A New Recipe Calculation Model

Loretta W. Hoover, University of Missouri-Columbia

Since the early 1960's, methods for calculation of nutrients in recipes have appeared in the literature. Neither foodservice facilities nor dietary surveys are likely to have the resources to analyze the nutrient composition of recipes in a chemical laboratory. Thus, estimation of nutrients with a computerized database system is the most common method for determining nutrient profiles for recipes. However, after using computers for over 30 years to estimate nutrients for recipes, a unified methodology has not evolved.

Current Methods

Although modeled for different purposes, the Retention Factor Method and the Yield Factor Method are the two most frequently used methods. Merrill, et. al (1) published a monograph describing the calculation method used to estimate nutrient values for home-prepared foods in Agriculture Handbook No. 8. This method, commonly referred to as the Retention Factor Method, has been described by Perloff (2-3). In this method, ingredient weights are adjusted with overall moisture and fat change factors and nutrient values are adjusted with nutrient retention factors (4-6).

With the availability of computer technology to support foodservice operations another model was designed for recipe calculation (7-10). This method commonly referred to as the Yield Factor Method relies on in-house and published food yields (11) to adjust ingredient weights to reflect food preparation, cooking effects, and removal of refuse. The nutrient profile for each ingredient corresponds to the finished form of an ingredient in a mixed dish. Recipe databases are a part of the infrastructure in a foodservice system and support menu management functions.

These two methods have different data requirements. Recipes coded with one method cannot be converted for use with the other method without considerable data modification.

Rationale for a New Recipe Calculation Model

A new recipe calculation model is being proposed to provide a versatile, integrated model that will facilitate data portability. Several authors (12-14) have addressed recipe calculation methodologies; however, a new model drawing on the advantageous features of the existing models has not been proposed. For some time, I have been encouraging development of a single comprehensive recipe calculation model that could be utilized for foodservice operations, product development, metabolic research centers, dietary surveys, or patient care.

Data portability would be enhanced if an integrated model were adopted. Recipes coded in one system could be loaded into another system without investing a large amount of coding effort to tailor recipe data.

Options for Implementing a New Model

A new model could be implemented by either re-engineering existing methods or designing a new integrated model. Re-engineering will probably be an appealing option to those who have existing systems; it preserves the investment already made in systems development. Thus, I will address the enhancements needed in the common methods to achieve a more versatile method.

Design of a new integrated model offers an opportunity to make improvements in how data structures are defined and to eliminate data redundancy throughout a recipe data base. In this paper, I will attempt to incorporate all of the unique features of existing models into a new integrated model and will propose some supporting data collections.

Enhancing Existing Methods

Enhancement of the Retention Factor Method for use in organizations where food production support is needed will require several new features. Although this method was never intended to facilitate food production, some individuals responsible for foodservice are interested in using the features of the Retention Factor Method for nutrient calculation. To support food production, the Retention Factor Method should:

- Preserve "As stated" ingredient weight including any refuse that might be present.
- Document ingredient weight adjustments by recording the factors used to arrive at an edible portion weight.
- Link ingredients to food inventory by recording the ID of the purchased form of the ingredient.
- Provide for inedible parts in served weight of a portion such as bones in BBQ ribs or chicken drumsticks.
- Include weights for fat when an ingredient so that the proper amount will be purchased and costed.
- Maintain standardization data indicating the yield and portions/batch for comparison with calculated values.

Several features are needed in the Nutrient Retention Factor method to support food production. The Nutrient Retention Factor method should:

- Identify re-usable by-products such as fats used for deep-fat frying or meat scraps that can be used in another recipe.
- Include EP-->AP factor to assure that an appropriate amount is purchased when an ingredient weight is stated in an EP form of the food (e.g. onions, peeled).
- Accommodate handling losses that occur normally during food preparation process (e.g. sauces that adhere to the cooking container).
- Document batch sizes (Min & Max) to provide information for recipe forecasting and scheduling.
- Include advance preparation code to indicate recipes or ingredients within a recipe which require some advance preparation.
- Include cost/price data to identify portion costs for the support of food cost accounting modules or for menu pre-costing.

