Nutrients, Foods, Diets, People: Promoting Healthy Eating

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Key Words: diet, nutrition, sustainability, front-of-pack

Conflict of Interest: None of the authors have any conflict of interest to report.
No financial Disclosures

Abstract
This paper is based on a session at ASN 2019 entitled nutrients, foods, diets, people: promoting healthy eating. A summary of the four presentations at this session is included in this paper. The overarching themes that link these four presentations are sustainability and food systems. The subjects range from newer definitions of healthy eating to linking sustainable production to sustainable consumption. Two of the papers discuss the importance of the cost of a healthy diet and information as facilitators or barriers to consuming a healthy diet.

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Introduction
There is a clarion call detailed in the Sustainable Development Goals (SDGs) to achieve a world that is free of both hunger and malnutrition (1). These goals are reinforced by the Framework for Action of the Second International Conference on Nutrition (2), and the UN Decade of Action on Nutrition, 2016-2025 (3). While some might argue that most, if not all, of the 17 SDGs relate either directly or indirectly to nutrition, it is SDG2, which focuses most prominently on nutrition, food security and sustainable agriculture (1); SDG2 emphasizes zero hunger, improved food security, elimination of malnutrition in all its forms and promotion of sustainable agriculture. Related to SDG2 is SDG12 (1) which focuses on responsible production and responsible consumption.

This paper is based on a session held at the American Society for Nutrition 2019 meeting. The ASN session included four individual presentations. The first presentation examined some of the issues related to the latest thinking on diets for optimal personal, public and planetary health (4). The second presentation focused on sustainable production for sustainable consumption. Presentations three and four analyzed a subset of factors that affect an individual's ability to access a healthy diet. While the four presentations explored somewhat different topics, there are two unifying themes: (1) sustainability (2) viewing issues from a food systems perspective. Before summarizing the main points in the four individual presentations, a discussion of some key issues related to food systems are discussed.

Food Systems as an Agent of Change

The United Nations Decade of Action on Nutrition (3) has specified that sustainable food systems are one of six critical action areas for promoting healthy diets and contributing to the realization of the SDGs by 2030. A food system gathers all the elements (environment, people, inputs, processes, infrastructure, institutions and activities that relate to the production, processing, distribution, preparation and consumption of food (5); a sustainable food system (SFS) takes this definition further to include a food system that ensures food security and nutrition for all, without compromising the economic, social and environmental bases to generate food security and nutrition for future generations (5). **Figure One** illustrates the UN Committee on Food Security High-Level Panel of Experts food systems framework emphasizing the links between production and consumption with a major impact on diets and nutrition outcomes (5).

The EAT Lancet Commission Report (6) stresses a food systems approach as a key means of meeting the Sustainable Development Goals (SDGs); the report concludes that, "Without a transformation of the global food system the world risks failing to meet the SDGs and the data are both sufficient and strong enough to warrant attention". This seminal document also concludes, "wide spread multi sector, multilevel action is needed including: a substantial global shift towards healthy dietary patterns; large reductions in food loss and waste; and major improvements in food production practices".

Healthy Diets, Healthy People, Healthy Communities

Globally one in three people are malnourished and, by 2030, data project that one in two people could be malnourished (7). Diet is the leading cause of poor health globally (8). As pointed out by Popkin et al (8)," Decades ago a discussion of an impending global pandemic of obesity was thought of as heresy"; this pandemic is now here and thus promoting a healthy diet is essential for human health.

The concept of a healthy diet is not new. More recently the FAO and the World Health Organization (9) have defined a sustainable, healthy diet as one that promotes all dimensions of individual health and wellbeing; has low environmental pressure and impact; is accessible, affordable, safe, and equitable and is culturally acceptable. These diets are meant to achieve optimal growth and development of all individuals and support functioning and physical, mental and social wellbeing at all life stages for present and future generations; contribute to preventing all forms of malnutrition (i.e. under nutrition,

micro nutrient deficiencies and overweight and obesity); reduce the risk of diet-related non communicable diseases (NCDs); and support the preservation of biodiversity and planetary health. Sustainable healthy diets must combine all the dimensions of sustainability to avoid unintended consequences (9). Many countries stress that a healthy diet is one that is based on their national food/nutrient based dietary guidelines. The essence of healthy diets is ones that promote health through consumption of a diet that is adequate in the quantity and quality of food that is consumed. In addition, not to be forgotten, are economic and social dimensions of sustainable diets which are often over looked.

