ingredients (in the form added) and the total weight of the prepared mixed dish across all recipe replicates;
3. Calculate the average ingredient proportions for the standard recipe; and
4. Check the calculations.

These steps are described below. An example calculation used to derive the average ingredient proportions for a base standard recipe is provided in [Box 6](#).

### Step 1. Identify and remove potential recipe outliers

Before calculating the average ingredient proportions for a given mixed dish using replicate data (e.g., recipe data collected from 6 cooks), potential recipe outliers should be identified and excluded from the analyses.

Recipe outliers are defined as recipes for which the calculated ingredient proportions deviate from the average ingredient proportions. There are no strict criteria on how to identify outliers, but we recommend calculating the deviation of each ingredient proportion from the overall mean ingredient proportion to help make decisions. This is done separately for each ingredient as follows:

- Calculate the ingredient proportion for the given ingredient separately by recipe replicate.
- Calculate the overall mean proportion for the given ingredient in the standard recipe using all recipe replicates data for that mixed dish.
- Calculate the standard deviation from the mean for the ingredient proportion by recipe replicate.
- Identify the standard deviation values for the given ingredient that deviate more than 2 SDs from the mean ingredient proportion across all recipe replicates.
- Consider if the recipe replicates' data for which the given ingredient has an ingredient proportion that deviates more than 2 SDs from the mean ingredient proportion across all recipe replicates need to be removed from the data used to compile the "average" standard recipe for that mixed dish.

### Step 2. Calculate the total weight of the ingredients (in the form added) and the total weight of the prepared mixed dish across all recipe replicates

Once outlier recipe replicates data have been excluded, use the remaining recipe replicate data to calculate the total weight of each ingredient used in the mixed dish and to calculate the total weight of the prepared mixed dish. To do this, the weights of each respective ingredient across the recipe replicate data are summed and the total weights of the prepared mixed dish across the recipe replicate data are summed.

### Step 3. Calculate the average ingredient proportions for the standard recipe

For each ingredient, divide the total weight of the ingredient (i.e., the weight across recipe replicates, as summed in Step 2 above) by the total weight of the prepared mixed dish (i.e., the weight across recipe replicates, as summed in Step 2 above).

### Step 4. Check the calculations

Calculate the sum of all average ingredient proportions to verify that the calculations were done correctly. The sum of the ingredient proportions for a mixed dish will often deviate from 1.0. For recipes where excess cooking water or broth is added, the sum of these proportions should be <1.0 (e.g., soups and stews). For recipes where no cooking water is added or the water fully evaporates, the sum should be >1.0.

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## Box 6. Example of Calculations to Derive Average Ingredient Proportions for Standard Recipes using Primary Data

*Example scenario:* Cooking sessions were conducted with 10 cooks and each cook prepared “cabbage with green pepper, onion, and tomato” using a pre-determined selection of core and supplementary ingredients. The following calculations were undertaken to compute the average ingredient proportions.<sup>A</sup>

### Step 1 – Identify and remove potential recipe outliers

- For each mixed dish prepared by an individual cook, ingredient proportions are computed for each ingredient (*data not shown*).
- For each ingredient, the overall mean and the SD for the distribution of ingredient proportion values for the 10 replicates are computed. It is useful also to tabulate the -2SD and +2SD values for the distribution of ingredient proportion across the 10 replicates for the ingredient, to visually observe where the ingredient proportion for a given replicate falls with respect to the +/- 2SD values for the overall mean ingredient proportion for the recipe.

Ingredients used in “cabbage with green pepper, onion, and tomato”	Ingredient proportions for all replicates (n=10)			
	Mean	SD	Mean-2SD	Mean+2SD
Cabbage, fresh, raw	0.81	0.32	0.18	1.45
Cooking oil, vegetable	0.05	0.01	0.03	0.08
Green pepper, fresh, raw	0.05	0.02	0.01	0.08
Onion, fresh, raw	0.06	0.01	0.03	0.08
Tomato, fresh, raw	0.19	0.06	0.06	0.31

- In this example, one recipe replicate (for which data are not shown) is excluded (the ingredient proportion for ‘cabbage, fresh, raw’ is 1.69, which is higher than the value for the Mean+2SD). The overall mean and the SD for the distribution of ingredient proportion values for the remaining 9 replicates is computed.

Ingredients used in “cabbage with green pepper, onion, and tomato”	Ingredient proportions (excluding outliers) (n=9)			
	Mean	SD	Mean-2SD	Mean+2SD
Cabbage, fresh, raw	0.71	0.08	0.55	0.87
Cooking oil, vegetable	0.05	0.01	0.03	0.08
Green pepper, fresh, raw	0.05	0.02	0.01	0.09
Onion, fresh, raw	0.06	0.01	0.03	0.09
Tomato, fresh, raw	0.19	0.06	0.07	0.31

### Step 2 – Calculate the total weight of the ingredients (in the form added) and the total weight of the prepared mixed dish across all recipe replicates

- For each ingredient used, the weight of that ingredient across all recipe replicates are summed ([see the second column of the table below](#)).
- The weight of the prepared mixed dish across all recipe replicates are summed ([see the third column of the table below](#)).

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A Example calculations to derive average ingredient proportions using recipe replicates are shown in an Excel spreadsheet in [Supplementary Material 2](#).

### Step 3 – Calculate the average ingredient proportions for the standard recipe

For each ingredient used, the sum of the weight of that ingredient across all recipe replicates is divided by the sum of the weight of the prepared mixed dish across all recipe replicates ([see the fourth column of the table below](#)).

### Step 4 – Check the calculations

- The sum of the average ingredient proportions is calculated ([see the last row of the table below](#)). Since the sum is close to 1, the calculated average ingredient proportions are considered plausible

Ingredients used in “cabbage with green pepper, onion, and tomato”	Total weight of ingredients, in the form added to the mixed dish (g)	Total weight of prepared recipe (g)	Average ingredient proportion
Cabbage, fresh, raw	5715	7917	0.72
Cooking oil, vegetable	402		0.05
Green pepper, fresh, raw	339		0.04
Onion, fresh, raw	427		0.05
Tomato, fresh, raw	1419		0.18
Sum of average ingredient proportions			1.05

### 3.3.2 Calculating the Average Ingredient Proportions for Homogenous Mixed Dishes Using Calculations

For variant standard recipes, it may be possible to derive average ingredient proportions using calculations with the primary data collected for the associated base standard recipe. The base standard recipe for which data were collected should include the greatest number of supplementary ingredients that make up the relevant mixed dish. The variant standard recipe, in which one or more supplementary ingredients vary, can then be derived using calculations without additional data collection.

There are two scenarios in which variant standard recipes can be derived using calculations. However, it is only appropriate to derive variant standard recipes using calculations for each of these scenarios when the assumptions below can be made. When these assumptions cannot be made, then primary data collection is required to derive the variant standard recipe.<sup>15</sup>

#### **Scenario 1** – *One or more supplementary ingredients are removed from the base standard recipe.*

In this scenario, the variant standard recipe has only a subset of the supplementary ingredients that are in the base standard recipe. The following assumption is made if the variant standard recipe will be derived by calculation.

*ASSUMPTION:* When supplementary ingredients are removed from the base standard recipe, the amount of other ingredients used in the mixed dish remains similar.

For example, when a variant standard recipe for bean sauce is calculated by removing the supplementary ingredient onion from the base standard recipe, which includes beans, oils, carrots, and onions, the assumption is that the amounts of beans, oil, and carrots used to prepare the bean sauce remain similar when the onion is not included in the preparation of the mixed dish.

If this assumption cannot be made, then primary data collection is required to derive the variant standard recipe.

#### **Scenario 2** – *One or more supplementary ingredients in the base standard recipe are replaced with different supplementary ingredients.*

In this scenario, the variant standard recipe includes the same number of supplementary ingredients that are in the base standard recipe, but some of the supplementary ingredients are different from the supplementary ingredients in the base standard recipe. The following assumption is made if the variant standard recipe will be derived by calculation.

*ASSUMPTION:* When supplementary ingredients in the base standard recipe are replaced with different supplementary ingredients, the amount of the supplementary ingredient used in the base standard recipe is similar to the amount of the replacement supplementary ingredient used in the variant standard recipe.

For example, when a variant standard recipe for vegetable stew is calculated by replacing the supplementary ingredient of pumpkin leaves in the base standard recipe with amaranth leaves in the variant standard recipe, the assumption is that the amounts of pumpkin leaves and amaranth leaves used in the vegetable stew will be similar.

