Exploration of selected Indian and Malay Foods For their Mineral Nutrients Profiles: A Chemometric Approach

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Abstract

The commonly eaten Indian and Malay foods were studied in Johor Bahru, Malaysia to obtain nutrient information and their relative mineral sourcing capacities. Exploratory Pattern recognition methods were applied. The mean concentrations of nine essential mineral nutrients (Ca, Mg, P, K, Na, Cu, Fe, Mn and Zn) were determined in the dishes of 22 equally selected Indian and Malay foods. Flame Atomic Absorption Spectrophotometer Instrument was used. Unsupervised Principal Component Analysis (PCA) and Hierarchical Cluster Analysis (HCA) were applied to the concentration data matrix. The results showed that both Indian and Malay foods can be categorized into three based on food nature. The rice, the flour and the meat and snack based foods. Malay foods are more of rice than the Indian foods which are more of flour. Both Indian and Malay foods are appreciably mineral nutrients rich. The dendrogram chart revealed close foods that can be substituted for each other. This means that intra and internationality food choice is possible. The study outcomes are significant in providing guide and choice to foods that are rich source of mineral nutrients. In addition, this study showed that the foods have potential capacities to be relevant in tackling mineral malnutrition and general health maintenance.

Key words. Foods; Mineral; Indian; Malay; PCA; HCA; Malnutrition

1 Introduction

Foods are chemical materials consumed in expectation of body nourishment and health maintenance. This health role of food is achievable if researches are geared towards qualitative and quantitative evaluation of existing foods [1]. Mineral malnutrition is a serious problem originating from concentration of any one of the essential mineral nutrients below the healthy value in human in body. Mineral malnutrition has been declared as the world foremost risk to health worldwide [2]. Applications of Principal Component Analysis (PCA) and Hierarchical Cluster Analysis (HCA) tools of chemometrics have helped in groupings and identification of food datasets [3]. The efforts to promote foods rather than dietary supplements in sourcing mineral nutrients require taking into consideration the traditionally eaten foods in localities. This study is aimed at qualitative evaluations of mineral nutrients of selected foods that are traditionally eaten by nationalities in Malaysia. This evaluation is to give direct information about the suitability of foods and relevance in tackling mineral malnutrition.

2 Methods

The foods were sampled from local restaurants. 22 foods were selected comprising equal number of Indian and Malay foods. Table 1 below shows the list of the selected foods. Dataset of 22 X 9 Matrix generated from the elements concentrations determined by FAAS. The data were stored as excel work-

sheet documents and imported to MATLAB software for chemometrics processing. Autoscale pre-processing was adopted. In building the PCA model, two principal components with cumulative variance 79.96% were selected. HCA was modeled with two principal components and according to Ward's rule [4-5].

FOOD SAMPLES		
Malay Foods	9.Nasi Lemak	17.Rasam
1.Apam Balik	10.Nasi Paprik	18.Roti Canai
2.Ayam Percik	11.Roti Jala _ Chicken curry	19.Roti Naan /soup
3.Beef Rendang	**Indian Foods**	20.Sambar
4.Ikan Asam pedas	12. Banana leaf Rice	21.Teh Tarik
5.Mee Robus	13.Chapati Kima	22.Thosai
6.Nasi Berlauk	14.Idli	
7.Nasi Goreng Kampung	15.Nasi Beriani	
8.Nasi Kerabu	16.Pongal	

3 Results and Discussion

The score plot of the Principal Component Analysis gives valuable information about the general nature of the foods eaten by both Indians and Malays. Figure 1 shows the score plot. There is clear group distinction similar to what [6] observed for distinct infant milk formulas. The foods are of three general categories. The rice based foods. Malay foods are more in this category. The other category is the flour based. There are more Indian foods in this group. The third category is made of fish, beef, chicken and general snacks. In this group, both Malay and Indian foods are well represented. The qualitative information obtained here is that the foods offered wide range of choice varieties.

