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APPLICATIONS OF BIOSTATISTICS IN ASSESSING DIETARY PATTERNS

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ABSTRACT One method that shows assurance for comprehending the intricate connection between nutrition and health is dietary pattern analysis. Although there are many statistical techniques available, the majority of the research concentrates on traditional techniques such as reduced rank regression, fundamental component assessment, factor evaluation, clumping analysis, and dietary quality ratings. Whereas each statistical method for dietary pattern assessment has its characteristics and uses, there is a need for additional research to assess the performance of newly developed techniques in terms of validity, reproducibility, and capability to predict various outcomes. The research questions are the primary determinant of the best strategy to use. There is always room for new analytical techniques to be developed for the purpose of deriving dietary trends because this is a dynamic field.

Keywords: *Epidemiology; Analysis; Food; Patterns; Assessment*

INTRODUCTION Dietary consumption, one of the key variables affecting health, differs greatly among people. The topic of epidemiology of nutrition has steadily evolved from specific nutrients to dietary trends, focusing on aspects of the total diet, as seen by the revisions made to the dietary guidance for Americans between 1980 and 2015. This change is the result of multiple factors. First off, every kind of food has a variety of nutrients that interact intricately and have underlying cumulative associations(Granato, Nunes, & Barba, 2017). Determining specific food properties will be challenging due to multicollinearity, which arises from the intricate relationships and interactions between all of the gathered food items when they are included in an analytical model at the same time. Over the last few decades, statistical techniques have developed that fully utilize dietary data gathered from various populations to generate dietary trends. Regardless of the statistical technique employed for dietary pattern evaluation, nutritional epidemiology studies aim to investigate the association between food patterns and health outcomes(Zhao et al., 2021).

Types of Analysis for Dietary Patterns:

Three categories—data-driven, investigator-driven, and hybrid methods—are used by most published reviews to classify statistical techniques for dietary pattern assessment in nutritional epidemiology(O'Mahony, 2017).

Advantages: The main source of scientific information for the nutritional advice and suggestions used to create nutrition quality ratings is data from studies on the prevention of health problems and diseases(Mumme et al., 2022). These ratings can be applied to recreate or compare outcomes across groups, as well as to describe general dietary features. There are strong correlations between many food quality scores and death and illness.

Disadvantages:

The researchers individually decide a category to create the ratings, define variety in diets, and interpret the recommendations. Furthermore, because dietary scores only take into account certain dietary components and ignore the link between various diets, they are unable to adequately characterize overall dietary patterns.

SOME CASE STUDIES:

Statistical Data Assessment for Diabetes:

The research protocol and population characteristics for each included trial, outlining the pertinent foundation risk factors, available data, and significant parameters (e.g., age, length of follow-up, conclusion relevance). For each outcome, we use a network diagram to show the available direct contrasts between various dietary interventions and the control group. The thickness of the lines reflects the number of accessible studies, while the size of the nodes reflects the sample number of each dietary intervention(Schwingshackl, Chaimani, Hoffmann, Schwedhelm, & Boeing, 2018).

Statistical analysis:

We used random effects NMA to calculate the aggregated comparative effect of each dietary strategy compared to all other interventions for each result measure of interest by means of the post-intervention values. To combine both indirect and direct impacts, NMA was employed. By allowing the comparison of several interventions at the same time and maintaining the in-depth randomization of individual trials, the NMA approach is

an extension of the conventional pairwise meta-analysis(Schwingshackl et al., 2019). To evaluate all potential pairwise relative impacts and derive a clinically important relative ranking of the various dietary therapies, we performed random impact NMA for each outcome(Trauchburg, Schwingshackl, & Hoffmann, 2023). Using the surface under the continuous ranking curves (SUCRA) and the distribution of ranking probabilities, we evaluated the relative ranking of the various diets for each outcome. We computed forecasting ranges for each outcome, assuming a shared network-specific heterogeneity parameter, to determine the extent to which this heterogeneity influences the relative effects in relation to the increased uncertainty expected in subsequent research. Using Statistics, we fitted every analysis presented in a frequentist framework(Schwingshackl et al., 2018).

