The role of energy cost in food choices for an Aboriginal population in northern Australia

Julie K Brimblecombe and Kerin O'Dea

ABSTRACT

Objective: To explore the relationship between dietary quality and energy density of foods (MJ/kg) and energy cost ($/MJ) for an Aboriginal population living in a remote region of northern Australia.

Design: For a 3-month period in 2005, we collected food and non-alcoholic beverage supply data from food outlets available to the study population. From these data, we compared the energy density of foods with their energy cost.

Main outcome measures: Energy density and energy cost of food purchases.

Results: The diet of the study population was high in refined carbohydrates and low in fresh fruit and vegetables. Foods with high energy density were associated with lower costs and contributed disproportionately to energy availability.

Conclusion: The energy–cost differential between energy-dense, nutrient-poor foods and energy-dilute, nutrient-rich foods influences the capacity of Australian Aboriginal people living in remote communities to attain a healthy diet. This is consistent with the "economics of food choice" theory, whereby people on low incomes maximise energy availability per dollar in their food purchasing patterns, and has particular relevance for developing nutrition policy and strategies in Aboriginal communities, where poor nutrition is a major determinant of preventable chronic disease.

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For editorial comment, see page 547

Aboriginal Australians, compared with the general Australian population, have high rates of premature mortality from preventable chronic diseases.[1] The association between higher morbidity and mortality rates from preventable chronic diseases and lower socioeconomic status is well established.[2] In remote areas of the Northern Territory, just over half (52.7%) the Aboriginal and Torres Strait Islander people are in the lowest income quintile;[3] government pensions and allowances are their main source of income.

Socioeconomic factors have a big impact on food and nutrient intakes and food purchasing patterns;[4-6] material and economic constraints are recognised as key determinants of dietary intake.[7] High-quality nutrition is known to protect against chronic diseases,[8] but energy-dense, nutrient-poor foods cost much less than nutrient-rich foods.[9,10] Applying incrementally increasing cost constraints to a typical French diet resulted in a diet high in refined carbohydrates and low in fresh meat, fruit and vegetables.[11] These findings led to the "economics of food choice" theory — that people's dietary decisions, when made within the context of sustained budgetary constraints, are driven by maximising energy value for money (dollars per megajoule [$/MJ]), resulting in energy-dense, nutrient-poor diets.[12]

To our knowledge, the energy cost of foods in relation to dietary patterns has not been examined for Australian Indigenous populations. Our study examined the relationship between dietary quality, energy density and energy cost of food in a remote Australian Aboriginal community, with the aim of explaining the persistent, poor dietary patterns reported for Indigenous populations over decades despite efforts to improve dietary quality.

METHODS

Study population and food outlets

Our study was conducted in an island community (population, about 1700 people,[13] of whom 93% are Indigenous) located 550 km from a major urban centre. At the time, community food outlets included a community store, two convenience shops (takeaway outlets), a school canteen and a government-sponsored, aged-care program providing weekly fresh food parcels to 16 community residents.[14] Alcoholic beverages were prohibited. Foods acquired through subsistence procurement were not included in our analysis.

Data collection

Electronic food-transaction data were provided by the community store for a 3-month period in 2005. All food and beverage items with accompanying unique identifier, unit weight, quantity sold, and dollar value (retail price) were electronically extracted from store data and imported to a Microsoft Access database (Microsoft Office Access 2003, Microsoft Office Professional Edition, Microsoft Corporation, Redmond, Wash, USA).

Weekly food orders were collected for the same 3-month period for the other food outlets and services. These data were entered into Microsoft Excel 2003 (Microsoft Office Excel, Microsoft Corporation) in the field and imported into the database.

Data for all food outlets were combined (community food supply). Food and beverage weights were expressed per edible fraction and their energy and nutrient contents were obtained from the Australian Food and Nutrient Database (AUSNUT 1999).[15] Volumes were converted to standard weight using the AUSNUT conversion factor. Food items were aggregated into major food groups and subgroups, as defined by the AUSNUT Food Grouping System.[15] The percentage contribution of each major food group and subgroup to total energy available through the community food supply was determined.

Estimated energy requirement

An aggregated daily energy requirement for the study population was determined, based on age- and sex-distribution, anthropometric data and estimated physical activity level. The mean height and weight for adult age-groups between 19 and > 70 years (19–30; 31–50; 51–70; > 70 years) were determined from available anthropometric data.[16] For those < 18 years in the population, the midpoint of the estimated energy requirement range for each of the categories of age and sex was used to determine an estimated energy requirement. For all age-groups a physical activity level of 1.6 was applied.[17]

Contribution of food groups to dietary energy and dietary cost

Energy density was defined as the amount of available energy per unit edible weight of food

(MJ/kg). Energy cost was defined as the cost per unit of energy ($/MJ) provided by each food, major food group and/or food subgroup. Food and beverage costs collected from the community store were used to determine the energy cost of food purchased. Tea, coffee, non-caloric beverages, non-caloric confectioneries and drinking water were excluded from the analysis. Energy-dense, low-cost foods were identified by comparing the energy cost ($/MJ) and energy density (MJ/kg) for each food.