The 2019 EAT-Lancet Commission report (6) focused on identifying a planetary health diet for the projected 2050 population of ten billion people. The report emphasizes a diet that addresses human health and planetary health simultaneously. This Commission report employed a four pronged approach which (1) defined a healthy reference diet; (2) defined planetary boundaries; (3) applied global food systems modeling framework (4) outlined strategies that would allow us to meet the goals of a healthy diet from a sustainable food systems perspective including food loss and waste, sustainable technologies on farms and diets. The full EAT Lancet Report was presented at ASN 2019. The focus on healthy eating in this current section is a general summary of the EAT Lancet Commission Report with some additional caveats for consideration in the future.

Based on these four assumptions presented above, **Table One** presents the healthy reference diet recommended by the EAT-Lancet Commission (6). Worth noting, this reference diet focused on the environment and health, and did not address the social and economic dimensions of sustainable diets. The healthy reference diet stresses, in most countries, an increased consumption of fruits, vegetables, and legumes with a concomitant decrease in animal foods, particularly red meat**. Figures Two and Three** provide data analyzing the consumption of foods across regions as compared to the healthy reference diet presented in **Table One**. Globally and in North America, people are over consuming red meat, starchy vegetables, eggs, and poultry. In Sub Saharan Africa, it is only starchy vegetables that are over consumed; this is not surprising given that diets in this region are dominated by maize, wheat and/or rice. What is clear is that overall, no region is immune from unhealthy diets; the world is not eating enough of nutritious foods that make up a healthy diet including fruits and vegetables, legumes and nuts and seeds **(Figures Two and Three**).

To fulfill the world population needs for the healthy reference diet, food production would need to dramatically change by 2050. **Figure Four** shows how production would need to change across food commodities in a business as usual approach versus one in which the world shifts to eating the healthy reference diet and reducing food loss and waste. Dramatic shifts would need to take place across agriculture landscapes. For example, using the value put forth in the EAT-LANCET reference diet, for a future scenario in 2050, where approximately ten billion people eat 25 grams of nuts daily would require an annual production of 89.2 million tonnes, increasing current production by almost 540% and requiring an annual growth rate of 2.3 million tonnes, or 17% per year.

The EAT-Lancet Commission report also examined the environmental effects of categories of food, separate from the analysis in establishing the healthy reference diet. As shown in **Figure Five,** the impacts of different food groups and individual foods have different environmental footprints currently and in a business as usual approach into 2050. Current trajectories show that the stress on the environment – including greenhouse gas emissions, land use, water use and eutrophification – have different impacts depending on the way food is grown.

The EAT-Lancet Commission report also outlined actions for diets and agricultural production that are essential to achieve human health and planetary health (**Table Two**). The desirable actions for agriculture are at identified at two levels, moderate changes and more aggressive targets for sustainable food production systems (Prod +) as well as diets and food loss and waste. Food loss and waste is the decrease in quantity or quality of food along the food supply chain, and thus, poor use of resources and negative environmental impacts. Estimates suggested that 30% of the world's food produced was lost or wasted. However, FAO has released new estimates that look independently at food loss and waste separately. They report that 14%of the world's food is lost from post-harvest up to (but not including) the retail level with Central and Southern Asia having more than 20% food loss. The predominant foods being lost are fruits and vegetables, and roots, tubers and oil-bearing crops. Food waste at the retail and household levels is yet to be computed (10).The EAT-Lancet Commission report was clear that their analysis did not estimate what it would cost to achieve a planetary health diet, nor did it consider the entirety of the food system. There were some shortcomings to the analysis in which the scientific literature is emerging to provide nuance to the issues. First, the planetary health diet remains unaffordable for roughly 1.6 billion people (11)). The implications of animal source food consumption is still being debated in the literature including the amount to consume on a daily basis, the substitution effects, and the implication of all animal source foods being equal, in which they have different environmental and health impacts depending on which environmental indicator is assessed and which health outcome (12;13)). Last, the environmental impacts on growing the planetary health diet may not be ideal for certain crops in which tree and groundnuts have a significant water footprint (14).

Sustainable Agriculture, Sustainable Food Systems, Sustainable Diets

The second paper in this ASN session focused on the links between sustainable production and sustainable consumption. Here again, the issues of sustainable production were viewed through a food systems lens. The presentation stressed the key components in a sustainable food system that is often overlooked in understanding the nuances in linking agricultural production to healthy diets. The complexities embedded in sustainable food systems have already been illustrated in Figure one. Undoubtedly, the agricultural part of a sustainable food system is critical to achieving sustainable diets.

