

Yield Factor and Summation Methods

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Two of the most commonly used methods for calculating nutrient content of food mixtures and recipes are 1) the YIELD FACTOR method, sometimes called the Missouri method, and 2) the SUMMATION method. Both methods provide useful information, but we must be aware of the limitations of each method and understand the usefulness for specific purposes. Each of these procedures uses information that is usually readily available and relatively easy to calculate, especially when incorporated into a computer system.

For the greatest accuracy and precision in any recipe calculation method it is necessary to have the following information:

1. Complete list of ingredients including water, cooking fat, seasonings, etc.
2. Descriptive information for each ingredient with as much detail as possible, e.g., cut of meat, fat trim, fresh, frozen, canned, kind of fat, etc.
3. A quantity measure for each ingredient, preferably expressed as a weight, especially for foods of variable densities such as chopped, diced, ground, flaked, etc., amount of salt, drained weight, amount of water, etc.
4. Preparation methods - Boiled, baked, braised, cooking time, etc.
5. Total yield of recipe - preferably in weight and measure, size and number of servings

Not often do we have all of these. For example, if we look at a recipe from a typical institutional recipe file, this is what we might see:

Curry Vegetable Soup

Low sodium chicken base	1 1/2 quarts
Water	3 quarts
Onions, diced	7 ounces
Celery, diced	7 ounces
Carrots, diced	7 ounces
Cabbage, diced	7 ounces
Curry powder	1 1/2 teaspoons
Black pepper	1 teaspoon
Parsley flakes	1/2 cup
Zucchini, 1/4" slices	8 ounces
Summer squash	8 ounces

Simmer first 10 ingredients 1 hour. Add squashes and simmer for 15 minutes.

YIELD: 24 (6 ounces each) servings

This is a recipe written for institutional use and could be called a standardized recipe. Note that most ingredients are quantified by weight, and a total recipe yield is provided.

The following recipe is from a cookbook and is typical of those used in the home:

Potato Soup

- 6 large potatoes, peeled, cut in 8-10 pieces
- 1 stalk celery, cut in large pieces
- 2 carrots, cup up
- 2 medium onions, peeled, whole
- 1/2 stick margarine
- 1/2 teaspoon pepper
- 1 tablespoon parsley flakes

Cook all together with WATER TO COVER about 1 1/2 hours. Remove onions and celery. Puree one-half of potatoes, return to soup. Serves 6

Note that the vegetable quantities are poorly quantified and the amount of water required is not specified. A serving size measure or total measured or weighed yield is not provided.

These examples represent the kinds of recipes encountered in institutional settings and those that might be provided by subjects in clinical situations, dietary surveys, or for publishing nutrient values of recipes.

The Yield Factor Method

1. Multiply weight of each ingredient by yield factor/s. Yield factors for a single food may include raw preparation yield, a cooked yield and an edible portion yield. For example, in preparing a cooked artichoke, the as purchased vegetable would be trimmed of its stem and top (preparation yield), cooked (cooked yield) and, as eaten, inedible parts would be removed (edible yield) to obtain a final prepared yield for an artichoke. Yield factors for specific recipes are often determined as recipes are developed and tested on site, and indeed, institutions do these measurements as they standardize their own recipes. Yield information for individual foods is published by USDA in Handbook 8, Handbook 456 and Handbook 102, "Food Yields Summarized by Different Stages of Preparation"
2. Compute total weight of recipe after yield factors have been applied to each ingredient.
3. Calculate nutrient content for each nutrient for each ingredient.
4. Total each nutrient for the all ingredients to obtain nutrient content for entire recipe.
5. Divide each nutrient total by number of portions. This will provide nutrients per portion.
6. Divide each nutrient total by number of 100 gram units in total weight of recipe to provide nutrients per 100 gram portion.

Figure 1 is a computer printout of a recipe for Ham and Macaroni au Gratin which was entered into the HVH-CWRU Nutrient Data Base system. It illustrates how yield factors have been used for the ingredients. Measure codes (MC) are two digit numbers and represent volume or weight measures, e.g., 01 = volume ounce, 42 = serving, 04 = quart, etc. Yield factor column headings are PR = preparation yield, CK = cooked yield, and EP = edible portion yield. Most ingredients are coded for cooked foods so that nutrient values will reflect nutrient changes due to cooking. Note that the cooked yield of water in which the macaroni is cooked is zero and the yield of macaroni is 273 percent, a published value which includes the water absorbed by cooking dry macaroni.

When this method is used to calculate nutrients per portion by dividing each nutrient total by number of servings, the nutrient values are more precise than the method which uses nutrients per summed weight of total recipe ingredients (last column in Figure 1) after yield factors have been applied, converting to 100 gram portions, and then calculating nutrients per portion using portion weight.

There is a limitation to this method in that water loss during cooking or baking is not taken into consideration. For some food mixtures, water loss, fat loss or fat uptake would not be counted. A modified version of this method allows for these losses or gains. It applies a factor to the total weight of the recipe for water loss and to the water and fat sums of those ingredients. Nutrient losses due to cooking procedure would not be considered for some ingredients, in this case for milk, flour, and cheese.

The Summing Method

1. Weight of each ingredient is translated to grams.
2. Calculate total weight of recipe: sum of weights of ingredients.
3. Divide total weight of recipe by 100 to obtain number of 100 gram units.
4. Calculate each nutrient per ingredient.
5. Calculate total for each nutrient value for the recipe.
6. Divide each nutrient total by number of portions for nutrients per portion.
7. Divide each nutrient total by number of 100 gram units for nutrients per 100 gram portion.

This method is simple and direct. It does not take into account changes in cooked weights or measures of ingredients or preparation and cooking changes, but it is applicable in some recipes such as for the Cheese Soufflé recipe illustrated in Figure 2. Note that no yield factors have been applied in this recipe, however, the same limitations apply as for the Macaroni and Ham au Gratin recipe in Figure 1.

At Case Western Reserve University, while participating in a clinical trial, we compared the two methods by calculating a number of different kinds of food mixtures to note the differences. We were receiving recipes from patients; most of these had limited information. Usually, we did not have total recipe yield information, but patients told us that they consumed a measured portion or a fraction of the recipe. For this clinical trial, we were primarily interested in the protein content of homemade mixtures and wished to determine the range of differences in the two methods of calculating nutrient content.

Table 1 summarizes the results for several types of recipes. The two vegetable mixtures show only small differences, but the meat mixtures have differences ranging from 30-60% for some nutrients. Note differences in total portion weights for the meat mixtures.

In summary, it is important to understand the limitations of these methods and to consider them in relation to the specific goals or purpose of the study or project. Equally important is the quantity and quality of the information provided about the recipes and mixtures.

References

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