



An introduction to sustainable diets and the value of dairy



The emphasis in nutrition is shifting from balanced diets to sustainable diets. In the past, balanced diets were advocated to prevent malnutrition and sustain human health. However, with the effects of environmental pressures such as climate change, pollution, hormone disruptors, desertification and water scarcity becoming increasingly clear, the Food and Agriculture Organization (FAO) is advocating for the implementation of sustainable diets.^{1,2}

Definition of a sustainable diet

Nutrition

Various measures have been applied to determine food intakes that are nutritionally adequate, affordable and both socially and environmentally acceptable for diverse populations.

Nutrient profiling methods, which are based on assessing the nutrient content of food and diets, were originally developed to support nutrient and health claims. These methods have since been used to design front-of-pack logos and in specific consumer health campaigns, such as to reduce food product advertising to children and, more recently, to justify taxation of sugar-sweetened beverages and foods.¹ Nutrient profiling has therefore been suggested as a potential approach for determining the nutritional adequacy of the general diet or food intake of populations.

Affordability

Metrics such as the 'Nutrient-Rich Foods Family of Scores' and the 'Food Affordability Index' have been used to study diet costs in the USA, UK, France and Mexico.¹ These metrics express energy value and nutrient content of a food per monetary unit (e.g. kcal/\$).

Not unexpectedly, nutrient-rich diets were generally found to be more expensive than those based on nutrient-poor foods (so-called 'empty calories'), in terms of both sale price and environmental cost. Animal-derived foods (meat, poultry, fish, eggs, milk and dairy products) had a higher nutrient content per calorie, but required more water, land and energy to produce than plant-based staple foods such as rice, maize, wheat and other grains.¹ The production of foods that are optimal for human health is therefore considered to be costlier and to have a more pronounced effect on the environment

than what is typically associated with producing foods with a lower nutrient value.^{1,2}

Cultural and societal acceptability

Considering arguments about affordability, it would seem logical to suggest that animal-derived foods should be replaced with plant-based foods. Vegetarian, vegan and Mediterranean diets are suggested as alternatives. However, such diets are often not culturally acceptable to all populations. Even diets that are nutrient dense and economically viable can be rejected for cultural reasons.^{1,2}

Environmental acceptability

The consideration regarding the effect of food production on the environment and biodiversity is a relatively recent introduction to the field of nutrition. Food production requires water, land and energy, all of which are becoming increasingly sought after given the impact of population growth, pollution, climate change and desertification. The environmental impact of food production can, for example, be quantified in terms of greenhouse gas emissions or land area and volume of water required to produce a specified quantity of food.²

The role of dairy in sustainable diets

With the topics of food production practices, land ownership, cultural preferences, global warming, water supply utilisation and diet styles being espoused passionately by various stakeholders, it is clear that some concessions have to be made to achieve the goal of sustainable diets. Drewnowski illustrates how dairy products can be used in designing a sustainable diet.¹

Energy density of dairy

Energy density is defined as dietary energy per unit weight of the edible portion of a given food (typically expressed as kcal/100 g). The more water a food contains, the lower its energy density.

Foods such as liquid milk, juices, soft drinks, fruit and vegetables are generally considered to have a low energy density owing to their high water content. In contrast, cheese and yoghurt, meat, poultry and fish contain only 30–60% moisture and are therefore considered to be of low to medium energy density. Dry foods such as cereals, sugar, oils and fats have a high energy density.

Foods with a high energy density often have a relatively low nutrient density, while the opposite is true for many foods with a low energy density. Nutrient profiling can be used to classify foods according to nutrient density categories.

Nutrient density of dairy

Dairy products such as milk, yoghurt and cheese have a fairly low energy density (<120 kcal/100 g), but contain more nutrients, specifically calcium and protein, than plant-based foods with a high energy density such as cereals and oils.¹ Only animal-derived foods contain >4 g protein/100 kcal and consumption of plant-based protein would have to be increased by 30–40% to equal the protein value offered by

animal-derived foods. According to a two-nutrient matrix, milk and dairy products can therefore be classified as nutrient-rich foods, which provide relatively more nutrients than energy.¹

Affordability of dairy

Energy-dense foods such as cereals, sugar and fats generally cost less per calorie than nutrient-dense foods.¹ Based on American study data from the Food and Nutrition Database for Dietary Studies (FNDSS 2009–2010), vegetables, fruit, meat, poultry and fish cost more per 100 kcal than sweets, grains and fats. Milk and other dairy products appear to be a good compromise: they are nutrient dense yet cost less than meat, poultry and fish and are also less energy dense than cereals and fats.

However, it is important to keep in mind that the data cited above were obtained in a high-income country; conditions and results may differ in lower-income countries.¹ A study conducted in Mexico in 2012 showed that food intake patterns were governed by food prices and socioeconomic status.² Diets of low-income consumers were based on low-cost, high-energy foods such as tortillas and lard,¹ which cost less per energy unit than milk and dairy, meat, vegetables and fruit.

Food acceptance measures

The general popularity of specific foods among a population has to be considered when proposing sustainable diets. For example, foods such as nuts, seeds, legumes, cereals, carrots, potatoes and cabbage, which could provide an affordable, nutrient-dense diet, are not generally popular among US consumers. Another example is the proposed sustainable diet in France. French researchers concluded that ‘rarely eaten or unpopular foods have no place in realistic dietary guidelines’.¹ Cultural acceptability has a pronounced influence on the trade-offs that may be deemed acceptable to design a sustainable diet. For example, if meat and fish are too expensive to be realistic protein sources, using proteins from pulses and legumes may be acceptable, whereas protein from invertebrates or algae may be unacceptable.