Sustainable food systems encompass four domains (**Figure Six**), each of which are influenced by the agricultural sector (15). It is also important to note that the agricultural sector is not a homogeneous entity but involves crop and animal production, forestry, land management, aquaculture as well as post production activities like processing and distribution. Each of the components in the agricultural sector presents different challenges in promoting sustainable food systems. There is not one simple policy, program or strategy that can, by itself, enhance the sustainability of these individual agricultural

components. Hence this presents a challenge in deconstructing parts of the agricultural sector to provide a menu of activities that need to be pursued to increase sustainability in the broad space of the agricultural sector.

Health is one of the critical domains of food systems and has already been discussed in the previous section. A healthy diet is one that meets energy and nutrient requirements in the context of local, cultural dietary patterns. As noted in the presentation, sustainable, nutrient adequate diets are not a "one size fits all" but are influenced by taste, convenience, age, food preparation, genetics, gender, physical activity levels, culture and food accessibility. There are also multiple other sustainability factors that influence the diet and nutrition; these include ecosystem stability, food affordability (talked about more in the next section), food availability, social cultural well-being, resilience, food safety and waste loss and reduction (16).

Environment is one of the other four factors that are critical for a sustainable food system. Here again, there are multiple issues that are embedded in understanding the ultimate effects of agriculture and food systems on the environment. Some of the critical factors of these include land and water use, green house gas emissions and biodiversity. The successful investments in new technologies and biotechnology, sometimes referred to as the "Green Revolution" led to significant increases in agricultural production particularly for wheat, rice and maize, increased world wide food supplies and increased average caloric intake, particularly in parts of Asia; thus the gloom and doom projections of massive global famine did not materialize (17). But the world is realizing some of the unintended consequences in that the successes achieved with the Green Revolution did so, in some cases, at the expense of depletion of natural resources, including land, water and biodiversity (17), which now need to be corrected. In addition, not all regions or countries benefitted from the Green Revolution.

Kofi Annan, the late Secretary General of the United Nations once said, "The Green Revolution stopped at the door of Africa." (18). Success from high yielding seeds depended in large part on a package of inputs – irrigation, fertilizers – that were not available in many Sub Saharan African countries.

The challenge going forward is to launch a "Greener, Green Revolution." It is imperative that countries pursue sustainable agricultural strategies that achieve improved agricultural production while respecting natural resources. The production increases that are projected to be needed (see **Figure Four**) to meet the targets for a healthy diet are aggressive.

Two of the most overlooked, yet possibly the most important factors influencing sustainable food systems are economics and society. A focus on economics, at a minimum, requires attention to livelihoods, productivity, affordability and costs of production. Agriculture matters for national and household incomes. The agriculture sector is a significant driver of economic growth in low and middle income countries (LMIC) and will continue to be so in the short to medium term. It has been shown that agricultural development can play a role in poverty alleviation. The emphasis in the agriculture sector is, in large part, driven by the fact that in most developing countries the largest share of the workforce is still involved in agriculture. Even where countries are transitioning to more industrialized economies, agriculture is still critical for livelihoods. To the extent that the agricultural sector is

expected to migrate to more sustainable production methods, these strategies will only be successful if productivity and incomes of farmers increase.

The cost of inputs for improved agricultural technologies often depends on a package of inputs that are beyond the purchasing power of small farmers. New technologies will need to be developed and be mainstreamed among the most vulnerable households. Technological innovations and technology knowledge will be essential and must finally reach a larger segment of farming households.

Finally societal factors are important for sustainable food systems to succeed. Yet societal factors, even where they are acknowledged, are rarely given serious attention.

The challenge for agriculture going forward are daunting. The agriculture sector will be required to meet the food needs of a growing population, for the most part, on the same amount of land and with a declining labor base due to urban migration. Agriculture will be expected to play a major role in alleviating malnutrition in all forms through the most obvious way of increasing food availability with more efficient production, while simultaneously increasing food affordability and production diversity. Innovation and technology will be key to successful implementation of new, sustainable agricultural practices to achieve the targets for healthy, sustainable diets.

Can healthier diets be achieved at no additional cost?

The final two presentations in the session discussed barriers and facilitators for healthy eating. Three components of the food environment are viewed as critical for achieving a healthy diet. The economic component covers food prices and diet costs, relative to national and household incomes; these issues are discussed below. The geography component covers physical access to foods and the availability of stores and other food sources at the local level. The information component covers dietary guidelines and other policies and the provision of nutrition information to the consumer at the point of sale (addressed in the final section of this paper).