Ethics approval

The study was approved by the Human Research Ethics Committee of the Northern Territory Department of Health and Families and Menzies School of Health Research, Darwin. The Community Council endorsed the study in June 2001.

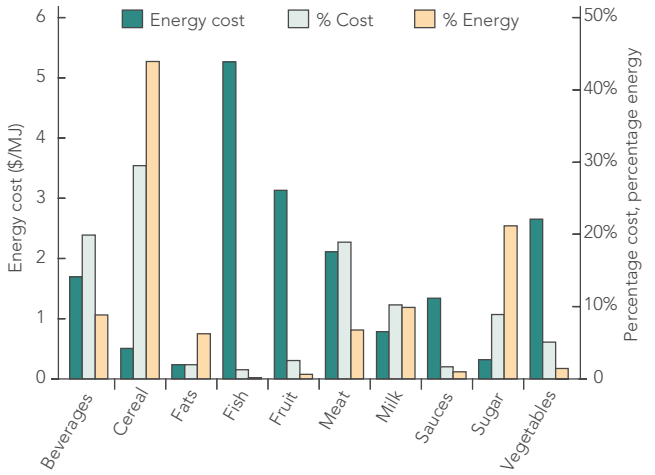
RESULTS

Energy available through the community food supply on an estimated per person daily basis of 9.45 MJ was comparable with the estimated average daily requirement for this population of 9.42 MJ, and comparable with the 9.07 MJ daily requirement reported for the Australian population.[18]

Refined carbohydrates contributed disproportionately to total dietary energy availability; ie, four food items — table sugar (16%), flour (13%), bread (11%) and milk powder (8%) — provided about half the energy available through the community food supply. In contrast, fruit (excluding fruit juice) and vegetables contributed minimally to energy availability (1% and 5%, respectively).

As illustrated in Box 1, cereal and cereal products, sugar and confectionery, and fats and oils contributed most to dietary energy relative to dietary cost. In contrast, nutrient-dense foods, such as meat and meat products, fish and seafood, fruit and vegetables, contributed least energy relative to cost. Energy costs (in $/MJ) of a range of foods found in the community store are given in Box 2. Sugar, cooking oil, rice, margarine and white flour are the lowest-cost options, providing dietary energy at minimal cost (< 0.26 $/MJ), compared with fresh vegetables, meat and fruit, which provided energy at a much higher cost. Box 3 highlights the up-to-100-fold range in energy costs of foods in this community store.

1 Community food supply — percentage energy and cost contributions to total energy and total diet cost, and dietary energy cost, for each of the major food groups



2 A range of community food items and their energy costs ($/MJ)

Meat, meat products, poultry, fish and egg

Prawns (7.64), canned oyster (5.52), drumstick (3.91), beef steak (3.77), chicken wing (3.21), lamb chop (3.15), kangaroo (2.92), canned tuna (2.81), minced meat (2.57), crumbed fish (2.47), bacon (2.32), canned corned beef (2.06), chicken nugget (1.93), canned spam (1.56), fish fingers (1.44), fresh egg (1.01), sausage (0.62)

Fruit and vegetables

Asparagus (110.70), alfalfa (42.1), cucumber (21.16), strawberry (18.21), Chinese cabbage (14.97), lettuce (12.16), tomato (11.15), broccoli (9.79), celery (9.85), grapefruit (7.73), zucchini (7.03), rockmelon (6.93), orange (5.11), fruit pieces (4.17), mandarin (3.89), canned peaches (3.77), fresh corn (3.10), capsicum (2.99), grapes (2.49), pineapple (2.03), frozen corn (2.00), apple (1.97), canned mixed beans (1.84), canned kidney beans (1.79), sweet potato (1.58), canned pineapple (1.53), avocado (1.07), potato (0.64)

Milk and milk products

Ice cream bar (2.79), regular yoghurt (2.27), flavoured milk (1.36), reduced-fat milk (1.31), full-cream milk (0.92), cheddar cheese (0.91), milk powder (0.63)

Cereals and cereal products

Pie (1.67), sweet biscuit (0.75), bread (0.55), oats (0.54), rice (0.18), flour (0.19)

Fats and sugars

Chewing gum (2.89), chocolate (2.61), sweets (2.05), butter (0.26), margarine (0.25), white sugar (0.20), oil (0.15)

Beverages

Orange juice (2.8), fruit drink (2.32), cola (2.2), cordial (0.43) ◆

DISCUSSION

The most important finding in our study was the marked gradient in cost per MJ between low-quality foods, rich in refined carbohydrates and fats, and the high-quality, nutrient-dense foods recommended in the *Australian guide to healthy eating*,[19] illustrating the inverse relationship between energy density and energy cost, consistent with published data.