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<sup>15</sup> In these cases, the same primary data collection methods used for base standard recipes can be used for variant standard recipes.

If this assumption cannot be made, then primary data collection is required to derive the variant standard recipe. The steps required to carry out the calculations for each of these scenarios are described below. Example calculations to derive the average ingredient proportions for each scenario are provided in [Box 7](#).

*SCENARIO 1. CALCULATION STEPS FOR VARIANT STANDARD RECIPES WHEN ONE OR MORE SUPPLEMENTARY INGREDIENTS ARE REMOVED FROM THE BASE STANDARD RECIPE*

**Step 1. Create a new recipe name that indicates the supplementary ingredients used**

Before carrying out the variant recipe calculation, it is important to create a new recipe name that clearly distinguishes the variant standard recipe from the base standard recipe. The variant standard recipe name should indicate the supplementary ingredients that were removed from the base standard recipe (e.g., bean sauce without carrots).

**Step 2. For each ingredient used in the variant standard recipe, copy the total weight of the ingredient, as calculated for the base standard recipe**

When the base standard recipe calculations were carried out, the weights of each ingredient used across replicates were summed to derive the total weight of each ingredient. When calculating the variant standard recipe, for each ingredient used in the variant standard recipe, copy the total weight of each ingredient, as calculated for the base standard recipe (these include all core ingredients and the selected supplementary ingredients).

**Step 3. Calculate an adjusted sum of the total weight of the variant standard recipe**

When the base standard recipe calculations were carried out, the weights of the prepared mixed dish across replicates were summed to derive the total weight of the prepared mixed dish. To account for the removal of certain supplementary ingredients, the weight of each supplementary ingredient removed should be subtracted from the total weight of the prepared mixed dish.

**Step 4. Calculate the average ingredient proportions for the variant standard recipe**

For each ingredient in the variant standard recipe, divide the total weight of the ingredient across recipe replicates (see step 2) by the total weight of the prepared mixed dish across recipe replicates (see step 3).

**Step 5. Check the calculations**

Calculate the sum of all average ingredient proportions to help verify that the calculations were done correctly. The sum of the ingredient proportions for a mixed dish will often deviate from 1.0. For recipes where excess cooking water or broth is added, the sum of these proportions should be <1.0 (e.g., soups and stews). For recipes where no cooking water is added or the water fully evaporates, the sum should be >1.0.

*SCENARIO 2. CALCULATION STEPS FOR VARIANT STANDARD RECIPES WHEN ONE OR MORE SUPPLEMENTARY INGREDIENTS IN THE BASE STANDARD RECIPE ARE REPLACED*

**Step 1. Create a new recipe name that indicates the supplementary ingredients used**

Before carrying out the variant recipe calculation, it is important to create a new recipe name that clearly distinguishes the variant standard recipe name from the base standard recipe name. The variant standard recipe name should indicate the new supplementary ingredient in the variant standard recipe (e.g., vegetable with pumpkin leaves).

**Step 2. Replace the ingredient with the new similar ingredient**

The total weight of each ingredient and the total weight of the prepared mixed dish are assumed to remain the same in the variant standard recipe as in the base standard recipe. As such, the average ingredient proportion derived for the ingredient that was in the base standard recipe can be applied to the new ingredient that is used in the variant standard recipe. In this scenario, no additional recipe calculations are needed to derive the average ingredient proportions for the variant standard recipe.

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## Box 7. Example of Calculations to Derive Average Ingredient Proportions for Variant Standard Recipes Using Calculations

*Example scenario:* Cooking sessions were conducted with 10 cooks and each cook prepared the base standard recipe “cabbage with green pepper, onion, and tomato” (see example calculation in [Box 6](#)).

Using the recipe calculations for this base standard recipe, two variant standard recipes can be derived using calculations; this is done either by removing (Scenario 1) or by replacing (Scenario 2) supplementary ingredients.

### SCENARIO 1. SUPPLEMENTARY INGREDIENTS ARE REMOVED FROM THE BASE STANDARD RECIPE

In this example, average ingredient proportions are calculated for a variant standard recipe “cabbage plain” in which the ingredients green pepper, onion, and tomato are removed from the base standard recipe.

#### Step 1 – Create a new recipe name that indicates the supplementary ingredients used

The recipe name is changed from “cabbage with green pepper, onion, and tomato” to “cabbage plain.” Note that it may not be possible to include all supplementary ingredients used in the name because it would become too long.

#### Step 2 – Copy the total weight of each ingredient retained in the variant standard recipe

The sum of the weights for each core and supplementary ingredient in the base standard recipe that is retained in the variant standard recipe is copied. In this example, cabbage and oil are retained as ingredients in the variant standard recipe ([see the second column of the table below](#)).

#### Step 3 – Calculate the sum of the total weight of the variant standard recipe

The total weight of the ingredients included in the base standard recipe that are not included in the variant standard recipe is subtracted from the total weight of the base standard recipe prepared (7917 g); these include green pepper, fresh, raw (339 g), onion, fresh, raw (427 g) and tomato, fresh, raw (1419 g) ([see the third column of the table below](#)).

#### Step 4 – Calculate the average ingredient proportions for the variant standard recipe

For each ingredient retained, the total weight of each respective ingredient is divided by the total weight of the variant standard recipe ([see the fourth column of the table below](#)).

#### Step 5 – Check the calculations

The sum of the average ingredient proportions is calculated ([see the last row of the table below](#)). Since the sum is close to 1, the calculated average ingredient proportions are considered plausible.

Ingredients used in “cabbage plain”	Total weight of ingredients, in the form added to the mixed dish (g)	Total weight of base standard recipe prepared minus the ingredients not included in the variant standard recipe (g)	Average ingredient proportion
Cabbage, fresh, raw	5715	$7917 - 339 - 427 - 1419 =$	1.00
Cooking oil, vegetable	402	5732	0.07
Sum of average ingredient proportions			1.07

*SCENARIO 2. SUPPLEMENTARY INGREDIENTS IN THE BASE STANDARD RECIPE ARE REPLACED WITH DIFFERENT SUPPLEMENTARY INGREDIENTS*

In this example, average ingredient proportions are calculated for a variant standard recipe “cabbage with green pepper, onion, and carrot” in which the ingredients tomato was replaced with carrot.

**Step 1 – Create a new recipe name that indicates the supplementary ingredients used**

The recipe name is changed from “cabbage with green pepper, onion, and tomato” to “cabbage with green pepper, onion, and carrot.”

**Step 2 – Replace the ingredient with the new similar ingredient**

The ingredient name “tomato, fresh, raw” is replaced with “carrot, fresh, raw” ([see the first column of the table below](#)).

In this example, all weight values and average ingredient proportions are the same as in the base standard recipe. The only change made is that the ingredient name “Tomato, fresh, raw” is replaced with “Carrot, fresh, raw”.

Ingredients used in “cabbage with green pepper, onion, and carrot”	Total weight of ingredients, in the form added to the mixed dish (g)	Total weight of prepared recipe (g)	Average ingredient proportion
Cabbage, fresh, raw	5715	7917	0.72
Cooking oil, vegetable	402		0.05
Green pepper, fresh, raw	339		0.04
Onion, fresh, raw	427		0.05
Carrot, fresh, raw	1419		0.18
Sum of average ingredient proportions			1.05



### 3.3.3 Calculating Average Ingredient Proportions for Non-Homogenous Mixed Dishes

Average ingredient proportions for a standard recipe for the remaining mixture of a non-homogenous mixed dish are derived using calculations. The data source for carrying out these calculations is the primary data collected for the associated mixed dish (i.e., the entire mixed dish, including both the nutrient-dense ingredients and the remaining homogenous mixture).

Recipe calculations should first be undertaken for the entire mixed dish, using the same steps described earlier to calculate the average ingredient proportions for a standard recipe using primary data (Section 3.3.1). The next step entails removing the nutrient-dense ingredients from the recipe and performing the necessary calculations to adjust for the removal of these ingredients from the recipe. These steps are described below; an example calculation is shown in Box 8.

#### Step 1. Create a new recipe name to indicate that the recipe is the remaining mixture of the non-homogenous standard recipe

Before carrying out any recipe calculations for the remaining mixture, it is important to create a new recipe name that clearly distinguishes the remaining mixture from the entire mixed dish. The name of the remaining mixture should indicate that the recipe only applies to the remaining mixture of the non-homogenous standard recipe, to make it clear that the nutrient-dense ingredients will be estimated separately (e.g., beef stew, remaining mixture without beef). This is essential to avoid double-counting nutrient-dense ingredients during data processing.