Several enhancements are needed in the Yield Factor Method to convert it to an Integrated Recipe Model. All of these enhancements are related to the calculation of nutrient values because the Yield Factor Method was originally designed to support food production and service. Specifically, the Yield Factor Method could be enhanced to:

- Link to nutrient retention factors to adjust for vitamin and mineral losses in ingredients.
- Adjust nutrient retention per ingredient using the retention factors rather than using the nutrient profile for only the finished form of an ingredient.
- Preserve moisture/fat change factors that relate to overall changes in a recipe.
- Preserve NDB ID of the specific fat that is associated with the fat change factor (e.g. bacon fat lost from frying bacon).

- Adjust for overall moisture change by adding new computational logic to adjust the aggregate moisture value for a recipe.
- Adjust for overall fat change by adding new computational logic to adjust the aggregate fat and fatty acid values using the fat change factor and the nutrient profile for the specified fat.

With the enhancements noted, both the Yield Factor and Nutrient Retention Factor methods could be made more versatile and compatible.

Design of a New Integrated Recipe Model

For organizations without an investment in existing software modeled on either of the common models, a new strategy could be implemented using the factors and advantages of the existing methods. A new strategy could be implemented to expedite data coding and, in the long-term, reduce the data maintenance effort.

As some of you will remember from last year, I suggested that, from a structural standpoint, nutrient databases will probably have a complex configuration. With enhancements in computer technology, we have begun to separate data according to type of data such as nutrient values or food descriptions and to provide links to data rather than coding redundant values in a data base. In this proposal for a new Integrated Recipe Model, a relational data base model influenced how some of the recipe data are segregated.

Criteria for a New Recipe Calculation Model

This integrated model was planned to meet the following criteria:

- Provides coding flexibility allowing use of either the Nutrient Retention Factor or Yield Factor methods.
- Documents weight adjustments due to advance preparation or refuse losses.
- Provides data coding diagnostics to alert a coder to inconsistencies between food production data and calculated yields and portion weights.
- Provides links to supporting data rather than coding redundant data within the Recipe Data Base.
- Minimizes the data maintenance effort by eliminating redundant data that might be coded inconsistently across recipes.
- Integrates with system modules to provide support for diet planning, food procurement and production, and financial management.

Components of an Integrated Recipe Model

The primary components of an Integrated Recipe Model are: Recipe General Information, Recipe Ingredient Information, Recipe Nutrients, Recipe Preparation Procedures, and an Ingredient File with alternative "as stated" forms and associated yield factors. The contents of each of the data collections are itemized on Handouts 1 and 2 . Although I attempted to be comprehensive with respect to data fields, I did not address the size or specific options for each data field.

The Recipe General Information is that information which refers to the total recipe and includes recipe identification, overall change factors, recipe standardization data, calculated recipe data, and diagnostic information.

On the first page of Handout 1, some of the fields of recipe general data are itemized. This list is not offered as a data structure. Instead, this list is proposed as an extensive listing of data that might be preserved about a recipe. The calculated and diagnostic data indicated near the end of the left column could be recalculated each time a recipe is modified rather than stored in a data structure. Some data fields have the term "multiple records" beside or under them indicating that more than one option could be preserved. The handling losses could be coded to account for post-production losses such as handling losses, carving losses, etc. These losses influence the batch yield in terms of both total weight and number of portions.

For foodservice operations, intermediate and finished recipe and portion weights are useful. A coding system for Recipe Standardization Status can be employed to indicate if a recipe was coded without recipe testing, after thorough recipe testing, or somewhere along that continuum. The Yield/Batch Size provides a reference point for comparing calculated values for a recipe. Similarly, the Portion Sizes indicate the expected size of different types of portions when a recipe is coded and prepared. On Handout 1, data fields related to recipe standardization are itemized in the middle of the left column.

