

Nutritional Adequacy in a Healthy and Sustainable Diet

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Introduction

Food based dietary guidelines (FBDG) have been developed for more than 100 countries worldwide. FBDG identify the type and balance of foods to consume for a healthy diet with adequate nutrients. Despite differences in cultural patterns and food preferences, the basic message in all guidelines remains the same with recommendations for higher consumption of fruit and vegetables and minimum consumption of calorie dense and nutrient poor foods. Therefore, FBDG have been suggested as basis for more sustainable and healthy dietary recommendations (IPCC, 2019). The food pyramid is used in Ireland to communicate these guidelines and was first launched as a visual graphic for healthy eating in 1993. Then, acid rain and air pollution were the environmental concerns of the day whereas now the climatic impact of how food is produced and consumed dominates the environmental discourse. It is estimated that food production and consumption contributes approximately 30% of all greenhouse gas (GHG) emissions in the EU. Hence, the dual challenge now exists to develop healthy eating recommendations in addition to the food pyramid to ensure that both personal and planetary health can be achieved, which is also known as a sustainable diet.

Balancing nutrient content with emissions for both body and planetary health

Is it possible to consume a diet where both healthy eating dietary guidelines can be achieved while also having minimal food related environmental impacts? There is no straight forward solution because not all healthy foods have low carbon footprint, just as not all foods with a low carbon footprint are considered healthy. If consideration is only given to the carbon footprint of foods where by recommendations for a sustainable diet promotes only low carbon foods without consideration of nutritional content, then the likelihood of nutrient inadequacies and unhealthy dietary patterns is high. For example, sweetened carbonated beverages and milk both have the same carbon footprint of approximately 400g of CO₂ per 200mL serving of the beverage. However, milk contains protein, which is an essential nutrient for maintaining and building new muscle and within three hours of its consumption it can be turned into muscle. It also provides one third of our daily calcium requirements for maintenance of health. In the case of the sweetened carbonated beverage, a 200mL glass will provide 86 calories and 21g of sugar, which accounts for two thirds of the daily recommendation along with no other nutrients. It is well established that too much sugar in the diet contributes to weight gain and tooth decay. A similar analysis can be completed for a meat-based meal compared to an equivalent plant based meal. For example one serving of beef based stew will contain more than double the amount of protein, vitamin D, vitamin B12 and zinc compare to an entirely bean/plant based stew. However, the serving of beef stew will have a carbon footprint of 3kg of CO₂, five times higher than that of the plant based dish at 0.6kg CO₂ per serving.

Sustainable dietary patterns

As individuals, we consume a range of foods that constitutes our overall diet and therefore any one individual food change does not result in our diet being more or less healthy or sustainable. A range of foods is generally consumed over a given day and it is this combination and balance of foods that determines the health and sustainability of the diet. A recent Irish study has shown that those with a cultural food pattern characterised by high consumption of meat, potatoes and vegetables had significantly lower overall dietary greenhouse gas compared to those with the unhealthy pattern who were consuming less meat but had a high consumption of unhealthy foods. Research on dietary related emissions using national food consumption surveys from Ireland, UK, France, Australia have also shown that a sustainable diet which meets requirements for health as well as generating lower emissions can be achieved with the inclusion of meat or dairy products in the diet (Hyland *et al.* 2017).

