ABSTRACT

This study deals with the application of gastronomic science to explore the food pairing behaviour in the regional cuisine of Northeast India i.e., in the states of Assam, Arunachal, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. Each regional cuisine differs in its recipe, ingredient uses, and flavour preferences, which reflect the type of food it prefers. Using gastronomic concepts, information was gathered about the chemical makeup of food ingredients used, flavour compounds present in them, and their combinations as seen in food recipes. An integrated data-driven approach provided a better insight into the preference of ingredients and combinations, allowing an extension of these combinations for possible newer formulations and modifications.

The recipe data information was gathered from a variety of sources, including the internet and cookbooks, which are frequently used in commercial food service establishments. The prevalent ingredients are identified based on the frequency of use in recipes, and authentic ingredients and combinations, are identified for characterizing each cuisine. The role of flavour compounds in influencing a preference for a favoured pairing of ingredients was investigated based on the number of shared compounds among the participating ingredients. This criterion is extended to characterize the cuisines as having positive or negative pairing behaviour based on a comparison of the average number of shared compounds in the actual recipes and that in randomly created recipes of the cuisine. The outcomes of this analysis are used for the completion of ingredient combinations, to meet the preference of consumers, and to develop a modified combination of ingredients to closely reflect the preference of the original combination of ingredients.

The Northeast regional cuisines use ingredients in a remarkably consistent way and most of the authentic ingredients were found to be from the spice category. The distribution of ingredients throughout each regional cuisine exhibited an unchanging pattern with a pure power law fit in the complementary cumulative degree distribution of ingredients. It indicated that few ingredients appear in a greater number of recipes. The statistics of the shared compound hypothesis revealed a bias toward negative food pairing behaviour. Few ingredients found commonly in a particular cuisine probably account for the food pairing effects, e.g., black mustard seed oil, green bell pepper, cayenne, onion, garlic, turmeric, and bay laurel in the Northeast regional cuisines. Additionally, the flavour network of the Northeast regional cuisines showed that the most prevalent ingredient is mostly from the spice and vegetable categories. However, we can observe that the link/edges between ingredients from the spice categories are not

as significant as compared to other categories such as dairy, cereal/crop and meat.

Similarities among the Northeast regional cuisine for comparison with Indian cuisines and cuisines from other countries (American, Italian and Chinese) were explored using t-Distributed Stochastic Neighbour Embedding (t-SNE) clustering algorithm and cosine similarities analysis. The findings revealed distinct differences both in the choice of ingredients and their flavours. The distinct clusters are formed mostly in the case of the ingredient profile but not in the flavour profile. In terms of similarity in recipes, the Assamese regional cuisine shares the most affinities with other Indian regional cuisines, with a total of 519 similar recipes out of 2916 recipes of the other Indian regional cuisine. Additionally, these regional cuisines were found to be more similar to East Asian cuisines as compared to western cuisines.

The outcomes of the study highlight the prospect for food developers in developing new food products to cater to the preferences of consumers who have more preferences for spicy-flavoured products than for dairy-flavoured products. Further, it offers a pathway for choosing food ingredient combinations for consumer acceptability, an aspect, particularly of interest in creating substitutes or supplements for persons with certain lifestyle diseases, which entails dietary restrictions but demands to meet the nutritional requirements and consumer acceptance.