The right column on the first page of Handout 1 is recipe general information for food service with the exception of the first field which is a flag to indicate if nutrients for the recipe are to be calculated with the yield factor method. The remainder of the data fields on the right column is grouped into categories of information such as production information, serving information and cost/price information. Most of those data fields could be left uncoded if recipe nutrients were the only desired output in a specific setting.

In the Integrated Recipe Model, the amount of information that would be maintained in the Recipe Ingredient Information would be limited to the quantity of the ingredient, links to the appropriate entries in an Ingredient File, some ingredient flags, and a link to recipe preparation procedures. Activation of the Ingredient Type flag identifies when an ingredient is another recipe such as a white sauce or is a re-usable by-product such a fat left over after deep-fat frying. A recipe ingredient flag could be activated to prevent an ingredient from being included when weight adjustments are made for moisture losses or gains (e.g. garnishes which are served with a finished dish but are not cooked). This simplified data record for each ingredient would prevent data redundancy such as ingredient names and yield factors and would minimize the data maintenance effort. Similarly, recipe coding should be faster and require less individual judgement.

Two other recipe files are those for the calculated Recipe Nutrients and for the Recipe Preparation Procedures. Both of these files can be stored with very simple data structures. The data fields proposed for each are itemized on the back side of Handout 1 in the right column. Provision is made for nutrient values for only 100 grams of each recipe to minimize the number of values that must be maintained for each food. A computer can assume the role of calculating the quantity of each nutrient in an amount consumed by a respondent or for designated portion sizes. The text of preparation instructions for a cook would be maintained in the Recipe Preparation Procedures file. The ID of the preparation step serves as the link to the recipe ingredient information in the opposite column of Handout 1.

An Ingredient File is proposed as a centralized collection of information that might be required for nutrient calculation and for food procurement and production. A list of the data fields in an Ingredient File is shown on the first page of Handout 2. The detail coded about alternative forms of ingredients could be maintained in this file rather than in the ingredient records in a Recipe Data Base. With this configuration, the details about each ingredient would not have to be coded each time an ingredient appears in a recipe.

In recipes, the same ingredient may be "stated" on different recipes in terms of alternative forms. For example, raw onions might be stated on one recipe as "onions, chopped" and on another as "onions, quartered". Including alternative forms of a food in the Ingredient File would be a way of preserving the name of ingredients stated on a recipe. Sometimes, ingredient names include preparation information such are peeling, slicing, draining, etc. The weights of different measures of each alternative form could be preserved in the Ingredient File or as a separate related data collection.

By preserving information about alternative forms of ingredients, EP-->AP factors could be derived and coded for each alternative form. EP-->AP factors are especially important in a database system supporting food production activities. Foods may be purchased in bulk in an unprocessed form but stated according to some processed amount in a recipe. In those instances, a EP-->AP factor is necessary in the data base system to convert the amount stated in the recipe to the amount that must be purchased. This factor is not involved in computing a nutrient profile for the recipe but is required to correctly cost the ingredient in the recipe when some pre-preparation occurs in a foodservice facility.

Several preparation options may exist for each alternative "As Stated" form. Appropriate yield factors and nutrient retention factors could be associated with each option. If the Ingredient File were the depository for yield factors, the actual values could be coded for each preparation option; otherwise, the IDs of the appropriate yield factors could be referenced in another data collection.

Frequently foods are served with non-edible parts (eg. bone in a pork chop); the non-edible portion needs to be included in the portion weight in order to monitor recipe yield and portion control. However, the nutrient values for the portion should correspond to only the edible portion. Thus, a link to a refuse factor would be necessary to eliminate the weight of refuse in a served portion.

Two fields have been allowed for Nutrient Data Base ID. If the Nutrient Retention Factor method activated, the ID for the "As Stated" form would be utilized. The ID for the "Served" form would not be required unless the Yield Factor Method were activated. Of course, in some instances, both data fields might reference the same entry in a Nutrient Data Base.