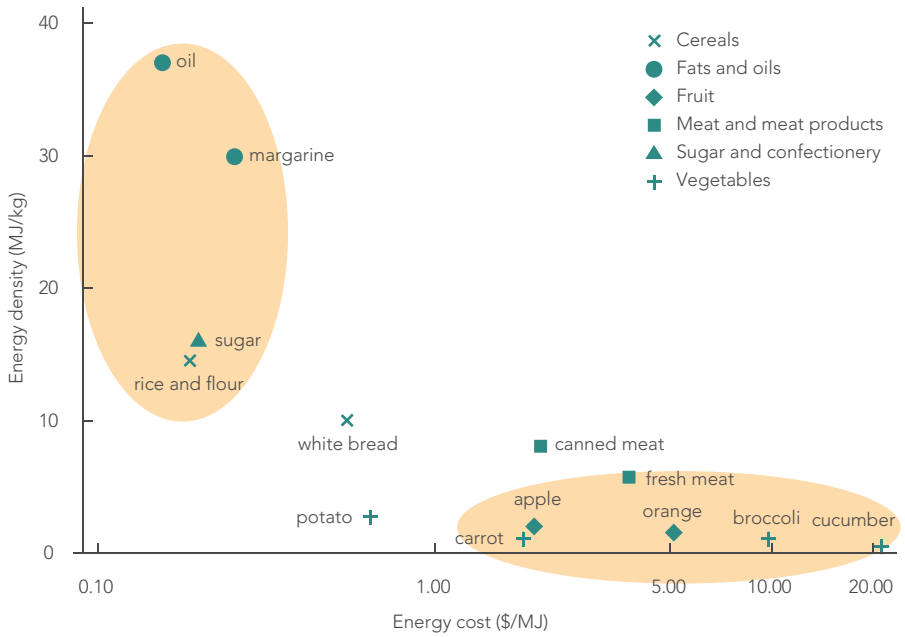
The dietary pattern we found — low intake of fruit and vegetables and high intake of refined carbohydrates — is consistent with that reported for economically marginalised groups in Australia and other affluent Western societies. Although foods such as meat, fruit and vegetables provide more nutrients per dollar spent, there is good evidence that, with sustained budgetary constraints, quality is compromised before quantity, with consumers maximising calories for dollars spent.

The results of our study highlight the importance of modelling the food supply available to Indigenous people in remote areas to identify practical modifications that can be achieved at minimum cost. Achieving nutritional recommendations at minimum cost, however, is a challenge, as often taste and convenience are compromised,[20] and the resulting diet is markedly changed from the typical diet, with much less fresh produce.[21] On the basis of self-selected diets, it has been shown that, under normal circumstances, high-quality diets cost more.[22]

A primary motive for our study was to better understand why the poor-quality dietary patterns of remote Indigenous communities[23] have changed little over more than two decades. This dietary pattern has been attributed to conservative food preferences resulting from the historical government policy, from the time of early European settlement through to the early 1970s, of providing rations for Indigenous Australians.[24] This pattern is reinforced by contemporary issues of limited availability of healthy food choices, high food costs and limited household-storage and food-preparation capacity.[25]

Our study shows that low income is a powerful driver of food choice — a factor compounded in remote communities by high costs of perishable foods, such as meat, fruit and vegetables.[26] Our study focuses on one large, remote community, but similar

3 Relationship between the energy density of selected foods from the community store and their energy cost plotted on a log scale



The shaded areas group the energy-dense, low-cost foods and the nutrient-dense, high-cost foods. ◆

socioeconomic conditions and disparities in food costs exist across all Indigenous communities in Australia.

This is the first demonstration of the relationship between energy density, energy cost and dietary patterns for an economically marginalised Indigenous population in Australia. By placing nutritional improvement in an economic, rather than an individual behavioural change framework, our study highlights the investment that improving nutrition for Indigenous people in remote communities will require.

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COMPETING INTERESTS

None identified.

AUTHOR DETAILS

Julie K Brimblecombe, PhD, MPH, GradDipNut&Diet, NHMRC Postdoctoral Research Fellow[1]

Kerin O'Dea, AO, BSc, PhD, Professor, Director[2]

1 Preventable Chronic Diseases, Menzies School of Health Research, Royal Darwin Hospital Campus, Darwin, NT.

2 Sansom Institute of Health Research, University of South Australia, Adelaide, SA.

Correspondence:

julie.brimblecombe@menzies.edu.au

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