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A New Method for Calculating the Nutrition Balance of the Food Package

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Abstract

Based on the previously published research on the nutritional balance of single recipes based on the fragrance index, this paper proposes a simple diet nutrition balance calculation method based on overlap rate. We calculated and compared the combination of any two of the 25 dishes based on the overlap rate method, which is the nutritional balance of the simple package. We also compared the overlap rate based method and the fragrance index based method for 6 simple packages. The results show that the results of the two methods have certain consistency. We also give a formula for calculating the nutritional balance of a simple package consisting of 3 dishes, which can be extended to a package consisting of more dishes.

Keywords

Food Package, Nutritious Balance, Overlap Rate, Diversity Indices

1. Introduction

Reasonable matching of food packages to ensure the balance of nutrients is a problem related to the public.

A Batad, M Bruenin, EH Marchlewicz, M Story, MG Wootan (2012) evaluated the nutritional quality of children's meals at chain restaurants. The conclusion of this research is that restaurants should support healthier choices for children by reformulating existing menu items and adding new healthier items, posting calories on menus, and setting nutrition standards for marketing to children [1].

Generating a healthy menu has been a problem not only for the children but for almost everyone. R Suharoschi, EA Pop, M Lazar, CA Semeniuc, AM Rotar… (2011) carried out a study with the aim to detect improper eating habits or nutritional problems of individuals in order to planned (designing) and develop a menu to ensure a balanced and healthy diet. Initially they assessed the volunteers' health by questionnaire, medical test and anthropometric data. Then with the help of nutritional programs they have developed for each volunteer a planned menu, ensuring the requirements for variety, seasonality and the strength of satiation, including scientific parameters (as GI, and inflammation factor) [2].

Wenqing Xu (2015) suggested a healthy set menu combination which includes "staple food", "pickled vegetables", "meat dishes", "vegetarian dishes", "dairy products or vegetable protein products" and "flavor snacks" [3].

In our previous essay, we have research on nutritious balance of specific examples in Chinese recipes applying diversity indices and cluster analysis. Initially, based on data of the nutritional ingredients of food, such as proteins, fat and vitamins, we categorize 1200 kinds of specific food using cluster analysis; then, according to a recipe given by a local restaurant, we calculate and compare the diversity indices based on the components of 25 single dishes in the recipe and analyze the nutritious balance of each dish [4].

In this essay, we will focus on a method to calculate the nutritious balance of a simple set menu.

2. Data Source

The data source is the same as our first paper [4]. Our original data mainly consists of food composition data and 25 dishes of food. Food composition data from [4], containing more than 1200 records, including the sequence number, name, test ingredients, energy, water, protein, fat, vitamins, trace elements, and so on. The 25 dishes of food are from the Sijinuantang restaurant in Wuxi. It contains double fresh with green pepper, original flavor chicken brine, broccoli with mashed garlic, tomato and egg soup and so on.

3. Calculate the Nutritional Balance of the Food Package

For detailed methods for calculating the nutritional balance of individual vegetables, please refer to the literature [4], which will not be described in detail here. Here we propose a new indicator of the nutritional balance of food meals, the overlap rate of food nutrition types, referred to as *FPOR*, as shown in Equation (1).

$$FPOR = |A \cap B| / \left(|A| + |B| - |A \cap B| \right) \tag{1}$$

In the above equation, the numerator indicates the number of sub-items of the same nutrient type of the two dishes A and B, and the denominator indicates the number of sub-items of all the nutrient types of the two dishes A and B minus the number of sub-items of the same nutrient type of the two dishes A and B. Considering the low quality of the ingredients, we only consider the main ingredients here. Using Equation (1), we calculated the nutritional overlap rate between 25 dishes, and **Table 1** lists the 7 dishes with the lowest and highest overlap rates.

From Table 1, we can see that the combination with the lowest overlap rate is assorted gluten and celery yam fungus, with an overlap rate of only 14%. On the contrary, in the lowermost groups of the table, the overlap rate reached 100%, completely overlapping. The combination with the lowest overlap rate is the best combination of nutritional balance of the package.

4. Discussions and Conclusions

Using the method of the literature [4], we can also get the calculation method of the package by using the fragrance index equation. Table 2 lists the nutritional balance of six simple packages based on the overlap rate and the Shannon index.

Considering that the difference between the two methods is relatively large, the dimensions of the calculation results are also inconsistent. Here we use linear regression to get the relationship between the two methods, as shown in Figure 1.