Several flags are included in the Ingredient File to record information about ingredients. One flag is available in this file to indicate if an ingredient is available as a government commodity item. Other flags are available to code advance freezer withdrawal and advance preparation.

Data in the Ingredient File could be stored in a Food Inventory File. However, I would like to offer a justification for a separate file. First, an Ingredient-->Food Inventory Cross Reference could be constructed very easily as shown at the bottom of Handout 2, and the Food Inventory ID could be displayed on recipes and all food purchasing and inventory documents. Secondly, organizations sometimes change food vendors and would be more independent if vendor catalog numbers were not embedded throughout in-house data collections such as recipes.

Thirdly, an Ingredient File might be developed as a generic data collection that could be integrated into different software systems. In this way, a lot of redundant effort might be eliminated. I believe that data coding consistency would be improved in recipes, also.

Could we begin to think of an Ingredient File in much the same way we think of a Nutrient Data Base? Would we be able to identify what Alternative Forms and Preparation Options should be included? No doubt, the contents would be expanded over time and not every organization would require all of the alternative forms or preparation options.

Related Data Collections

Some other related data collections are: Units of Measure, Portion Sizes, a Nutrient Data Base, Nutrient Retention Factors, and Refuse Factors. Yield Factors and Weights of Measures could also be preserved as separate data collections. With data in the related files linked by relational keys, data redundancy can be minimized. Coordination of these collections of data will reduce reliance on printed documentation and will support on-line, real-time look-up of pertinent data when coding recipes. Pertinent data fields in each of these data collections are shown on the back side of Handout 2.

Implementation of an Integrated Recipe Model

Implementation of this proposed Integrated Recipe Model involves several tasks. The first task is to create related data collections that are linked to the different segments of the Recipe Data Base and the Ingredient File. The next task would involve designing or modifying an existing Recipe Data Base to include pertinent data fields. With the data structures in place, one would be ready to develop a data entry dialog and the computational logic required to capture and process the data. To facilitate evaluation of recipe coding, software should be designed to incorporate diagnostic capabilities. Another important feature to include in a recipe calculation system is the capability of re-calculating nutrient values for all recipes on demand. Total re-calculation is desirable each time a new version of the nutrient data base is installed in a system. Also, re-calculation would be needed for all affected recipes when revised yield factors or refuse factors are available.

Data entry functions should be easy to use correctly, default factors to an "inactive" status, provide look-up support for data linkages, trigger data entry controls such as data edits for validity, and permit recipe modification without having to re-code all information of the basic recipe.

Diagnostic capabilities should be incorporated into the software to evaluate aspects of data coding against standardization data or across all recipes. The validity of coding can be reviewed by comparing the descriptions of all IDs linked to an ingredient. For example, one might compare the names of the ingredient and alternative form with the name of the ID in the Nutrient Data Base, the name of the ID in the Refuse Factors File, and the name of the ID in the Food Inventory File. Cross-references of ingredients and recipes can be useful to identify recipes containing specific ingredients.

The coding of yield factors might be compared across all recipes for a given form of an ingredient if an Ingredient File were not used. Similarly, moisture change factors might be compared across recipes of the same type such as casseroles, cakes, soups, etc.

Using these diagnostic capabilities, inconsistency in data coding over time by different coders can be detected and reconciled. These capabilities are important in any recipe data base system regardless of which calculation method is used.

Benefits of an Integrated Recipe Model

The benefits of an Integrated Recipe Model will be a comprehensive set of features which are suitable for a variety of purposes with simplified recipe coding and maintenance. A consensus on an Integrated Recipe Model will facilitate the development of new data bases of supporting data.

Mixed dishes, coded according to recipes, will probably constitute an increasing proportion of the data records in nutrient data bases as we attempt to reflect data for foods as consumed. The recipe strategy provides a way to reflect ethnic and regional variations, to estimate values for constituents of interest when laboratory analyses are not feasible, and to recalculate nutrient profiles when ingredients change or the nutrient values of the ingredients are up-dated. The expanding use of these calculation procedures will emphasize the essentiality of better data about cooking losses and gains and nutrient retention.

