A STANDARDIZED METHOD FOR RECIPE CALCULATIONS

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Many nutritionists have a desire to reflect nutrients of specific foods consumed by clients by calculating the estimated nutrients for a set of recipe ingredients. On the surface, the task seems very straightforward and easy to accomplish. With the advent of computer processing, automation of recipe calculation has been feasible. Several methodologies have been used for calculating nutrients for recipes.

Two strategies are being used for storing nutrient data for combined foods or recipes. In some systems, recipe files are created to store ingredient information and nutrients for standard portion sizes. In other systems, nutrient data for recipes are loaded in the nutrient data base. Creating data records on Recipe Files involves entry of the quantity of each ingredient and yield factors which reflect the changes occurring for each ingredient during the production process. Using this technique, both the nutrients and costs for a recipe can be determined when the recipe calculation system is interfaced with a nutrient data base and a food inventory file. The recipe file can also be designed to store information about the quantities of ingredients in terms of the proportional amounts of each ingredient (1). The second approach for maintaining recipe nutrient data is to load nutrient information for a standard amount of a recipe as a new item in a nutrient data base. With this approach, the nutrients should be stored in the same unit of measure as other items in the nutrient data base, e.g. household measure or 100 grams. When this technique is utilized, calculation of nutrients in a recipe is frequently done externally to the file manually with the data entered as an update to the nutrient file. Regardless of the technique used for storing the nutrients for a recipe, the procedure for computation should be computationally accurate and provide values which correspond to the actual nutrients expected to be present in a food.

A recipe calculation task was included in a methodology developed by Hoover and Perloff (2) for assessing nutrient data base system capabilities. The task was included in the review model since procedures for recipe calculation by computer have not been standardized and considerable variation may exist when nutrients are calculated using various approaches. In the review model, a simple 9-ingredient recipe for a tuna noodle casserole was included as a computing task. The recipe included: 1) ingredients which gain weight during cooking; 2) some that lose weight during cooking; and 3) others that remain the same. After examining the computer output from systems during the development of the model, several problems associated with recipe calculation were identified. Exploration of these problems revealed several methodological issues associated with the various approaches used to calculate nutrients for recipes.

Recipe Calculation Approaches

Several approaches are used to calculate nutrients for recipes. Each of the strategies may be suitable in certain circumstances; however, none of the approaches is without some limitations. Three approaches are described below with pertinent aspects and difficulties identified.

Aggregate Nutrients for Weights of Raw Ingredients

This technique is appropriate only for calculating the nutrients in uncooked recipes where the weights of the ingredients are indicated for edible portion (EP) weights and when no losses occur during the food production process. For cooked foods, this approach would probably over-estimate some nutrients per portion since the weights for the raw forms of the ingredients would include losses which occur during the cooking process. Similarly, the nutrients per 100 grams for cooked foods would probably be under-estimated for some nutrients since the weight of the ingredients would be higher for the raw foods and would result in a larger portion size and a lower concentration of nutrients per 100 grams. This technique is not recommended for adoption in a computerized system due to its many deficits.

Aggregate Nutrients for Yield Adjusted Weights of Finished Form of Ingredients

This technique is applicable for both uncooked and cooked foods. The food production process for a recipe is considered by making adjustments to reflect losses or gains in ingredient weights. Yield factors such as those presented in Agriculture Handbook No. 102 (3) are utilized in this technique to adjust ingredient weights to reflect changes in weight during the cooking process. Several yield factors may be needed in a recipe calculation system to reflect ingredient weight changes. Andrews (4) proposed using four yield factors:

a. Preparation yield factor: used to adjust the edible portion (EP) weight of an ingredient to the as-purchased (AP) weight to determine the true cost of the amount of the ingredient required to provide the amount of the EP weight. This factor is not utilized to adjust the weight of an ingredient to calculate nutrients.

b. Preparation yield factor: used to reflect the yield of an ingredient after the preparation process such as paring, draining, or chopping.

c. Cooking yield factor: used to reflect the yield of an ingredient after the cooking process has occurred.

d. Consumable yield: used to reflect the yield of an edible portion of an ingredient after discarding certain portions such as bones in meats or pits in fruits.

Using this approach, the weight of an ingredient is adjusted to reflect the weight of an ingredient in the finished form of a recipe; the adjusted weight of the ingredient and the nutrients for the finished form of the ingredient are used to estimate the nutrients in the recipe. For example, if an ingredient were uncooked in a recipe, the form of the food would be raw. In a cooked recipe, the final form would be a cooked food.

Although this approach appears to be very thorough and comprehensive, some problems are encountered when using this technique. If the weight of some of the ingredients are adjusted to reflect evaporative losses which occur during the cooking process, the nutrients for the ingredient will be under-estimated since the finished weight of the ingredient is used to determine all of the nutrients. In some instances, the loss of nutrients due to cooking may not be proportional to the moisture loss due to evaporation. In some instances, for nutrients not sensitive to heat, the concentration of nutrients in the finished form of the food may actually be greater as a result of the evaporative loss. A second problem can be encountered; one may choose a yield factor that reflects the change of weight for an ingredient and then discover that the nutrients for 100 grams of the food in a food composition table were determined using a different yield factor. For example, one may select a yield factor of 262% for boiled egg noodles and then find that the nutrients for 100 grams of cooked noodles were determined for the food composition table using a yield factor of 310%. Thus, using a yield factor of 262% would under-estimate the nutrients for the noodles. A third problem encountered using this technique since nutrient data are not available for some cooked ingredients. Thus, nutrients would be over-estimated for some foods such as milk and flour which are used as ingredients in cooked recipes.