The third presentation in this ASN session analyzed the impact of cost on the ability to purchase a healthy diet.

The nature of the global food supply is such that calories are cheap whereas nutrients are not. Globally, calories from staple grain crops, maize, wheat, and rice and those from sugar cane tend to be inexpensive, whereas the recommended nutrient-rich foods generally cost more. In low income and middle income countries (LMIC), the nutrition transition drives the dietary shift from grains and tubers toward more varied diets with more animal protein but also more processed foods with added sugars and fats (19). In high income countries (HIC), it is lower income groups that consume energy-dense diets of low nutritional value. The consumption of nutrient-rich whole grains, low-fat dairy, lean meats, and fresh produce rises with education and incomes.

The social gradient in diet composition has been observed before. As far back as 1935, John Boyd Orr showed that higher household incomes in the UK were associated with higher quality diets (20).

Whereas the consumption of fruits, vegetables, and fish rose with incomes, the consumption of bread, potatoes, sugar and lard declined Subsequent studies conducted in India (21) showed that cereals and sugar provided calories at far lower cost than did meat, dairy, or even vegetables and fruit. Indian consumers switched from cheap cereal calories to more expensive calories as their living standards rose. Dietary diversity also follows an income gradient, whether at the national or at the household level. Historically only the poorest countries and the poorest households maintain a largely plant-based diets of starchy staples but this is rapidly changing (22); increased incomes bring more animal proteins from eggs and dairy, chicken, fish and meat and more vegetables and fruit. Even though healthier diets generally cost more, a great deal of individual variability is observed.

Calculations of the relation between monetary cost and the nutrient density or foods (or total diets) have relied on a technique known as nutrient profiling (NP). NP models try to distinguish between foods that are energy dense and those that are nutrient rich. The calculation is based on the nutrient content of foods relative to calories, though some NP models have also incorporated healthy ingredients in the overall score. The current version of one such model, the Nutrient Rich Food index (NRF9.3) is based on nine nutrients to encourage (protein, fiber, vitamins A, C, D, iron, calcium, potassium, and magnesium) and 3 nutrients to limit (added sugar, sodium, saturated fat) (23). The overall nutrient density score is based on the sum of percent daily values for nutrients to encourage minus the sum of percent maximum recommended values for the nutrients to limit. First, based on foods in the US food supply, foods that are energy dense (added sugars and fats) tend to be nutrient poor (**Figure Seven**). Second, foods that are energy dense tend to cost less per 1000 kcal (**Figure Eight**) than do the recommended and more nutrient rich options, especially the low energy density vegetables and fruit. Third, low-cost energy-dense foods that are nutrient poor can result from industrial processing. There is an overlap between the NOVA classification of “ultra processed” foods (24), defined as containing added fat, sugar and salt, and the pre-existing NRF9.3 nutrient profiling model, also based on saturated fat, added sugar and salt. These concepts are summarized in **Figure Nine** where the energy density, nutrient density and cost per 1000 calories are compared for the four NOVA categories, unprocessed, processed, ultra processed and culinary ingredients. As expected, the unprocessed meat, poultry, fish and produce were the most nutrient rich but also more costly. Conversely, the so-called ultra processed foods were more energy dense, had lower nutritional value, but were substantially cheaper than the healthier alternatives. The relative energy and nutrient cost of the global food supply require constant attention. It is not a coincidence that the burden of obesity, diabetes and diet-related NCDs is gradually shifting from the global rich to the global poor.

Does Information Matter?

There are numerous ways in which information can act to influence consumer choices about foods. Broad educational efforts such as national dietary guidelines are often aspirational, though associated policies on food programs can have substantial impact (25). Consumers are also influenced indirectly through advertising and various media campaigns as well local or national policies on food taxes (26). However, voluntary front-of-package (FOP) labeling can directly inform shoppers at the point of

purchase independently of mandatory, numeric nutrient data presented on the back of packages which people have difficulty interpreting (27).

FOP labels can: (a) be nutrient specific and include approaches like 'multiple traffic lights' and 'guideline daily amounts'; (b) provide warning symbols for foods high in negative attributes like salt and added sugar; or (c) serve as an interpretative or summary score derived from a nutrient profiling system and expressed as numbers and/or symbols like stars. While FOP labels characterize foods as opposed to diets, they represent a way to improve dietary choices and thus overall dietary patterns. Particularly over the last decade, there has been a worldwide proliferation of this approach to over 300 nutrient profile models and FOP label programs with applications to grocery stores, school foods, and marketing to children (28).