In this proposal of an Integrated Recipe Model, the data maintained in the existing recipe models have been merged and re-organized into a configuration that minimizes data redundancy and coding effort. Only minor modifications in computational strategies have been suggested, but additional enhancements may be warranted. My comments have been limited to the estimation of nutrients in recipes and have not extended to the collection and coding of recipes in dietary intakes records.

The Handouts reflect my thinking at this point and provide a reference point for discussion. Perhaps some of you can identify fields of data that should be added. Others of you may offer other ways to configure the data fields. I welcome all of your suggestions for improvements in my proposal. In closing, I am hopeful that we can, at some point, unify our support for a comprehensive model.

References

1. Merrill, A.L., Adams, C.F. and Fincher, L.J.: Procedures for Calculating Nutritive Values of Home-prepared Foods: As Used in Agriculture Handbook No. 8, "Composition of Foods--Raw, Processed, Prepared", Revised 1963. U.S. Department of Agriculture, ARS 63-13, 1966. (35 pp.) (Out of print -- contact USDA Nutrient Data Research Branch regarding availability.)

2. Perloff, B.P.: Recipe Calculations for NFCS Data Base. In: Murphy, S. and Rauchwarter, D. (Eds.): Proceedings of the Tenth National Nutrient Data Bank Conference, pp. 11-21. (San Francisco, CA, July 22-24, 1985) Springfield, VA: U.S. Department of Commerce National Technical Information Service, 1985. (Publication PB86-159589)

3. Hoover, L.W. and Perloff, B.P.: Model for Review of Nutrient Data Base System Capabilities. Second Edition. Columbia, MO: University of Missouri-Columbia Printing Services, 1984.

4. U.S. Department of Agriculture, Human Nutrition Information Service: Provisional Table on Percent Retention of Nutrients in Food Preparation, 1984. (2 pp.)

5. U.S. Department of Agriculture, Human Nutrition Information Service: USDA Table of Nutrient Retention Factors, Release 3, 1989. (Data set)

6. Murphy, E.W., Criner, P.E., and Gray, B.C.: Comparisons of methods for calculating retentions of nutrients in cooked foods. J. Agric. Food Chem. 23(6):1153-1157, 1975.

7. Balintfy, J.L. and Blackburn, C.R.: From New Orleans: A significant advancement in hospital menu planning by computer. Insitutions 55(1):54-56, 102, 104-105 (July), 1964.

8. Andrews, J.T., Moore, A.N., and Tuthill, B.H.: Electronic data processing in intra-departmental food cost accounting. J. Am. Dietet. A. 51:332, 1967.

9. Andrews, J.T.: Development of a standardized recipe data file for computer systems. In: Moore, A.N. and Tuthill, B.H. (Eds.): Computer Assisted Food Management Systems, pp. 33-45. Columbia, MO: University of Missouri Technical Education Services, 1971. (Out of Print -- Available through Inter-Library Loan from the University of Missouri-Columbia -- Call No. RA975.5.D5 C66 at Ellis Library)

10. Sager, J.F.: Recipe and ingredient control by computer. Hospitals 43(18):87-90 (September 16), 1969.

11. Matthews, R.H. and Garrison, Y.J.: Food Yields Summarized by Different Stages of Preparation. U.S. Department of Agriculture, Agriculture Handbook No. 102 (rev.), 1975.

12. Hoover, L.W.: A standardized method for recipe calculation. In: Stanton, J.L. (Ed.): Proceedings of the Seventh National Nutrient Data Bank Conference, pp. 86-91. (Philadelphia, PA, May 3-5, 1982) Springfield, VA: U.S. Department of Commerce National Technical Information Service, 1985. (Publication PB85-2452249)

13. Marsh, A.: Problems associated with recipe analysis. In: Toblemann, R. (Ed.): Proceedings of the Eighth National Nutrient Data Bank Conference, pp. 29-38. (Minneapolis, MN, July 25-27, 1983) Springfield, VA: U.S. Department of Commerce National Technical Information Service, 1984. (Publication PB84-159151)

14. Powers, P.M. and Hoover, L.W. Calculating the nutrient composition of recipes with computers. J. Am. Dietet. A. 89:224-232, 1989.

