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COMMUNICATION TO THE EDITOR

Is the "Diet Problem" Identical to the "Menu Planning Problem"?

The "diet problem" (see Dantzig [3, 4]) is a classic example of the application of the linear programming method. The solution is a list of foods that collectively provide the selected nutrients in specified minimal quantities give certain constraints. The universal constraint is cost, which is to be minimized. Although other constraints as valid as cost may be included, they have often been treated as irrelevant for purposes of model simplification.

The linear programming solution to the "diet problem" was developed for selecting feedstuffs to be blended for an adequate animal diet at least cost, according to Clithero [2]. Model development was facilitated by existence of known relationships and adequate data: (1) nutritional requirements by species, (2) nutrient contributions of feedstuffs, (3) species preferences, (4) intestinal bulk tolerance by feedstuff, etc., and (5) costs of production. The linear programming method provided the means for utilizing these kinds of data in deriving optimal feed blend solutions given variable costs.

Victor Smith [9, 10] reviewed linear programming solutions of the human diet problem. Initial models using recipe ingredients resulted in a rather unpalatable diet which included liberal quantities of flour, dry Navy beans, and cabbage, and limited quantities of spinach and evaporated milk. Subsequent models allowing some standard food items and seasonings resulted in improved solutions although the diets were still unacceptable. P. E. Smith [8] has also discussed model limitations. Difficulties resulted basically because the model was formulated to plan a menu analogous to a "one-dish meal" that could be repeated indefinitely and whose exact composition could be varied with cost. Unfortunately, a number of psychological factors relating to monotony or lack of variety interpose and invalidate this model.

Peryam [7] commented that menus planned by early models were unacceptable because the items were not selected to conform to traditional menu patterns. He suggested that menu items should be selected for each meal component, i.e. entree, vegetable, salad, etc. Implementation of this modification changed the problem to one of menu planning; computer application was first reported by Balintfy and Blackburn [1]. Early models resulted in repetition intervals which required suboptimal menu combinations in order to achieve least cost, e.g. cabbage might be included in every meal as the source of ascorbic acid. Subsequent modifications have utilized man-machine interactions to improve menu quality. Gue and Liggett [6] have reported a refinement which allows planning of selective menus (several choices of item for each meal component). This model appears satisfactory for situations such as hospitals that are characterized by frequent customer turnover.

The "menu planning problem" for most types of institutional feeding situations must include the psychological parameters relating to variety in order to assure continued acceptability and consumption [5]. These parameters include color, texture, shape, flavor, and kind (e.g. tomato, cheese, chocolate, apple, etc.). Theoretical explanations of the exact relationship between frequency and monotony are limited. Accordingly, mathematical representation is difficult. Eckstein offers a first approximation for dealing with this dilemma [5].

Although not a part of the "menu planning problem" per se, further complication results from the lack of accurate, complete, and reliable data. For example, preference

data have been reported sporadically for some types of institutions but the procedures and degree of control have been highly variable. Hence, the available supporting data cannot be summarized or generalized.

In addition to the raw food cost, nutritional, and variety components of the problem, production time and costs must be included in the model. Clarification of relationships and collection of supporting data are required in order to formulate an operational model.

Summary

Although the "diet problem" for animals and humans is similar in basic formulation, psychological parameters relating to monotony and production factors complicate the model for the human diet. The "diet problem" differs from the "menu planning problem" in (1) simplicity of the problem, (2) complete definition of the relevant parameters, and (3) availability of accurate, complete, and reliable data. For these reasons the designation "diet probem" should be restricted to linear programming methods applied in animal feed blending; textbook examples should use feedstuffs for illustration. The term "menu planning problem" should refer to methods for planning menus for the human diet, including the related psychological parameters and production factors, but should not include projects in data collection or the peripheral problems of menu control.

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