Nutritional adequacy

In general, plant-based foods have a lower carbon footprint, whereas foods from animal sources are higher, especially from ruminant animals. Therefore, new dietary patterns and guidelines have been proposed such as Eat Lancet, which strictly limits intakes of animal-based foods because of the higher environmental impact. However, foods from animal sources should not be removed as they provide many essential nutrients necessary for good health and therefore are an important part of a healthy diet. A balanced and diverse diet will supply adequate intake of many micronutrients, essential to prevent deficiencies and illness. Removal of an entire food group such as meat can result in inadequate intakes of many essential nutrients. Restrictive diets devoid of animal sourced foods such as vegan diets have been shown to increase the likelihood of nutritional deficiencies (Chouraqui, 2023). A recent review of environmentally friendly diets characterised by low intakes of animal sourced foods resulted in lower micronutrient intakes especially decreased intakes of zinc, calcium, iodine, and vitamins B12, A, and D, increased risk of inadequacies (Leonard *et al.* 2024). These findings are further supported in studies from India where vegetarian diets are frequently the cultural norm. One study showed how the risk for moderately or severe anaemia was much higher for women who did not consume meat fish or eggs (Rammohan, 2012). In the aging community in India, there was a high burden of vitamin D and B12 deficiencies. These nutrients are of particular importance for health aging and with negative consequences for cognition, immunity and frailty if deficiencies occur (Sundarakumar *et al.*, 2021). A review of vegan and vegetarian diets in children suggested that those following these dietary patterns were susceptible to inadequate intakes of certain nutrients as well as high intakes of dietary fibres may further impact bioavailability of nutrients consumed. The risk of malnutrition in these children on restrictive diets is high unless supplementation is also used. These restricted diets especially in younger children requires substantial commitment and planning alongside expert guidance, supplementation to ensure adequate nutrition (Kiely, 2021). Similarly using food intake data from French adult population survey, a modelling study of low meat diets concluded that significant planning and careful consideration would be required to achieve overall nutritional adequacy (Kesse-Guyot *et al.* 2022). Hence, the risk of nutritional inadequacy is high when essential food groups are removed from the diet and few have the essential skills or expertise to ensure adequate intakes from other sources. Throughout the life-course from preconception to pregnancy, infancy to adolescence and then in older years, there are critical growth and development periods, whereby nutrition and adequate nutrient intakes play a crucial role. Careful consideration must be applied to these cohorts of the population when developing sustainable food based dietary guidelines, whereby nutrient adequacy should take precedence over other considerations.

Alignment with dietary guidelines and reduction in greenhouse gas emissions

Current food consumption patterns in Ireland do not align with FBDG. Energy dense and nutrient poor foods from the top of pyramid are being consumed in amounts far exceeding the recommendation of sparingly and no more than twice per week. Currently, average daily consumption of these treats is approximately 690g per day, generating GHG emissions of 1.8kgCO₂/day. Foods from the protein shelf include meat, poultry, fish and legumes. Meat was consumed in excess of recommendations by approximately 70-90g per day. Consumption of foods from the protein shelf generates emissions of approximately 2.8kgCO₂/day. At the bottom of the food pyramid is fruit and vegetables, which is the most important shelf and the foundation on which our diets should be based. The recommendation is to consume at least five portions of fruit and vegetables a day, and ideally seven portions. However, intakes of fruit and vegetables were too low with the majority of people consuming just over two portions per day. The resultant GHG emissions associated with current fruit and vegetable consumption is low at approximately 0.15kgCO₂/day. Consumption of foods from the cereals and dairy shelves align better with the recommended intakes.

Changes to current food consumption, especially fruit and vegetables, meat, and treats, are needed to align with dietary guidelines. Treat consumption should be at least halved. While this would not meet the guidelines in the food pyramid, it would be an achievable reduction with resultant benefits for health and reduced GHG emissions. If treat foods were swapped for three portions of fruit, alongside a modest reduction in meat intake by one portion per day, the healthiness of our diets can be increased, while simultaneously bringing a substantial daily reduction in emissions of 1.6kgCO₂/day. These moderate and achievable changes to the familiar foods we consume would represent a 25% reduction in emissions from current eating patterns. Therefore, a simple rebalance of what we currently consume to align with healthy eating guidelines will meet the dual challenge of personal and planetary health for sustainable diets (Conway & McCarthy 2024).

Recommendations to change our current consumption habits should be evidence based and consider the prevailing cultural food consumption patterns of the population. As was evidenced in the Irish population, a pattern reflecting the cultural consumption of meat, vegetables and potatoes had the lowest carbon footprint and was consumed by at least half of the population. Discretionary foods that have low nutritional quality and should be consumed sparingly and being consumed in high amounts with a resultant high carbon footprint and therefore requires attention from a sustainability perspective. Guidelines developed for sustainability reasons should be holistic in nature, take many parameters into consideration especially and prioritise considerations such as health and nutrition, rather than concentrating on one food group or one measure such as emissions. No single food production method or consumption pattern can address the issue of sustainable diets. This will require multi-actor and multi-pronged strategic approaches to produce and consume food in a more sustainable way to achieve the ultimate goal of sustainable food production and consumption for both personal and planetary health.

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