The NMA states that the best dietary strategy for enhancing glycemic management in T2D patients appears to be the Mediterranean diet. The evidence's extremely low to moderate validity must be taken into consideration when interpreting these findings. The results, however, might still have an impact on dietary guidelines for the management of type 2 diabetes.

Statistical Data Assessment Related to Obesity:

Globally, obesity is a major public health concern that has led to enormous medical costs. It also poses a significant risk for developing a number of chronic illnesses, including cancer, heart disease, and type 2 diabetes. According to a World Health Organization fact sheet, 13% of individuals worldwide who are above the age of 18 are obese, and 39% of adults who are overweight. The nationwide prevalence estimates for overweight and obesity in adults in China from 2015 to 2019 were 34.3% and 16.4%, respectively(Okati-Aliabad, Ansari-Moghaddam, Kargar, & Jabbari, 2022). Despite the fact that different people naturally fluctuate in terms of stature and body size, lifestyle factors like food consumption that alter energy balance are acknowledged as significant contributors to the obesity epidemic of today. The a priori MDS was linked to a lower risk of obesity in several trials, according to an integrated review of previous systematic reviews on DP and obesity(Glicksman, 2016). There are significant differences in the patterns identified by studies that used the aftereffects approach to summarize dietary patterns (DPs). A diet high in fruits and vegetables was linked to a lower risk of obesity, but a Western diet high in meat, fast food, processed, deep-fried foods, and beverages with added sugar was linked to a greater chance of obesity. Nevertheless, considering the variations in eating customs and cultures(Jiang et al., 2022).

A Comparison of Dietary Pattern:

To acquire prevalence estimations and standard errors using the Taylor linearization approach. The assumptions were adjusted for age, sex, and the province-by-province distribution of adult Chinese citizens. The sample plan of our survey was to get a nationwide estimate, and the weighting coefficients were obtained from data from the Chinese population census in 2010. In short, each individual case in the analysis was given a specific coefficient (a person weight), and then it was multiplied to determine the real population with the same traits of sex, age, province, and location. The weighting coefficient was the inverse of the adjusted chances of obtaining the data for the respondent(Li et al., 2020). Every single example in the analysis was given a unique coefficient, or individual weight, which it was then multiplied by to represent actual individuals with the same sex, age, province, and geographical characteristics. Standard errors were computed using suitable statistical methods using information from the intricate survey structure. Categorical data were analyzed using Fisher's exact test or chi-squared test, depending on the situation. The data are shown as percentages with 95% confidence intervals.

FMM is an additional clustering technique that calculates the likelihood of assigning each person to a group and takes the covariate adjustment into account throughout the fitting phase(Subedi, Neish, Bak, & Feng, 2020). It remains not as popular as TCA, though, presumably due to the distribution requirements, the complexity of the model, and the requirement for greater statistical knowledge. Moreover, at the expense of increased model complexity, FMM does not regularly produce significantly superior clustering results than the k-means algorithm. These data-driven approaches are all data- and population-specific, meaning that none of them take health consequences into account when determining dietary habits. As a result, the results are not very reproducible and do not adequately explain the connection between food and illness. The RRR approach fully utilizes the historical understanding of biological correlations to pinpoint food patterns that have a major impact on the genesis of disease(Rothschild et al., 2017).

CONCLUSION

To sum up, multiple study problems can be addressed by utilizing any of the dietary pattern derivation techniques. Therefore, the first step in performing dietary pattern analysis is identifying the issues that need to be resolved and then choosing the best approach. Combining many methodologies in the identical study to get complementing data and interpretations are a smart idea if it's not obvious which approach is best. A few attempts have been performed to solve these issues. For instance, fresh indicators of food intake and techniques for correcting measurement errors have been created. We might also need to study techniques from other fields, such as behavioral epidemiology's replacement models, computer sciences and mathematics' pattern recognition techniques, and operations research's deciding and optimization techniques.

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