In Figure 1, the abscissa is the overlap ratio of the package, and the ordinate is the Shannon index of the package. In the figure, the linear regression of six simple packages gives the correlation coefficient $R^2 = 0.5976$, Significance F = 0.215675. This result shows that the two methods have certain consistency.

Table 1. Nutritional balance of the package.

Dish *A*	Dish *B*	Number of overlapping	Number of dish *A*	Number of dish *B*	Rate of overlapping
Assorted gluten	Celery, yam & fungus	1	5	3	14%
Assorted gluten	Mushroom and vegetables	1	5	2	17%
Squirrel shaped fish	Assorted gluten	1	1	5	20%
Tofu pudding	Assorted gluten	1	1	5	20%
Eel with chopped chili	Assorted gluten	1	1	5	20%
Mushroom with goose liver	Assorted gluten	1	1	5	20%
Two kinds of mushroom with nuts and scallop	Assorted gluten	1	3	3	20%
…	…	…	…	…	…
Fried whitebait with scrambled eggs	Scallop in egg white	2	2	2	100%
Fried whitebait with scrambled eggs	Braised eel paste	2	2	2	100%
Marinated chicken	Squirrel shaped fish	1	1	1	100%
Marinated chicken	Braised turtle	1	1	1	100%
Marinated chicken	Fish with pepper	1	1	1	100%
Marinated chicken	Frog and shrimp	1	1	1	100%
Marinated chicken	Stinking mandarin fish	1	1	1	100%

Table 2. The nutritional balance of six package approached by the two methods of calculation.

Dish *A*	Dish *B*	The overlap rate	The Shannon index
Assorted gluten	Celery, yam & fungus	0.857	2.673
Scallop in egg white	Flavor of the field	0.750	2.023
Squirrel shaped fish	Double fresh with pepper	0.667	2.233
Tofu pudding	Scallop in egg white	0.500	1.272
Double fresh with pepper	Fried whitebait with scrambled eggs	0.333	2.165
Marinated chicken	Frog and shrimp	0.000	1.006

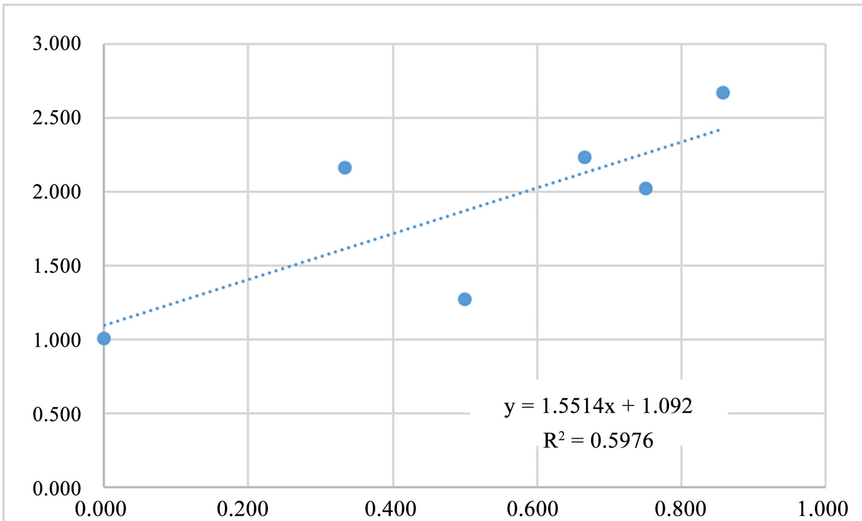

Figure 1. Relationship between the two methods.

We can generalize Equation (1) to the overlap rate calculation of three dishes, see Equation (2). The situation of three or more dishes can be analogized.

$$FPOR = |A \cap B \cap C| / \left(|A| + |B| + |C| - |A \cap B| - |A \cap C| - |B \cap C| + |A \cap B \cap C| \right) \quad (2)$$

The shortcomings of this paper are as follows: first, due to the large amount of calculation, the package only considers the two-two combination, and does not consider three dishes and more. The second point is that the sample size of the recipe is less. The third point, the deficiency of this article is that the food ingredients and recipes in China are analyzed only, but not in other countries.

This paper proposes a method for calculating the nutritional balance of the package based on the overlap rate. Although only a simple combination of two dishes is studied, this method can be extended to a package consisting of three or more dishes, thus having Wide application prospects.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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