FOP labels have been shown to reduce consumer intake of energy, total fat, and unhealthy nutrients and, perhaps more importantly, to influence industry practices to reduce product content of ingredients such as sodium and artificial trans fat (29). The effectiveness of FOP labels in helping shoppers distinguishes between more and less nutritious foods appear dependent on a variety of factors, including ease and speed of understanding, inclusion of an overall nutrition indicator, and ability to attract attention via aesthetic features (29). However, the lack of consistency in studies of their effectiveness and the use of simulated shopping models rather than conducting them in real-world supermarkets limits the ability to determine which approach is best at persuading consumers to buy more nutritious foods. While warning FOP labels appear particularly effective, it is noteworthy that they advise shoppers what not to buy rather than direct them to better options.

The use of FOP labels can help to create healthier food environments because they are more easily understood regardless of the consumers' level of literacy and because they indirectly motivate companies to reformulate products or develop new and better ones (29). Nonetheless, it is noteworthy that most FOP labels have been utilized only in developed countries; none have been created or tested in low-income countries. Importantly, FOP labels have been recommended by the World Health Organization as part of a comprehensive approach to promote healthy diets and reduce the risk of NCDs (25). Recent studies indicate that FOP labeling is increasingly recognized by consumers and influencing their behavior, though additional research will be necessary to further refine their graphical presentations and underlying algorithms as well as strengthen the governance of these programs (29). Particularly within the context of this discussion is the potential for the underlying algorithms of FOP labels providing interpretative summary scores to include metrics of food processing, artificial additives, relative risk of NCDs, and sustainability.

Discussion

Just as there are barriers and facilitators to healthy eating in the overall food environment, there are equally significant challenges to sustainable production. While a multi sector approach to the SDGs is increasingly common, actions happen at the sectoral level. There is not a consensus at either the international or national levels on what agricultural technologies are best to feed a growing global

population. There are potential trade-offs in utilizing a specific production strategy; a key challenge is to identify sustainable agricultural production systems that minimize environmental impact, improve the incomes and livelihoods of the rural poor, while considering social and cultural norms. There is no consensus on the most effective farming techniques and technologies to maximize the impact of sustainable agriculture (30). The common approaches put forth include sustainable intensification, climate smart agriculture and agro ecological approaches (30) to name a few. Based on available evidence, it would appear that a combination of agricultural technologies will be needed in many countries. There are huge gaps in our understanding of potential strategies to choose for optimal performance of the agricultural sector.

The EAT-Lancet healthy reference diet (6) is an important step in advancing our knowledge of a healthy diet. However, as shown in Figures Two and Three, food systems need to undergo dramatic transformation. While the EAT-Lancet healthy reference diet provided a road map of an optimal dietary pattern to promote health, their analysis did not include cost to achieve this type of diet; several recent studies have found that the cost of this diet is unreachable for 1.6 billion people (11,31). The analysis within this paper shows that healthy eating is not low cost. Nutrient dense diets, on average, cost more. This finding is reinforced by other recent findings on the cost-nutrient continuum (11,31). Unless strategies can be developed to decrease the cost of healthy foods at the margin, the planetary reference diet will be beyond the reach of the many vulnerable consumes.

In addition as discussed, there are significant implications for agricultural production in adapting the reference diet to national and local areas. As discussed in this paper, the increases in agricultural production that are necessitated by the EAT reference diet are challenging; the feasibility of these production changes need to be considered within the context of current national agricultural policies and how and if these strategies will or can be adapted to achieve agricultural production targets.

Figure One identifies lack of information as one possible limiting constraint to healthy eating. Here again, this may vary by income group, education, gender, and geographic area. The use of FOP labeling may help better inform consumers about better food choice ; while these approaches hold promise for improving information access, they have not been widely used, and where they have, it is primarily in developed countries. The delivery methods for transmitting nutrient scoring systems and FOP may need to be modified to reflect the local contexts. In most rural areas of developing countries, supermarkets are not yet common. In these areas, food is purchased from wet markets or small kiosks. Innovative ways of using FOP labels or other educational efforts need to be developed, implemented, and tested for their effectiveness.