#### Step 2. Copy the total weight of each ingredient retained in the remaining mixture

When the standard recipe calculation for the entire mixed dish was carried out, the weight of each ingredient used across replicates was summed to derive the total weight of each ingredient. To calculate the standard recipe for the remaining homogenous mixture, copy the total weight of each ingredient that is included in the remaining mixture (i.e., keep all ingredients except the nutrient-dense ingredients).

#### Step 3. Calculate an adjusted sum of the total weight of the remaining mixture recipe

When the standard recipe calculation for the entire mixed dish was carried out, the weight of the prepared mixed dish across replicates was summed to derive the total weight of the prepared mixed dish. To account for the removal of the nutrient-dense ingredients, the total weight of each nutrient-dense ingredient should be subtracted from the total weight of the prepared mixed dish.

#### Step 4. Calculate the average ingredient proportions for the variant standard recipe

For each ingredient in the remaining mixture recipe, divide the total weight of the ingredient across replicates (see Step 2) by the total weight of the remaining mixture across replicates (See Step 3).

#### Step 5. Check the calculations

Calculate the sum of all average ingredient proportions to help verify that the calculations were done correctly. The sum of the ingredient proportions for a mixed dish will often deviate from 1.0. For recipes where excess cooking water or broth is added, the sum of these proportions should be <1.0 (e.g., soups and stews). For recipes where no cooking water is added or the water fully evaporates, the sum should be >1.0.

## Box 8. Example of Calculations to Derive Average Ingredient Proportions for the Remaining Mixture of a Non-Homogenous Mixed Dish Using Calculations

*Example scenario:* Cooking sessions were conducted with 10 cooks and each cook prepared “fried rice with shrimp”. Recipe calculations were conducted to derive average ingredient proportions for the entire mixed dish.

Ingredients used in “fried rice with shrimp”	Total weight of ingredients, in the form added to the mixed dish (g)	Total weight of prepared recipe (g)	Average ingredient proportion
Rice, polished, raw	5,433	15,456	0.35
Cooking oil, vegetable	635		0.04
Bok choy, fresh, raw	2,870		0.19
Onion, fresh, raw	1,356		0.09
Shrimp (peeled), fresh, raw	3,835		0.25
Sum of average ingredient proportions			0.91

To derive average ingredient proportions for the remaining mixture of the non-homogenous mixed dish, perform the following calculations.

### Step 1 – Create a new recipe name that indicates that it is a remaining mixture

Change the recipe name from “fried rice with shrimp” to “fried rice without shrimp, remaining mixture.”

### Step 2 – Copy the total weight of each ingredient retained in the remaining mixture

The total weight for each ingredient used in the remaining mixture is copied from the base standard recipe. In this example, shrimp was determined to be a nutrient-dense ingredient. All ingredients except shrimp were therefore included in the remaining mixture of the mixed dish (see the second column of the table below).

### Step 3 – Calculate an adjusted sum of the total weight of the remaining mixture recipe

The total weight of each nutrient-dense ingredient that is not included in the remaining mixture is subtracted from the total weight of the mixed dish prepared (15,456 g); the only ingredient subtracted is shrimp (3,835 g) (see the third column of the table below).

### Step 4 – Calculate the average ingredient proportions for the variant standard recipe

For each ingredient in the remaining mixture, divide the total weight of the ingredient is divided by the total weight of the remaining mixture (see the fourth column of the table below).

### Step 5 – Check the calculations

The sum of the average ingredient proportions is calculated (see the last row of the table below). Since the sum is close to 1, the calculated average ingredient proportions are considered plausible.

Ingredients used in the remaining mixture	Total weight of ingredients, in the form added to the mixed dish (g)	Total weight of remaining mixture(g)	Average ingredient proportion
Rice, polished, raw	5,433	15,456 – 3,835 = 11,621	0.47
Cooking oil, vegetable	635		0.05
Bok choy, fresh, raw	2,870		0.25
Onion, fresh, raw	1356		0.12
Sum of average ingredient proportions			0.89

### 3.4 Standard Recipe Database

When standard recipes are created for a given survey, a survey-specific standard recipe database is typically developed as part of the pre-survey work conducted before the data collection for the survey. The standard recipe database is the output of the various recipe calculations undertaken to derive average ingredient proportions for both base standard recipes and variant standard recipes.

If survey planners decide to estimate amounts of non-homogenous dishes consumed as separate components, then the standard recipes created for the remaining homogenous mixtures should also be included in the standard recipe database.

For each standard and variant standard recipe included in the database, the following information should be provided:

- The recipe name, with descriptive details (e.g., including core and supplementary ingredients used)
- A list of all core and supplementary ingredients used, with descriptive details
- An average ingredient proportion for each ingredient.

The format to use for the database depends on the method of data collection used for the 24-hour dietary recall survey (e.g., paper or technology-assisted data collection). It is also essential that the format of the database is aligned with the recipe calculation method used. An example template for a standard recipe database appropriate to use for recipes calculated using the simplified ingredient method is provided in an Excel spreadsheet (see [Supplementary Material 3](#)).

## 4 Non-Standard Recipes

The simplified ingredient recipe calculation method can also be applied to non-standard recipes to derive data at the ingredient level, as is needed for food-based analysis. The steps required to process non-standard recipe data collected are very similar to the steps required for processing standard recipe data, but some specific adaptations and additional data quality checks are required. While for standard recipes average ingredient proportions are derived from replicate recipe data collected during cooking sessions or from vendors and restaurants, for non-standard recipes ingredient proportions for the reported mixed dish are calculated using a single data point collected during the 24-hour dietary recall interview. When recipe data is collected during the 24-hour dietary recall interview, it is not possible to weigh the amounts of ingredients used and the total amount of the mixed dish prepared; these are therefore estimated using PSEMs.

The specific data sources and recipe calculation steps required for processing non-standard recipe data collected using the simplified ingredient method are described below.

### 4.1 Data Required to Calculate Non-Standard Recipes

The data requirements to apply the simplified ingredient method to non-standard recipes include:

- i. Primary data collection from the survey respondent during the 24-hour dietary recall interview to derive the **ingredient proportions** (i.e., the amount of each ingredient added to the mixed dish and the amount of the entire mixed dish prepared are estimated using PSEMs). (see [Section 4.1.1](#))
- ii. Primary data collection from the survey respondent during the 24-hour dietary recall interview to provide an estimate of the **amount of the mixed dish consumed** using a PSEM. (see [Section 4.1.2](#))
- iii. A combination of primary data collection and the use of secondary data sources to compile the data needed to perform the recipe calculations. These include “edible portion factors”, needed to account for inedible parts of ingredients, as well as “nutrient retention factors” and “food composition data”, needed to derive the **energy and nutrient contribution of each ingredient** used in the mixed dish. (see [Section 4.1.3](#))

The data requirements, appropriate sources for obtaining the necessary data, and data collection procedures for non-standard recipe calculations are summarized in [Table 5](#).

#### 4.1.1 Data Needed to Calculate Ingredient Proportions (gram to PSEM ratio)

When non-standard recipes are used in a survey, recipe details are collected during the 24-hour dietary recall interview. The respondent, and/or the person who prepared the mixed dish, is asked for a detailed description of the types and amounts of ingredients used to prepare the mixed dish, the preparation methods, the total amount of the mixed dish prepared, and the amount of mixed dish consumed. As amounts of the actual food used or consumed cannot usually be weighed, all amounts are estimated by the respondent using PSEMs.

When ingredient proportions for a non-standard recipe are calculated, the amount of the ingredient used is expressed in grams, but the total amount of the prepared mixed dish is expressed in grams of proxy material used as PSEM (e.g., raw rice). The ingredient proportion is therefore referred to as a “gram to PSEM ratio”.

The key steps required to collect non-standard recipe data during a 24-hour dietary recall interview are provided below.

### Step 1. Create a recipe name

For each non-standard recipe reported, the enumerator is asked to create an informative recipe name that adequately describes the mixed dish and, if relevant, indicates core and supplementary ingredients added (e.g., chicken rice pilaf).

### Step 2. Collect ingredient details and estimate the amounts used

For each ingredient used to prepare the mixed dish, the respondent or cook is asked to report the ingredient's name, description, and cooking state when added (e.g., chopped chicken, boneless, raw). The amount of each ingredient used is estimated using a PSEM.

