

Identification of foods with optimal nutritional value through data mining

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Background: Exclusive breastfeeding for 6 months has been shown to be the optimal way of feeding for the healthy growth and development of infants. It is also an integral part of the reproductive process with important implications for the health of mothers. Review of evidence has shown that, on a population basis, exclusive breastfeeding for 6 months is the optimal way of feeding infants. While breastfeeding is a natural act, it is also a learned behaviour, and several factors drive early cessation of breastfeeding. Poor breastfeeding and complementary feeding practices, coupled with high rates of infectious diseases, are the principal proximate causes of malnutrition during the first two years of life. Complementary feeding is defined as the process starting when breast milk alone is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are needed, along with breast milk.

Objectives: The objective of the study was to identify foods that have similar dietary contents as human milk.

Methods: Firstly, we listed the traditional or most consumed foods from various continents and compared them with human milk based on their dietary contents. A correlation-based distance measure (CBDM) metric was formulated for foods/diets classification. Secondly, in order to extend the search for similar food, we have deployed a computational framework coupled with a database of 8672 food/diets and 519 compounds with concentration profiles for food screening. Thirdly, Genome-scale models (GEMs) were used to understand the influence of similar food on *in silico* growth of tissues; liver (hepatocytes), fat (adipocytes) and skeletal muscle (myocytes).

Results: Lack of similarity was marked between human milk and traditional foods in any of the food groups. Mineral and vitamin content in African diets were marked low. Correlation-based screening identified foods such as goat milk (Spearman's correlation ($\rho = 0.936$), quark with fruit ($\rho = 0.927$), cheese ($\rho = [0.915-0.925]$) and yoghurt ($\rho = 0.902$) similar to human milk. Quark with fruit has been recommended for growing infants.

Conclusion: Current feeding guidelines are based more on tradition and speculation than scientific evidence, or are far more prescriptive than is necessary regarding issues such as the order of foods introduced and the amounts of specific



foods to be given. We have identified at least 19 foods that have similar dietary content as human milk. These foods could aid in formulation of infant formula or given as a complementary foods together with breast milk. Moreover, the study suggests that the dietary regime of Africa should be revised and foods with high nutritional values should be included.

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