Aggregate Yield Adjusted Weights of Ingredients and Adjust Nutrients for Raw Ingredients using Nutrient Retention Factors

This technique is suitable for both uncooked and cooked foods. This technique reflects the procedure described in the USDA publication ARS 62-13 (5). This technique is also illustrated in the review model prepared by Hoover and Perloff (2). With this technique, the food production process is considered to make appropriate adjustments for losses or gains in ingredient weight. Judgment must be used to apply the retention factors for some nutrients. While this approach appears to be very precise and complete, some problems are associated with utilizing this approach. Difficulty is encountered when estimating nutrient retention for a food item which has been subjected to a number of cooking processes. Also, retention factors are available for only a limited number of foods. The effect of cooking time and temperature on nutrient retention is not reflected in the adjustment procedure. Thus, utilization of this technique also requires considerable judgment and discretion.

Computer Software Considerations

When developing a data base which will accommodate nutrient information for recipes, the data base should be designed to be functional. A numbering system should be designated which is convenient for the user. Some data bases are organized with recipes entered into the file in categories according to appearance on a menu, e.g. entrees, vegetables, desserts. Another approach would be to enter the recipes according to the type of food, e.g. milk, eggs, fruits. The numbering system should facilitate location of a recipe in reference printouts which relate to the data base.

Another consideration when designing a nutrient data base for recipes is the unit of storage for data. For example, if the data in the nutrient data base were stored in 100 gram portions, the amount of nutrients for a recipe store in that data base should be for the same amount. If the nutrients were stored in household measures, the weight of the portion should be determined and the nutrients should be entered into the data base for that size portion.

Reliable software for computing nutrient data should be developed. Several features are needed in software of this type. A user should be able to create new recipes utilizing the preferred computational approach. If yield and retention factors are utilized, the data entry procedure should accommodate entry of the factors and appropriate adjustment of the ingredients and nutrients. Another feature of computational software for recipes should be the capability of updating recipes on the file. If errors are made in coding a recipe, a user should be able to correct the errors. If an ingredient is changed, a user should be able to make that modification in a recipe stored on a file. Also, a recipe may need modification or updating to reflect newly acquired nutrient data for the ingredients. A third feature needed in computing software is the capability of deleting recipes which are regarded as no longer appropriate or as inaccurate.

Software developed for the purpose of computing nutrients in recipes should be computationally accurate. The values computed by the program should carry the appropriate amount of accuracy and rounding should be at the final computational stage. Also, appropriate factors should be utilized when portions of a recipe are adjusted to reflect the nutrients for a specific portion size. For example, if the nutrients for a recipe are stored on a 100 gram basis, the computer should use the appropriate factor to determine nutrient for a portion of 136 grams.

Managerial Considerations

Developers of data bases have several managerial considerations to keep in mind when computing nutrient values for recipes. Acquisition of yield and retention factors must be arranged. Standard references exist for yield data; however, the actual yield occurring in a foodservice or home may be needed. After a procedure for computing nutrients for recipes has been determined, coding procedures should be developed to assure that the approved technique will be utilized as intended. Also, the consistency of use of the coding procedures should be monitored. As personnel changes occur, the assumptions and judgments used by earlier coders of recipes may not be known to new staff who attempt to apply the procedures; thus, some inconsistency in recipe coding may result. Data base management is another responsibility after a system is in use. Security and back-up should be provided for the data base. Coding of recipes for a system requires a substantial amount of professional time, an investment which should be protected by assuring that the data base is not vulnerable to loss. Policies should be established relative to the updating of the data base and documentation of the status of the data base. The protocol for incorporating newly available nutrient data into existing recipes should be established.

Future Needs

Due to the methodological issues described earlier, a widely accepted procedure for calculation of nutrient data for recipes is needed. A standard procedure which adequately approximates the nutrients in actual food items is needed by both nutritionists and foodservice managers. The procedure should be formulated so that both nutritional and cost data can be determined for a recipe. The various preparation stages in a recipe should be accommodated adequately in such a methodology.

After a standard methodology is determined, appropriate data will be needed. For example, yield factors are needed for foods which have been subjected to preparation processes so that a recipe coder will know the basis for the nutrients in the ingredient. If the standard procedure utilizes retention factors, then retention factors for nutrients will be needed for many more foods to reflect the changes in nutrient values which occur as a consequence of the preparation processes. Values for yield and retention factors could be stored in the nutrient data base with the nutrient values for each food item.

Another consideration in the area of recipe nutrient data bases is the procedure for merging data from several sources. For example, a developer may wish to enter data for a food item from several sources such as USDA, food manufacturers, and computed values for recipes. With advance planning and coordination, developers can enter these items into a data base without risking a possibility of contention for the same space in the data base at a future time. For example, assignment of a certain digit could designate a position in the data base for items computed from home or institutional recipes.

Summary

Calculation of nutrients for recipes has been performed for several decades. Some rather specific procedures have been developed; however, methodological issues are present for each of the approaches. When a data base developer decides to include calculated nutrients for recipes in a data base, several managerial responsibilities are assumed relative to the procedures for determining the nutrient values and the monitoring of consistency of coding and data base management.

Standard procedures are needed for calculation of nutrients in recipes. These procedures should meet the needs of both nutritionists and foodservice managers by computing both nutrient values and costs for recipes. The procedure should result in computed values which approximate the actual nutrients in a recipe. Data which support the calculation procedure will be needed in an easy to use form. Data bases should be planned to accommodate data eminating from USDA, food manufacturers, and home or institutional settings. Planning and precision are needed to assure suitable processes for computing nutrient data for recipes.

References

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