Diets that do include some animal-derived foods and do not require drastic or unrealistic food changes, such as the Mediterranean diet or DASH diet, may point the way to meeting the challenges of cultural acceptability, but not necessarily satisfy the criterion of affordability.²

Milk and other dairy products may be suitable, cost-effective and culturally acceptable alternative sources of protein and other nutrients.

Environmental impact metrics

Each phase of food production has an environmental cost. This cost can be quantified in terms of greenhouse gas emissions or the so-called carbon footprint.^{1,2}

Calculations based on a unit weight of food show that plant foods typically have a smaller carbon footprint than animal-derived foods. However, many vegetables contain as much as 90% water per kilogram and are therefore not energy dense. Drewnowski cautions that expressing carbon cost per unit of food weight is not contextually realistic and proposes that carbon cost should rather be expressed per energy unit.¹ While livestock production has a greater environmental impact than the production of grains and other edible plants, animal-derived foods such as meat, fish, eggs and dairy products are nutrient dense and can contribute significantly to the health of a population when included in a general diet.

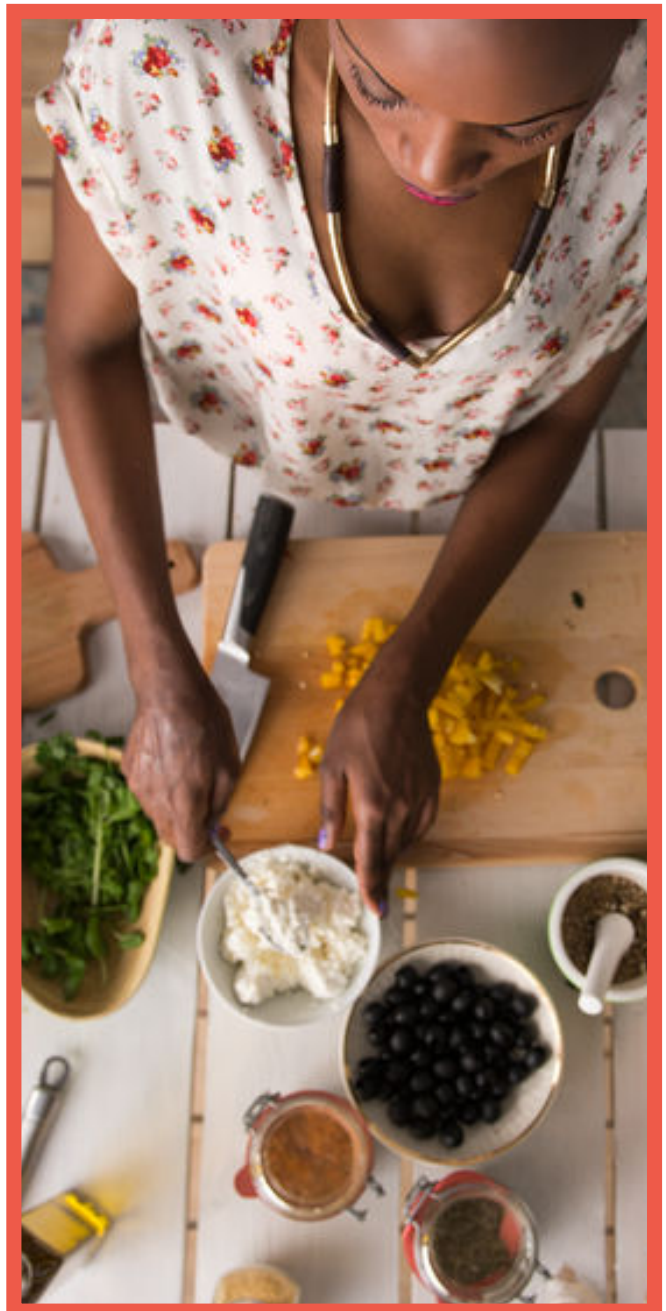
Urbanisation and the associated shift to more Westernised diets are driving the dietary transition from plant to animal proteins.

The value of dairy

It is essential that the choice of protein food in transitional populations should not increase cost or environmental impact of a diet. An analysis by Perignon et al.² showed that the choice of meat replacement foods and a reduction in energy value are the two main factors reducing the environmental impact of a diet. When comparing the Mediterranean diet with the standard Spanish diet, or a vegetarian diet with the recommended German diet, greenhouse gas emissions and water footprint were reduced by 72% and 38%, respectively, owing to reductions in energy intake of 61% and 20%. Dairy meets at least three of the four criteria defined for sustainable diets. Milk and dairy are:

- **nutritious**, as they provide more nutrients per unit of energy (protein, six minerals, four vitamins) than most high-energy foods
- **affordable**, as they provide the highest calcium content plus high-quality protein per monetary unit
- **acceptable** to diverse consumer populations and may be a more acceptable protein alternative to transitional populations than plant proteins.

If modern farming practices are applied, dairy production may also have a more acceptable environmental impact than production of other animal-derived food sources.¹



Conclusion

Defining a sustainable diet that meets all four FAO criteria is challenging and requires compromises. Some existing diets, which are not as restrictive as vegan or strict vegetarian diets and which do include some animal-derived foods, may be viable departure points, but animal-derived foods will have to be chosen carefully to ensure affordability and cultural acceptability. Dairy may well prove useful in this regard.¹

References

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3. Food and Agricultural Organization of the United Nations. International Scientific Symposium Biodiversity and Sustainable Diets United Against Hunger. <http://www.fao.org/ag/humannutrition/285060efe4aed57af34e2dbb8dc578d465df8b.pdf> Accessed April 2018.

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