The ingredients used for the preparation of mixed dishes for which non-standard recipe data are being collected are often included in the survey-specific FRIL. As such, they will have been assigned interview probes and a PSEM that the enumerator is guided to use. A PSEM conversion factor is needed for each ingredient; these are typically compiled as part of the pre-survey activities.

### Step 3. Estimate the total amount of the mixed dish prepared

The total amount of the mixed dish prepared is estimated using a PSEM. It is not possible to assign a PSEM for a mixed dish for which the details were unknown before data collection, and as such, the enumerator has to select an appropriate PSEM. When using a non-standard recipe, the PSEMs that are suitable to estimate the amount of total mixed dish prepared include proxy weight using a material that can be shaped (e.g., playdough), proxy weight using a free-flowing material that is pourable (e.g., raw rice), proxy weight using a material that heaps (e.g., Kinetic Sand®), and calibrated household utensils (e.g., spoons, scoops, and/or ladles). However, survey planners often instruct enumerators to use raw rice to estimate the total amount of the mixed dish prepared because this is the only proxy material that is typically carried by the enumerator in a sufficiently large quantity.

The collection of recipe details is needed for each respondent who reports the mixed dish on a given day, but recipe details only need to be collected once if a respondent reports having consumed the same mixed dish more than once on a given reference day.<sup>16</sup>

When the person who prepared the mixed dish is not available during the 24-hour dietary recall interview, it may not be possible for the respondent to provide recipe details. This is especially relevant for mixed dishes prepared outside the home. When this happens, the enumerator should try to get the best possible description of the mixed dish from the respondent and a list of the core ingredients included in the mixed dish.

During data processing, data gaps in recipe information will need to be filled using different data sources. One possibility is to use non-standard recipe details collected from other respondents to complete the recipe information. Another option is to carry out additional primary data collection to create additional standard recipes (i.e., cooking sessions and data collection from vendors and restaurants). A third option, albeit less preferable, is to use existing data sources (e.g., standard recipes collected for previous surveys or recipes in cookbooks).

Decisions about how to compile recipe data to fill gaps in the collection of non-standard recipes should typically be made in accordance with the stated objectives of the survey and with consideration given to the frequency with which each mixed dish with data gaps was reported, the survey resources available for undertaking additional data collection, and the desired level of accuracy for the survey data collected.

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<sup>16</sup> This is normally true but if technology is used for data collection, this could vary by the technology used.

#### 4.1.2 Data Needed to Estimate the Amount of Mixed Dish Consumed by the Respondent

Once the details for a non-standard recipe have been collected, the respondent is asked to report the amount of the mixed dish consumed using a PSEM. This is done in the same way as for mixed dishes with a standard recipe, except that non-standard recipes do not have a pre-assigned PSEM. This is because the recipe for the mixed dish encountered during the survey is unknown until the time of data collection with the respondent.

Using the same PSEM to estimate the amount of total mixed dish prepared and the amount of the mixed dish consumed is strongly recommended. When this is done, the weight of the total mixed dish prepared and the amount of the mixed dish consumed are not calculated and the need to derive a PSEM-specific factor for the non-standard recipe is eliminated. Instead, recipe calculations are done in the units of the PSEM used to estimate these amounts (e.g., grams of raw rice that represent the total mixed dish prepared and grams of raw rice that represent the amount of mixed dish consumed). The ingredient proportion for non-standard recipes is for this reason referred to as a “gram to PSEM ratio”.

#### 4.1.3 Data Needed to Process Non-Standard Recipe Data

When calculating ingredient proportions, edible portion factors are needed for ingredients that are added to the mixed dish with inedible parts that are not removed during preparation (e.g., whole fish, meat with bones, corn on the cob). To account for these inedible parts, an edible portion factor is applied at the ingredient level rather than at the recipe level. It is more accurate to apply an edible portion factor at the ingredient level than at the recipe level because ingredients typically have different edible portion factors and usually most ingredients in a recipe will have no inedible parts. The edible portion factor should relate to the food in the form added to the mixed dish, which is typically raw. Primary data collection can be used for edible portion factor data, however, in some cases, secondary data may also be appropriate to use.<sup>17</sup>

To use the standard recipe data collected in data analysis requires the use of nutrient retention factors and food composition data for each ingredient used. Nutrient retention factors are generally collated from existing data sources because deriving these values is complex. For foods or nutrients for which there are no losses due to preparation or processing, the nutrient retention factor is set to 1 or 100%.

Nutrient retention factors can be applied to the ingredients during data processing. Alternatively, the FCDB can be adapted so that the ingredients listed have the energy and macronutrient content of the ingredient in the form added (typically raw), but the micronutrients content reflects nutrient losses during preparation, processing, cooking, or other treatment by applying nutrient retention factors. The recipe ingredients added to the FCDB for the survey should be only used for this purpose and should be labeled distinctly from the corresponding raw form of the ingredient (e.g., using a separate variable or a distinguishing factor in the food code variable).

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<sup>17</sup> Data sources for edible portion factors can be downloaded from the *Intake* online resource library, available at [Intake.org](http://Intake.org).

**Table 5. Data Requirements and Sources for Non-Standard Recipe Calculations**

Data requirements	Recommended data sources	Details related to data collection methods
<b>Data needed to derive ingredient proportions</b>		
Estimated amount of each ingredient in the form in which it was added to the mixed dish (usually raw) <sup>A,B</sup>	Data collection during the 24-hour dietary recall interview	The respondent is asked to estimate the amount of each ingredient added to the mixed dish using a pre-determined PSEM.  A PSEM conversion factor for each ingredient is typically compiled as part of the pre-survey work, and is used to convert each amount into grams of edible food.
Estimated amount of the entire prepared mixed dish (usually cooked)	Data collection during the 24-hour dietary recall interview	The respondent is asked to estimate the amount of the entire mixed dish prepared using a PSEM.  The amount is expressed in grams of proxy material used as a PSEM (e.g., raw rice).
<b>Data needed to estimate the amount of mixed dish consumed by the respondent</b>		
Estimated amount of mixed dish consumed by the respondent	Data collection during the 24-hour dietary recall interview	The respondent is asked to estimate the amount of mixed dish consumed using a PSEM.  The amount is expressed in grams of proxy material used as a PSEM (e.g., raw rice).
<b>Data needed to process non-standard recipe data</b>		
Edible portion factors for food items for which the inedible parts are not removed during the preparation of the mixed dish	Primary data collection	Data are typically collated as part of the pre-survey work before data collection for the survey. Data gaps are filled during and after the data collection. <sup>C</sup>
Nutrient retention factors for each ingredient to reflect nutrient losses during cooking <sup>D</sup>	Taken from published data	Data are typically collated as part of the pre-survey work before data collection for the survey. Data gaps are filled during and after the data collection. <sup>E</sup>
Food composition data for all ingredients <sup>F</sup>	Compiled using various data sources	

- A For ingredients added to the mixed dish with inedible parts, the inedible portion of such ingredients is accounted for using an edible portion factor at the ingredient level.
- B The weight of water used as an ingredient does not need to be estimated. However, the amount of water used as an ingredient can be assessed if used for other purposes.
- C The recommended procedure on how to collect edible portion factors is provided in Annex 2 in Vossenaar M, Lubowa A, Hotz C, Deitchler M, Moursi M, Arimond M, Crispim S, and Arsenaault J. 2020. *Considerations for the Selection of Portion Size Estimation Methods for Use in Quantitative 24-Hour Dietary Recall Surveys in Low- and Middle-Income Countries*. Washington, DC: *Intake* – Center for Dietary Assessment/FHI Solutions. Available at: [Intake.org](http://Intake.org).
- D Nutrient retention factors relate to the proportion of the nutrient remaining in the cooked food in relation to the nutrient originally present in the raw food and take values >0 and ≤1 or >0 and ≤100%.
- E Developing a FCDB for a dietary survey can be a complex task. Extensive guidance is available from the Food and Agriculture Organization's (FAO) INFOODS website (<http://www.fao.org/infoods>), including criteria for the inclusion of values in the database and guidance on imputation.
- F These ingredients should have the energy and macronutrient content of raw foods, but the micronutrient content should be adjusted to reflect nutrient losses during cooking by applying nutrient retention factors.

## 4.2 Non-Standard Recipe Calculations

The recipe calculations for non-standard recipes using the simplified ingredient method require several steps.

- Step 1. Calculate the ingredient proportions for the non-standard recipe.
- Step 2. Calculate the amount of each ingredient consumed by the respondent.
- Step 3. Calculate the energy and nutrient content of each ingredient.
- Step 4. Calculate the amount of each ingredient consumed in the form consumed.