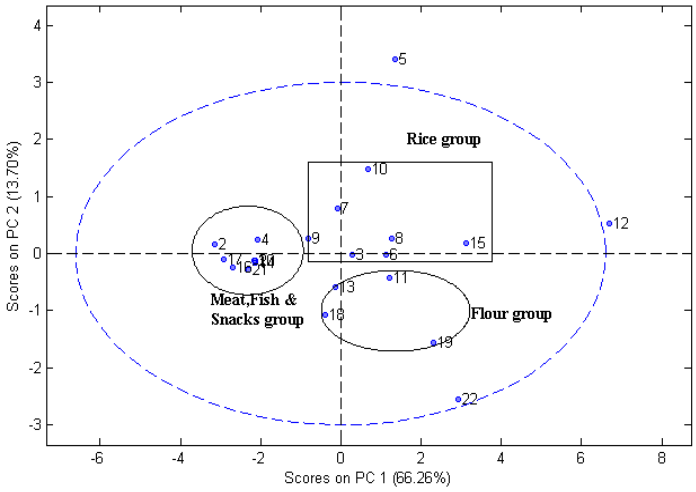

Figure 1. PCA Score/Sample Plot of Food Profile

The hierarchical cluster analysis performed on the food dataset resulted in the chart called the dendrogram presented in Figure 2. The dendrogram shows groupings of food based on their essential mineral nutrient values. The HCA dendrogram gives similar information with the biplot (loading/score) plot of the PCA. However, presentation with HCA has the advantage of more clearly distinguishing and accounting each of the food dish members of each grouping. Sometimes, crowdedness of the group members in PCA makes it difficult for all to be accounted for. This advantage was exploited by [7] in estimating the honey authenticity through observing HCA clusters in the dendrogram. Out of the seven mineral nutrients rich foods, three are Malay foods, while four are Indian foods. Five Malay foods constitute moderately containing mineral nutrient group. Two Indian

foods are in this group. The group of foods with fewer contents of mineral nutrients has five and three Indian and Malay food members respectively.

The other important information observed from dendrogram in Figure 2 is close substitute foods in terms of their mineral nutrient proportion. This gives information about the substitutability of foods when sourcing mineral nutrients. This is applicable to situation of non-availability or dislike of certain food. The choice of the other close substitute food alternative can still serve the same purpose. The closest foods in this study are *Apam balik*, *Idli* and *Sambar*. Among the mineral rich foods, Malay foods (*Nasi berlauk* and *Nasi kerabu*) are close substitutes. In this same group, the Indian foods (*Roti Naan* with soup and *Thosai*) are also close substitutes.

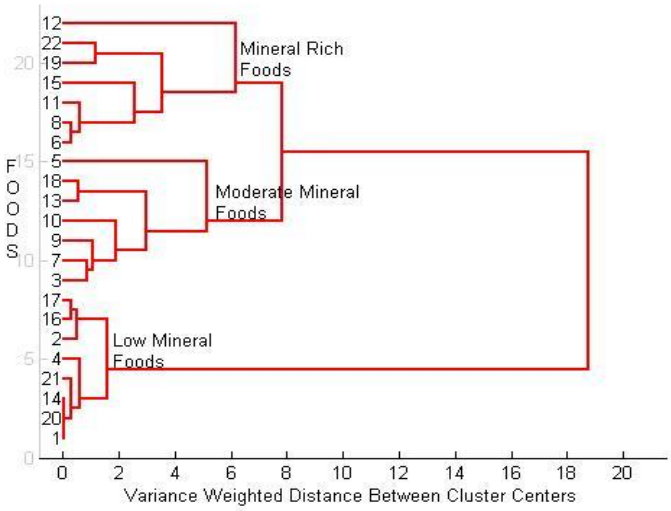

Figure 2. Dendrogram of Food Clusters based on Mineral Contents

4 Conclusion

The foods eaten by both Malays and Indians are quite similar and can be studied under three categories (The rice, the flour and the fish/beef/chicken/general snacks based foods). Foods originating from both nationalities are adequately represented in the three categories. This means the food across the categories are not really alien to the two nationalities. This similarity probably suggests the cultural affinity and overlap feeding which can widen availability and choice of foods for sourcing mineral nutrients.

Mineral rich foods can be found among the studied Malay and Indian foods. This food quality information suggests the potentialities of the foods' relevance in confronting mineral malnutrition. They can serve as auto-supplements to prevent mineral deficiency diseases and maintenance of general heath. Savings can be made by individuals as the house hold budget for mineral dietary supplements can be minimized or eradicated.

This study does not only show foods as possessing appreciable quality mineral contents but also provides greater choice varieties due to information about close substitute foods. The Malays and the Indians therefore have wider options of foods without compromising the qualities.

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