Handout 1

Data Fields in an Integrated Recipe Model

Loretta W. Hoover, Ph.D., R.D., University of Missouri-Columbia

RECIPE GENERAL INFORMATION

- Recipe ID Number
- Recipe Variation ID:
  - Basic Recipe
  - Modification of Basic Recipe:
    - Low Fat
    - Ingredient Substitution
- Recipe Name(s):
  - Full Production Name
  - Abbreviated Production Name
  - Menu Name
- Handling Loss Percentage(s)
- Overall Change Factors:
  - Moisture Change
  - Fat Change
- Nutrient Data Base ID for Fat Change
- Recipe Standardization Data:
  - Recipe Standardization Status
  - Recipe Weight Prior to Cooking
  - Recipe Finished Weight
  - Weight Per Gallon (lbs)
  - Actual Portion(s) Information: (multiple records)
    - ID of Portion Size
    - ID of Unit of Measure
    - Number of Measure Units
    - No. of Portions/Portion ID
    - Gram Weight/Portion ID
- Calculated Recipe Data:
  - Total Weight of Ingredients
  - Coded Finished Recipe Weight
  - Computed Recipe Yield (%)
  - Actual Recipe Yield (%)
  - Computed Portion(s) Information: (multiple records)
    - ID of Portion Size
    - No. of Portions/Portion ID
    - Gram Weight of Portion
- Recipe Coding Diagnostic Information:
  - Finished Weight Difference
  - Finished Weight Percent Difference
  - Recipe Yield (%) Difference
  - Diagnostic Portion(s) Information: (multiple records)
    - ID of Portion Size
    - Gram Weight Dif./Portion ID
    - No. of Portions Dif./ Portion ID
- Yield Factor Nutrient Calculation Method Flag (Y or N)
- Recipe Production Information:
  - Recipe Classification(s):
    - ID of Menu Category: (Beverage, entree)
    - ID of Diet Category Type: (Regular, Low Fat)
  - Advance Preparation Code
  - Batch Sizes:
    - Minimum
    - Maximum
  - Preparation Time: (multiple records)
    - ID of Unit of Time
    - Amount of Time
  - Cooking Information: (multiple records)
    - ID of Cooking Equipment
    - Cooking Temperature
    - Cooking Time: (multiple records)
      - ID of Unit of Time
      - Amount of Time
- Recipe Serving Information: (multiple records)
  - ID of Portion Size
  - No. of Portions/Serving Pan
  - Serving Utensil/Portion ID
- Recipe Cost/Price/Portion Information: (multiple records)
  - ID of Portion Size
  - Ingredient Cost/Portion ID (calculated)
  - Selling Price/Portion ID
  - Mark-up %/Portion ID

Note: All of the data fields associated with "ID of Portion Size" could be positioned as one grouping. They are listed separately for presentation purposes.

Handout 1 (Continued)

Data Fields in an Integrated Recipe Model

Loretta W. Hoover, Ph.D., R.D., University of Missouri-Columbia

RECIPE INGREDIENT INFORMATION:

Recipe ID Number
Recipe Variation ID
Ingredient Sequence No.
Quantity of Ingredient:
    (multiple records)
  ID of Unit of Measure
  Number of Measure Units
    (as stated on recipe)
Links to Ingredient File:
  ID of Ingredient File
    (Optionally could be Food Inventory File ID or Nutrient Data Base ID)
  ID of Alternative form of ingredient "as stated" on recipe from Ingredient File
  ID of Preparation Option of alternative form of ingredient "as stated" on recipe from Ingredient File
Recipe Ingredient Flags:
  Ingredient Type:
    (regular, substitute, sub-recipe, re-usable by-product)
  Immunity to Loss/Gain Adjustment
Recipe Production Information:
  ID of Recipe Preparation Procedures Step