Steps 1 and 2 differ from the calculations used for standard recipes, but steps 3 and 4 are the same. For non-standard recipes, all steps are carried out after data collection is completed as part of the dietary data processing work.

Instructions for carrying out steps 1-4 are described below. An example of a non-standard recipe calculation using the simplified ingredient method is provided in [Box 9](#).

### *STEP 1. CALCULATE INGREDIENT PROPORTIONS*

#### *STEP 1A. CALCULATE THE AMOUNT OF EACH INGREDIENT USED TO PREPARE THE MIXED DISH REPORTED*

The amount of each ingredient added to the mixed dish is estimated during the 24-hour dietary recall interview using a pre-determined PSEM. The amount is recorded in the relevant units (e.g., grams of food replica, grams per standard unit, grams of proxy material, volume of the selected utensil, and grams of size depicted), and a PSEM-specific factor<sup>18</sup> is applied to derive the weight of the ingredient in grams.

#### *STEP 1B. DERIVE THE WEIGHT OF THE EDIBLE PORTION OF EACH INGREDIENT*

Some mixed dishes are prepared with ingredients that include inedible parts (e.g., whole fish, meat with bones, corn on the cob). Since these inedible parts are not removed before the preparation of the mixed dish, the estimated weight of these ingredients will include these inedible parts. To account for these inedible parts that are not removed, an edible portion factor is applied at the ingredient level (not at the recipe level). The edible portion factor should relate to the food in the form added to the mixed dish, which is typically raw. The weight of each ingredient is multiplied by the relevant edible portion factor. For ingredients that do not include inedible parts, the edible portion factor is set to 1.

Steps 1A and 1B can be done together by using the PSEM conversion factor for each respective ingredient included in the mixed dish, which is calculated as the PSEM-specific factor X the edible portion factor.

#### *STEP 1C. CALCULATE THE INGREDIENT PROPORTIONS (GRAM TO PSEM RATIO)*

For each ingredient included in the mixed dish, an ingredient proportion is calculated as the weight of the edible portion of the ingredient used in the state and form in which it was added to the mixed dish (which is typically raw) divided by the total amount of prepared mixed dish estimated using a PSEM during the 24-hour dietary recall interview (e.g., grams of raw rice). The total amount of the mixed dish that was prepared is not converted into grams because it is not possible to derive a PSEM conversion factor for a mixed dish for which a standard recipe was not developed.

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<sup>18</sup> A PSEM-specific factor is needed to convert the amount of a food item reported as consumed, estimated using a pre-determined PSEM, into its equivalent weight in grams (e.g., "grams of ingredient used") before accounting for any inedible parts of that food (e.g., bones, seeds, pits, or peels).



When water is added as an ingredient, it is not necessary to calculate an ingredient proportion for water. This is because water has no energy or nutrients and because the recipe calculation accounts for water loss during preparation.

## *STEP 2. CALCULATE THE AMOUNT OF EACH INGREDIENT CONSUMED*

### *STEP 2A. CALCULATE THE AMOUNT OF EACH INGREDIENT CONSUMED IN THE FORM ADDED TO THE MIXED DISH*

For each ingredient, the weight of the ingredient consumed in the form added to the mixed dish is calculated by multiplying the ingredient proportion (gram to PSEM ratio) by the amount of mixed dish consumed, as estimated using a PSEM during the 24-hour dietary recall interview (e.g., grams of raw rice). The weight of each ingredient should correspond to the form in which the ingredient was added to the mixed dish, which is typically raw, whereas the weight of the prepared mixed dish consumed corresponds to the weight of the prepared mixed dish, which is typically cooked.

## *STEP 3. CALCULATE THE ENERGY AND NUTRIENT CONTENT CONSUMED FOR EACH INGREDIENT*

### *STEP 3A. ADJUST THE NUTRIENT CONTENT OF RAW INGREDIENTS IN THE FOOD COMPOSITION DATABASE (BY NUTRIENT AND PREPARATION METHOD)*

Given that the simplified ingredient method estimates the amount of the ingredient consumed in the form in which that ingredient was added to the mixed dish (typically raw), it is important to link the estimated amount to the energy and nutrient values of the food in the same form. It is also essential to account for nutrient losses (generally vitamins, minerals, and trace elements) for nutrients influenced by preparation, processing, or other treatment (e.g., cooking).

To account for nutrient losses, each nutrient value for each ingredient is multiplied by a nutrient retention factor (expressed as a value between 0 and 1 or as a percentage of retention from 0 to 100%). Nutrient retention factors can be applied to ingredients during data processing. Alternatively, separate lines can be created in the FCDB for the version of that ingredient with nutrient retention factors applied. When different cooking methods applied to a given ingredient require different nutrient retention factors, then multiple additional rows will be needed to accommodate the different resulting nutrient values for that ingredient. These ingredients should be selected by the interviewer when selecting ingredients for non-standard recipes collected during the 24-hour dietary recall interview.

### *STEP 3B. CALCULATE THE ENERGY AND NUTRIENT CONTENT CONSUMED FOR EACH INGREDIENT*

The energy and nutrient contribution from each ingredient in the amount of mixed dish consumed is calculated by multiplying the weight of the ingredient in the form added to the mixed dish by the energy and nutrient content of the ingredient (with nutrient values adjusted for nutrient loss) and then dividing by 100 (because energy and nutrient values are presented per 100 g).

## *STEP 4. CALCULATE THE AMOUNT OF EACH INGREDIENT CONSUMED IN THE FORM CONSUMED (OPTIONAL)*

When the simplified ingredient recipe calculation method is used, amounts of ingredients consumed are expressed as grams of the ingredient in the form in which it was added to the dish, which is typically raw. For energy and nutrient intake estimations needed to assess the nutrient adequacy of the diet, no further conversions are needed.

However, for all food and food group-based analyses, where the interest is in the amount of food or food group in the form “as consumed”, there is a need to convert raw amounts to prepared amounts. For example, dietary guidelines are sometimes expressed in servings per day of the food in its prepared form, and dietary metrics may have gram thresholds for scoring that represent amounts of food groups “as consumed”. As such, an additional step is required to convert the amount of the ingredient in the form it was added to the dish to the form it was consumed using yield factors.

## Box 9. Example of Recipe Calculations Using the Simplified Ingredient Method for a Non-Standard Recipe

*Example scenario:* During the 24-hour dietary recall interview, “jollof rice with tomato” is reported as consumed by the respondent. A non-standard recipe is collected and the respondent and/or the cook are asked to estimate (i) the amount of each ingredient used to prepare the jollof rice with tomato (in the form added to the mixed dish), (ii) the total amount of jollof rice with tomato prepared (after cooking), and (iii) the amount of jollof rice with tomato consumed.

This example shows the recipe calculations for a single ingredient (i.e., basmati rice, raw) and a single nutrient (i.e., thiamin). These same calculations would be applied for all other ingredients and energy and nutrients of interest.<sup>A</sup>

### STEP 1 - Calculate ingredient proportions

#### STEP 1a - Calculate the amount of the edible portion of the ingredient used (i.e., basmati rice in this example)

The amount of raw basmati rice used to prepare the jollof rice with tomato is estimated during the 24-hour dietary recall interview using raw rice as the PSEM; the amount of raw rice weighed is 389 g.

The PSEM conversion factor<sup>B</sup> for raw basmati rice estimated using raw rice is 1.0.

The weight of the edible portion of raw basmati rice is calculated as:

$$389 \text{ g} \times 1.0 = 389 \text{ g}$$

#### STEP 1b - Calculate ingredient proportions (gram to PSEM ratio)

The amount of prepared jollof rice with tomato is estimated during the 24-hour dietary recall interview using raw rice as the PSEM; the amount of raw rice weighed is 1,020 g.

The ingredient proportion (gram to PSEM ratio) for raw basmati rice is calculated as:

$$389 \text{ g} / 1020 \text{ g} = 0.38$$

### STEP 2 - Calculate the amount of each ingredient consumed

#### STEP 2a - Calculate the amount of mixed dish consumed by the respondent

The amount of jollof rice with tomato consumed is estimated during the 24-hour dietary recall interview using raw rice as PSEM; the amount of raw rice weighed is 325 g

The amount of jollof rice with tomato consumed is not calculated.

#### STEP 2b - Calculate the amount of each ingredient in the form added to the mixed dish

The ingredient proportion of raw basmati rice is 0.38 (calculated in step 1b)

The amount of jollof rice with tomato consumed is 325 g of raw rice (see step 2a)

The amount of raw basmati rice consumed is calculated as:

$$325 \text{ g} \times 0.38 = 124 \text{ g}$$

### STEP 3 - Calculate the energy and nutrient content consumed for each ingredient

#### STEP 3a - Adjust the nutrient content of raw ingredients in the food composition database

Raw basmati rice contains 0.02 thiamin per 100 g

The nutrient retention value for thiamin for cooked basmati rice is 0.8

The adjusted nutrient value of thiamin is calculated as:

$$0.02 \text{ g} \times 0.80 = 0.016 \text{ mg} / 100 \text{ g}$$

#### STEP 3b - Calculate the energy and nutrient content consumed for each ingredient

The amount of raw basmati rice consumed is 124 g (calculated in step 2b)

The adjusted nutrient value of cooked basmati rice is 0.016 mg (calculated in step 3a)

The thiamin context of the cooked basmati rice consumed is calculated as:

$$124 \text{ g} \times 0.016 \text{ mg} / 100 \text{ g} = 0.02 \text{ mg}$$

### STEP 4 - Calculate the amount of each ingredient consumed in the form consumed (optional)

The amount of raw basmati rice consumed is 124 g (calculated in step 2b).

The yield factor used to convert the amount of raw rice into the amount of cooked rice is 3.

The amount of cooked basmati rice consumed is calculated as:

$$124 \text{ g} \times 3 = 372 \text{ g}$$

A Example calculations for all ingredients and a single nutrient (thiamin) are shown in an Excel spreadsheet in [Supplementary Material 1 \(tab 2\)](#).

B The PSEM conversion factor is calculated as the “PSEM-specific factor” X the “edible portion factor”. In this example, the PSEM-specific factor is calculated as the “density of raw basmati rice (g/ml) ÷ density of raw rice (g/ml)” and the edible portion factor = 1.

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# Annexes

## Annex 1: Overview of Recipe Calculations Methods

Several methods have been established for calculating the energy and nutrient content of recipes and/or their ingredients. These methods differ in the application of the yield and nutrient retention factors at either the ingredient or the recipe level or a combination of both. The yield factor accounts for weight changes as a result of moisture (e.g., water) and solid (e.g., fat) losses or gains due to food preparation, processing, or other treatment. The nutrient retention factor accounts for vitamin and mineral losses due to food preparation, processing, or other treatment. The choice of which recipe calculation method is the most appropriate to use depends on the intended purpose of the recipe calculation. [Table 6](#) presents the advantages and disadvantages of the recipe calculation methods.

Although recipes can be analyzed in a laboratory, and various food composition tables include analyzed energy and nutrient values for several mixed dishes, data provided by analysis cannot be disaggregated into individual ingredients, which is typically desirable for the analysis and interpretation of dietary data. In addition, it is typically not feasible in terms of time and resources to perform the laboratory analysis of mixed dishes reported as consumed in a dietary survey.

**Table 6. Advantages and Disadvantages of Recipe Calculation Methods**

Method	Nutrient retention factors	Yield factors	Advantages	Disadvantages	How data can be used
<b>Ingredient method</b>	Not applied	Applied at the ingredient level	Provides nutrient intake data at the ingredient level, facilitating food-based analysis Unequal weight loss of ingredients is considered	Weight loss is not measured for the mixed dish This method provides different nutrient values compared to other methods	Calculating the energy and nutrient content of each ingredient in the cooked form
<b>Recipe method</b>	Applied at the recipe level	Applied at the recipe level	The weight loss of the prepared mixed dish is measured, making it more precise The “recipe method” and “mixed method” provide similar nutrient values, except where differences in nutrient retention factors are big	Does not allow the recipe to be disaggregated into ingredients, thereby precluding the possibility for food-based analysis Unequal weight loss of ingredients is not considered	Calculating the energy and nutrient content of recipes

Method	Nutrient retention factors	Yield factors	Advantages	Disadvantages	How data can be used
<b>Mixed method</b>	Applied at the ingredient level	Applied at the recipe level	<p>Adjusts for changes in the water content of the recipe due to cooking. Ingredients are adjusted for nutrient retention</p> <p>By adjusting the recipe for changes in yield following cooking, the mixed-method approach provides an accurate measure of the total water (g) and fat (g) content of the recipe</p> <p>This method is endorsed by the Food and Agriculture Organization of the United Nations (FAO)<sup>A</sup> and European Food Information Resource (EuroFIR)<sup>B</sup> in an attempt to harmonize recipe calculation procedures to calculate the energy and nutrient content of recipes</p>	Does not allow the recipe to be disaggregated into ingredients, thereby precluding the possibility for food-based analysis	Calculating the energy and nutrient content of recipes
<b>Simplified ingredient method<sup>C</sup></b>	Applied at the ingredient level	Applied at the recipe level	<p>Provides nutrient retention-adjusted intake data at the ingredient level, facilitating food-based analysis</p> <p>The recipe yield factor is derived from the data collected, bypassing the need to rely on recipe yield factors from secondary sources</p>	<p>Does not give an accurate measure of the water content (g) of the prepared mixed dish</p> <p>Requires the weight of the prepared mixed dish, which is often missing in existing databases</p> <p>Does not provide a measure of the cooked weight of the recipe ingredients, and therefore requires further data processing for the analysis of dietary guideline adherence</p> <p>Increases the size and complexity of the food composition database (FCDB)</p>	Calculating the energy and nutrient content of each ingredient in the form added

<sup>A</sup> Guidance on recipe calculation methods are provided in the FAO/ Network of Food Data Systems (INFOODS) e-learning course on food composition data (Lesson 5.2: Recipe Calculation), available at: <http://www.fao.org/infoods/infoods/training/en/>.

<sup>B</sup> EuroFIR. *Report on collection of rules on use of recipe calculation procedures including the use of yield and retention factors for imputing nutrient values for composite foods*. EuroFIR TECHNICAL REPORT, 2008. Available at: <http://www.eurofir.org/2015/12/16/eurofir-recipe-guideline/> and Reinivuo, Heli, Simone Bell, and Marja-Leena Ovaskainen. "Harmonisation of recipe calculation procedures in European food composition databases." *Journal of Food Composition and Analysis* 22.5 (2009): 410-413.

<sup>C</sup> Recipe calculation method recommended by *Intake* in the context of quantitative 24-hour dietary recall surveys.

## Annex 2: Recommended Requirements for the Use of Existing Data Sources for Standard Recipes

### *THE RECIPE DATA COLLECTED MUST BE RELEVANT AND RECENT:*

- Standard recipe data collected from communities that are similar to those selected for the current survey (i.e., similar geographic areas, relevant demographic groups, and the same season as planned for the data collection for the survey).
- The recipe data were collected less than 10 years ago.
- The recipes represent mixed dishes typically prepared by comparable groups in comparable geographic areas (i.e., not embellished versions of the mixed dishes as often included in recipe books).

### *ADEQUATE DOCUMENTATION MUST BE AVAILABLE TO HELP DETERMINE THE QUALITY OF THE DATA:*

- A sufficient number of replicates were collected (e.g., 6 per standard recipe).
- The amounts of the ingredients and mixed dishes prepared were measured accurately using high-quality dietary scales that were regularly tested.
- The amounts of the ingredients and mixed dishes prepared were measured accurately using high-quality dietary scales that were regularly tested (for data collected using cooking sessions).
- The amounts of the ingredients and mixed dishes prepared were estimated credibly (for data collected from food vendors and restaurants).

### *ALL RECIPE DATA NEEDED TO PERFORM THE RECIPE CALCULATIONS MUST BE AVAILABLE, INCLUDING:*

- A detailed description of all ingredients added to the mixed dish, including if their weighing included inedible portions.
- A detailed description of the recipe preparation methods.
- The weight of each ingredient in the form in which it was added to the mixed dish (usually raw).
- The weight of the entire prepared mixed dish (usually cooked).<sup>19</sup>

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<sup>19</sup> Existing recipe data sources often lack information about the weight of the prepared mixed dish. If this is missing, one possibility is to prepare the dish and weigh the prepared mixed dish.

## Annex 3. Cooking Sessions for the Collection of Standard Recipe Data

### Part 1: Field Preparations for Cooking Sessions

#### *DATA TO BE COLLECTED DURING THE COOKING SESSIONS*

The data to be collected during standard recipe cooking sessions should be determined in advance. This requires considering how these data will be used for recipe calculations and other purposes.