RECIPE NUTRIENTS:

Recipe ID Number
Recipe Variation ID
Proximate and Nutrient Values:
    (multiple records)
  ID of Nutrient
  Nutrient Value per 100 gms

RECIPE PREPARATION PROCEDURES:

Recipe ID Number
Recipe Variation ID
Preparation Information:
    (multiple records)
  ID of Preparation Step
  Text of preparation procedures

Handout 2

Pertinent Data Fields In Other Data Collections
Referenced by an Integrated Recipe Model

Loretta W. Hoover, Ph.D., R.D., University of Missouri-Columbia

Ingredient File:
- ID of Ingredient File
    - (Also, could be Food Inventory ID or NDB ID)
- Description(s) of Ingredient: (multiple records)
    - Full name
    - Abbreviated name
- Commodity Ingredient Flag
- Advance Freezer Withdrawal Code
- Alternative Forms of Ingredient: (multiple records)
    - ID of alternative form "as stated" on a recipe
    - Description(s) of ingredient "as stated" on recipe: (multiple records)
        - Full name "as stated" on recipe
        - Abbreviated name "as stated" on recipe
    - ID of Nutrient Data Base ("as stated" form)
    - EP-->AP Conversion Factor
    - Advance Preparation Flag
    - Weights of Measures: (multiple records)
        - ID of Unit of Measure
            - (Cup, Pint, Wedge, etc.)
        - Gram Weight of Unit of Measure
    - Preparation Information: (multiple records)
        - ID of Preparation Option: (multiple records)
            - (e.g. Baked, served bone-in)
            - Yield Factors: (multiple factors)
                - ID of Type of Yield Factor:
                    - Preparation Yield (AP-->EP)
                    - Cooking Yield
                - Yield Factor Value (proportion)
        - Consumable Yield: (multiple records)
            - ID of Refuse Component in Served Portion
        - ID of Nutrient Retention Factors
        - ID of Nutrient Data Base (served form)

Optional: Need when Food Inventory ID is not ID of Ingredient.

Food Inventory File:
- ID of Ingredient "as purchased"
- Description of purchased form
- etc.
- etc.

Ingredient-->Food Inventory Cross-Reference:
- ID of Ingredient File
- ID of Food Inventory File
    - ("as purchased" form)

Handout 2 (Continued)

Pertinent Data Fields In Other Data Collections Referenced by an Integrated Recipe Model

Loretta W. Hoover, Ph.D., R.D., University of Missouri-Columbia

Unit of Measure:
- ID Code for Unit of Measure:
  - LB/OZ
  - GM
  - etc.
- Description of Unit of Measure

Portion Size:
- ID of Portion Size:
  - SM
  - RG
  - LG
  - PT
  - etc.
- Description of Portion Size:
  - small
  - regular
  - large
  - patient
  - 100 grams
  - 3 oz
  - child
  - cafeteria
  - etc.

Nutrient Data Base Descriptions:
- ID Number of form (raw or final) of ingredient
- Description of food

Nutrient Data Base Values:
- ID Number of form (raw or final) of ingredient
- Proximate and Nutrient values:
  - (multiple records)
  - ID of Nutrient
  - Nutrient Value per 100 grams

Nutrient Retention Factor Descriptions:
- ID of set of factors
- Description of set of nutrient retention factors
  - (e.g. Legumes, CKD 45-75 min, BLD, DRND, BKD)

Nutrient Retention Factors:
- ID of set of factors
- Nutrient Retention Factor Values:
  - (multiple records)
  - ID of Nutrient
  - Retention Factor Value

Refuse Component Descriptions:
- ID of Refuse Component
- Description of Refuse Component
  - (e.g. bones, bone and fat, peel, etc.)

Refuse Component Factors:
- ID of Ingredient File
  - Refuse Factors:
    - (multiple records)
    - ID of Refuse Component
    - Refuse Factor Value (proportion)