Standard recipe data collection must include:

- i. the name and a full description of every ingredient used (i.e., food “descriptors”);
- ii. the weight of each ingredient (except for water) in the form added to the mixed dish (typically raw);
- iii. the steps and methods used to prepare the mixed dish;
- iv. the weight of the cooked mixed dish; and
- v. the density of the final cooked mixed dish or remaining mixture; density data are needed to compute a PSEM conversion factor.

*Intake* recommends that the data recorders use pen and paper to record all the data collected during cooking sessions. Because cooking sessions involve a lot of activity, it can be very challenging to accurately record all data needed with an electronic data collection tool. Each separate standard recipe should be recorded on a separate sheet of paper. An example Excel data-entry form for data collection using pen and paper is provided (see [Supplementary Material 4](#)).

Ideally, the data should be entered electronically on the same day as data collection (e.g., a cooking session in the morning, followed by data entry in the afternoon). This provides an opportunity to verify data that may be unclear. *Intake* strongly recommends double entry of the data collected during standard recipe cooking sessions to ensure data quality.

#### *STAFF NEEDS*

The collection of standard recipe data during cooking sessions generally requires a team supervisor to coordinate and oversee the work; survey assistants to prepare the cooking facilities, observe the cooks and ensure procedures are followed; data recorders to register the weights of all ingredients and cooked mixed dishes, and kitchen assistants to help prepare ingredients and clean. The recommended numbers of team members for a single cooking session involving 6-10 cooks, as well as what would typically entail their main responsibilities to carry out during the cooking sessions, are shown in [Table 7](#).

**Table 7. Responsibilities of Team Members for Cooking Sessions for Data Collection <sup>A</sup>**

Team member	Main responsibilities
1 team supervisor (local field coordinator)	Identifies, contacts, and invites the participating cooks Ensures that the sampling plan is followed (location, number of recipes, number of replications achieved) Prepares the ingredient procurement list based on the recipes for each day of data collection and the amounts required Instructs the participating cooks Coordinates and supervises activities in each cooking session (site set-up, data collection, recording by the assistants, etc.)
2 data recorders	Determine the weight of empty pots used by the cooks Weigh and record all ingredients as used by the cooks Weigh and record the total cooked weight of mixed dishes prepared by the cooks Determine the density of the cooked mixed dishes
2 survey assistants	Assist in preparing the ingredients to be provided to each participating cook Arrange and number the cooking stations Ensure the weights of all empty pots used for cooking are obtained Observe the cooks and ensure they are following instructions and that all ingredients and their weights are recorded Assist in determining the density of the cooked mixed dishes
1-2 kitchen assistants	Assist in preparing ingredients and cooking materials Assist in washing dishes, pots, etc.

Figure 4 gives an illustration of a potential site layout along with the positioning of the data collection team members. The data recorders should typically remain seated at the data-recording table for the duration of the cooking session while survey assistants walk back and forth between the data-recording station and each cooking station. Likewise, cooks will need to move between the data-recording table and their cooking station. It is important to ensure that there is sufficient space for everyone to move freely and safely (i.e., not crossing each other's paths).

#### *PROCUREMENT OF EQUIPMENT AND SUPPLIES*

Cooking sessions require various kitchen utensils to prepare and present all food items (e.g., stoves, pots, bowls, plates, and cups) and equipment for standard recipe data collection (e.g., dietary scales to weigh all the ingredients and mixed dishes). Also, all ingredients expected to be needed during the cooking session should be purchased in excess. Kitchen supplies should be purchased in advance. Ingredients, however, must be procured locally the day, or the day before, the cooking session to ensure that all ingredients are the varieties commonly used in the area and fresh. The cooks who participate in the standard recipe data collection sessions should not be expected to provide any cooking ingredients or materials.

The equipment needed for data collection includes digital dietary scales, spare batteries, and standardized weights. This equipment may not be readily available in the area (or even country) where the cooking sessions will be carried out and should therefore be procured well in advance. In addition, data entry forms should be developed and printed in advance.



**Figure 4. Site Layout Plan Showing the Roles of the Team Members for the Cooking Sessions for Data Collection**



## Part 2: Data Collection Procedures During the Cooking Sessions

### *PROCEDURES THE DAY BEFORE THE COOKING SESSION*

Before the first cooking session in a given setting, there are a set of procedures that must be completed by the team members to prepare for the cooking session. The team supervisors and data recorders should test the digital scales for accuracy and precision ([Step 1](#)) and determine the volume of measuring cups that will be used to assess the density of the mixed dishes prepared ([Step 2](#)).

An example of detailed procedures the day before data collection is provided in [Box 10](#); these procedures should be adapted to the local context. When feasible, it is useful to meet with the cooks the day before the cooking session so that they can adequately prepare for the cooking sessions. This provides an opportunity to explain the cooking procedures in detail, collect informed consent for participation in the cooking session, and assign the mixed dishes to be prepared ([Step 3](#)). It also provides an opportunity to set up the cooking and data collection venue with the necessary cooking stations and data recording tables ([Step 4](#)). The most important preparatory step is to confirm that the cook is comfortable with the core and supplementary ingredients previously identified as commonly added to a given mixed dish, what flavorings they wish to use, and the quantities of each ingredient that should be purchased (i.e., the amounts they usually use at home) ([Step 5](#)). This allows all relevant ingredients to be purchased and ensures that no ingredients are forgotten ([Step 6](#)).

### *PROCEDURES ON THE DAY OF THE COOKING SESSION*

All cooks should be asked to prepare a set of mixed dishes with which they are familiar and should be instructed to prepare the mixed dish using the core and supplementary ingredients previously identified as commonly added to a given mixed dish, to add flavorings as desired and to use the amounts of ingredients they usually use at home. Once the dish has been prepared, other cooks can confirm that the mixed dish was prepared as typically done in the geographic area.

An example of detailed procedures for cooking sessions on the day of data collection is provided in [Box 11](#); these procedures should be adapted to the local context. The first step entails finalizing the set-up of the cooking venue and setting out the ingredients provided ([Step 1](#)). Then the cooks are asked to process and weigh their ingredients ([Steps 2-5](#)). The cooks are then asked to prepare the mixed dish and weigh the final preparation ([Steps 6-7](#)). The survey assistant then determines the density of the mixed dishes and, where relevant, the density of the remaining homogenous mixture of a non-homogenous mixed dish ([Step 8](#)).

During the cooking session, the team supervisor must ensure that the procedures are being followed and that all data are being correctly collected and recorded ([Step 9](#)). The site assistant must ensure that the cooks are following instructions and they come to the weighing table one at a time. In addition, the site assistant should remind the cooks throughout the cooking session of the following:

- All ingredients that were originally selected and weighed, but not used for the recipe, should be returned to the weighing table (and the data recorder must weigh them and record their weights in grams)
- If the cooks need more of any ingredient, they should come to the weighing table and request it (and the data recorder must weigh it and record the weight in grams)
- When cooking, the cooks should take care not to spill the weighed ingredients and the prepared mixed dish (otherwise the ingredient proportions will change).
- When cooking, the cooks should not eat any of the ingredients or dishes being prepared.
- When the recipe has been fully prepared, the cook must bring the entire dish to the weighing table; none of the food prepared should be removed (and the data recorder must weigh and record the weight in grams).

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## Box 10. Detailed Procedures the Day Before the Cooking Session

### One-time preparations by the survey team (without cooks)

#### Step 1 – Test the dietary scales with 3 different standard weights<sup>A</sup>

- Ensure that the table is level and the scale is placed on a flat surface.
- Test the dietary scales using 3 different standard weights.
  - Put each standard weight on the scale at least 3 times.
  - Record each measured weight to the nearest g on the log sheet.
  - Ensure that each weight measurement is within the acceptable accuracy and precision that corresponds to a given standard weight.
  - When one or more measurements are not within the acceptable range, check that the dietary scale is positioned correctly and that the batteries are charged, and repeat the procedures described above. If this does not solve the problem, replace the digital scale.

#### Step 2 – Determine the volume of the measuring cups<sup>B</sup>

- The volume of all containers that will be used to measure the density of the mixed dishes and the remaining homogenous mixture of non-homogenous mixed dishes should be measured and recorded using the following procedures. Ideally, there should be a “medium” container and a “large” container.
  - Place the cup on the scale.
  - Zero the scale with the cup in place.
  - Fill the cup with water to the brim (fill most of the way, and add the last bit with a spoon), and record the weight, which is also the volume. Since 1.0 g of water is 1.0 ml, the weight is equal to the volume.
  - Remove the cup from the scale, wipe any spilled water, and repeat the procedure 2 more times, recording the weight (which is equal to the volume) each time.
  - The volume of the measuring cup will be used to calculate the density of all mixed dishes for which density data are being collected. Therefore, this step must be carried out with a high level of accuracy, or all density data to be collected will be fraught with error.
  - Calculate the average of the 3 measurements and record it along with the number assigned to the cup: this is the precise volume of the cup.
  - Record the exact average volume of the cup on a sheet and the cup.

### One-time preparations with cooks

#### Step 3 – Welcome the cooks and explain the procedures

- Introduce your team, including the kitchen assistants.
- Explain what the cooks have been invited to do and answer their questions.
- Review the consent document and check whether anyone has any questions or concerns.
- Ask each cook to sign the consent form.
- Make precise appointments for the cooking sessions.
- Give each cook an identification number tag to facilitate data recording.

#### Step 4 – Prepare the cooking venue

- Set up the cooking site according to the layout plan (see [Figure 11](#) for an example layout).

#### Step 5 – Prepare a detailed list of ingredients

- Assign a set of mixed dishes to be prepared by each cook during the upcoming cooking session.
- Confirm that each cook knows how to prepare the mixed dishes assigned to him or her.
- Confirm the list of ingredients that are typically included in each mixed dish.
- Discuss the time needed to prepare the set of assigned mixed dishes.
- Carefully prepare a comprehensive list of ingredients and the estimated amounts needed to prepare the selected mixed dishes to be cooked during the upcoming cooking session.

**Preparations the day before each cooking session by the survey team (without cooks)**

**Step 6 – Purchase the ingredients for the selected mixed dishes**

- Use a checklist to purchase ingredients. Purchase ingredients in excess, i.e., more than the amounts indicated as needed by the cooks.

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<sup>A</sup> For detailed guidance related to the procedures for testing dietary scales, see Vossenaar M, Deitchler M, Hotz C, Lubowa A, and Ferguson E. 2020. *Routines and Procedures to Test the Accuracy and Precision of Digital Dietary Scales Used in Quantitative 24-Hour Dietary Recall Surveys*. Washington, DC: Intake – Center for Dietary Assessment/FHI Solutions. Available at: [Intake.org](https://intake.org).

<sup>B</sup> For guidance on procedures for determining the density of food items and the volume of utensils, see Vossenaar M, Hotz C, Arsenault J, Deitchler M, Moursi M, Lubowa A and Arimond M. 2021. *How to Compile a Portion Size Estimation Method Conversion Factor Database for a Quantitative 24-Hour Dietary Recall Survey in a Low- or Middle-Income Country*. Washington, DC: Intake – Center for Dietary Assessment/FHI Solutions. Available at [Intake.org](https://intake.org).

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## Box 11. Detailed Procedures on the Day of the Cooking Session

### Prepare the cooking venue

#### Step 1 – Set out the raw, unprocessed ingredients on the tables used by the data recorders.

- The ingredients should not be cut, peeled, or processed; the cooks will be asked to do this themselves.
- The amounts available should exceed the amount likely to be used and each cook should have sufficient amounts of each ingredient.

### Ask each cook to approach the data recording table to select cooking materials and ingredients

#### Step 2 – Ask the cook to choose and weigh a cooking pot

- Ask the cook to select a pan or pot that is similar to what she or he normally uses to cook the dish at home.
- Label the pot with the cooking station number.
- Weigh the empty pot (**WITHOUT** the lid)

#### Step 3 – Ask the cook to select ingredients from the data recording table

- Give each cook a large tray with a set of bowls and ask her/him to select her/his ingredients.
- Guide the cooks to put each ingredient in a separate bowl.
- Use the list of ingredients that the cook provided the previous day to double-check that the same ingredients are being chosen.

#### Step 4 – Ask the cook to process all ingredients

- If any ingredients need to be processed (e.g., peeled, cut, diced, ground) ask the cook to do this at his or her cooking station.
- Emphasize that the cook should **not** start cooking before you have weighed all ingredients and have given them the go-ahead to start cooking.
- ingredients should not be washed before they are weighed. Water can add weight to some ingredients, especially leaves and pulses. Tomatoes may be washed and dried by shaking or with a dry cloth before dicing.

#### Step 5 – The data recorder weighs all processed ingredients

- Ask the cook to return all ingredients to the data recorder at the table.
- Weigh each ingredient separately.
- For ingredients that are cooked including inedible parts (e.g., whole fish, meat with bones, corn on the cob) a separate edible portion factor will need to be applied at a later stage. In these cases, the ingredient description should indicate that bones or other waste were present.
- There may also be cases where pre-cooked ingredients are added to a recipe. These should be indicated as being cooked or otherwise processed (e.g., fried fish).
- The amount of water added as an ingredient is not needed when using the simplified ingredient recipe calculation method, however, the amount of water used may need to be recorded for other purposes.

### Ask each cook to prepare the first assigned mixed dish

#### Step 6 – Ask the cook to prepare the first mixed dish

- The survey assistant should observe the participants during preparation, ensuring that all ingredients are used.
- If at any time a cook decides to add more of a given ingredient, he or she must collect the additional ingredients and take these to the data recorder to be weighed and recorded. Similarly, any ingredients not used should be returned for weighing and recording by the data recorder.
- The cook is asked to describe the preparation method for each mixed dish.

### Weigh the entire prepared mixed dish

#### Step 7 – The data recorder weighs the cooked mixed dish

- Once the mixed dish is cool (if it was cooked), the cook is asked to take the cooked mixed dish in the pot to the data recording table.
- The cooking pot containing the cooked mixed dish (without the lid) is weighed.
- If recipe books are to be developed, this could provide an opportunity to photograph the prepared mixed dish.

## **Determine the density of the prepared mixed dish (or remaining mixture) (optional)**

### **Step 8 – The survey assistants determine the density of the cooked mixed dish (or remaining mixture)<sup>A</sup>**

- The density of the mixed dish is determined by the survey assistant.
- In brief, the following procedures are used:
  - *Determining the density of a mixed dish using the entire mixed dish*
    - Put a clean transparent bowl that is large enough to hold the entire mixed dish on the scale and press “tare”.
    - Pour the mixed dish into the bowl and ensure that it is well spread out. There should be no air spaces, but overpacking or condensing should be avoided.
    - Mark the level of the mixed dish on the outside of the bowl with a permanent marker.
    - Empty, wash and dry the transparent bowl.
    - Put the clean transparent bowl on the scale and press “tare”.
    - Fill the transparent bowl with water up to the mark and record the weight of the water in grams.
  - *Determining the density of a mixed dish for a sample of the mixed dish*
    - Put a clean transparent container on the scale and press “tare” (the volume of this container is pre-determined).
    - Fill the container to the top. Level the surface with a knife removing any excess. There should be no air spaces, but overpacking or condensing should be avoided.
    - Record the weight of the mixed dish in the standard volume container.
  - *Determining the density of a remaining mixture*
    - Remove all nutrient-dense ingredients from the prepared mixed dish.
    - Put a clean transparent bowl that is large enough to hold the entire remaining mixture on the scale and press “tare”.
    - Pour the remaining mixture into the bowl and ensure that it is well spread out. There should be no air spaces, but overpacking or condensing should be avoided.
    - Mark the level of the remaining mixture on the outside of the bowl with a permanent marker.
    - Empty, wash and dry the transparent bowl.
    - Put the clean transparent bowl on the scale and press “tare”.
    - Fill the transparent bowl with water up to the mark and record the weight of the water in grams.
- Record all measurements on the data collection form.

## **Ensure that all data are recorded correctly**

### **Step 9 – Team supervisors check that all data have been recorded adequately**

- After clean-up, supervisors confirm that all materials (especially the digital scales) have been returned.
- The data entry form is reviewed for completeness.
- The participants are thanked for their time and efforts.<sup>B</sup>

<sup>A</sup> For guidance on procedures for determining density of food items, see Vossenaar M, Lubowa A, Hotz C, Deitchler M, Moursi M, Arimond M, Crispim S, and Arsenault J. 2020. *Considerations for the Selection of Portion Size Estimation Methods for Use in Quantitative 24-Hour Dietary Recall Surveys in Low- and Middle-Income Countries*. Washington, DC: *Intake* – Center for Dietary Assessment/FHI Solutions. Available at [Intake.org](https://intake.org).

<sup>B</sup> Participants should not be allowed to take home the mixed dishes they prepared. Knowing that the mixed dish will be taken home may influence how the dishes are prepared (e.g., larger portions, richer, more expensive ingredients).