A very ambitious goal for food systems is to make a major contribution to improving diets and diet quality and thereby becoming a key solution to overweight, obesity and non-communicable diseases. While this goal is admirable, to date, there are no models that demonstrate that this can be done. This finding is reinforced by the fact that no country, at present, has implemented a national strategy for addressing overweight and NCDs.

An often overlooked factor in discussing the links between sustainable production linked to sustainable consumption is consumer preferences, taste and convenience. While cost and information can alleviate constraints to healthy eating, these elements alone may not shift consumer preferences enough to make significant impacts on choosing healthy diets.

A food systems approach for achieving many of the SDGs holds promise. Progress in defining national policies using a food systems approach is hampered by the limited number of studies linking sustainable production to sustainable consumption. Indeed, there may be inconsistent or nuanced results when studies are conducted, revealing the complexities of a food systems approach.

The design of future research needs to address the different domains of food systems, realizing that there are multiple food systems within countries. A multi-disciplinary perspective in evaluating diet, nutrition and food systems will be needed.

Acknowledgements

All authors contributed to the writing and revisions contained in the paper. The authors would like to thank Jennifer Stickland for her outstanding help in formatting the paper.

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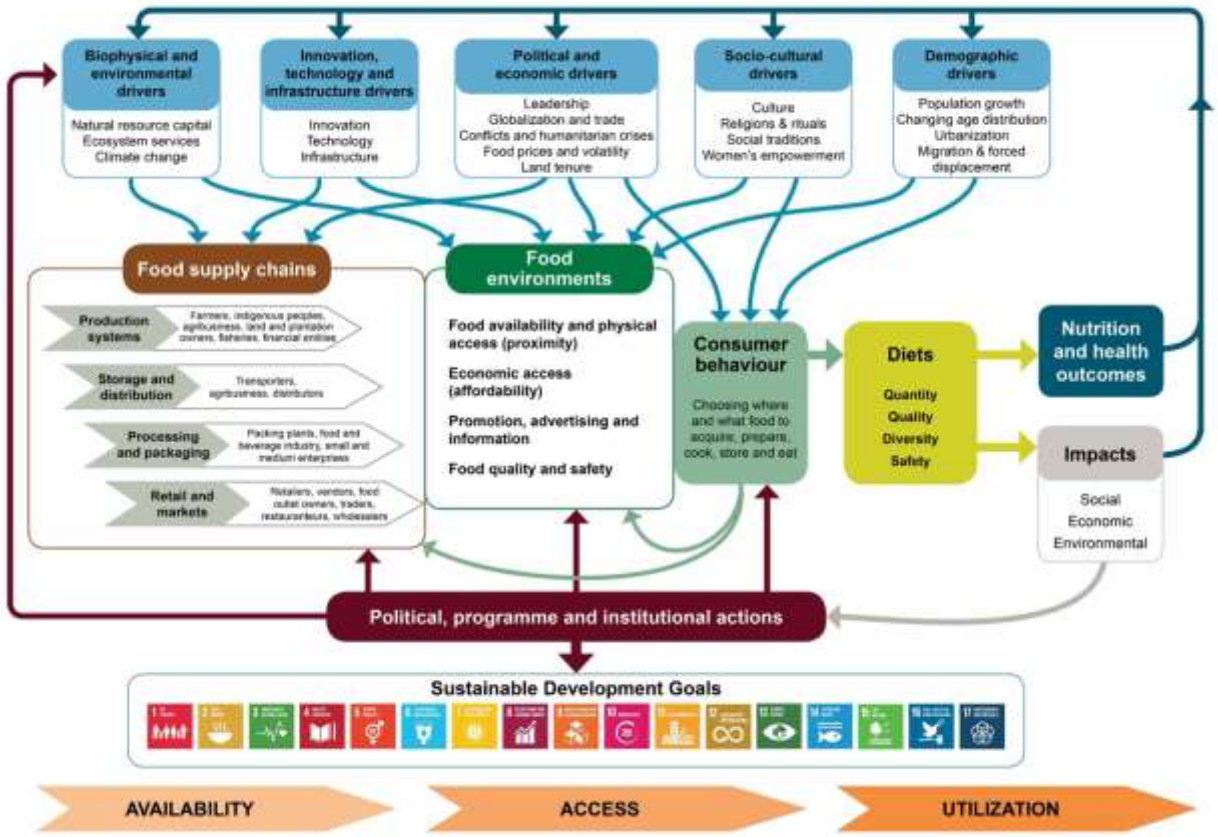
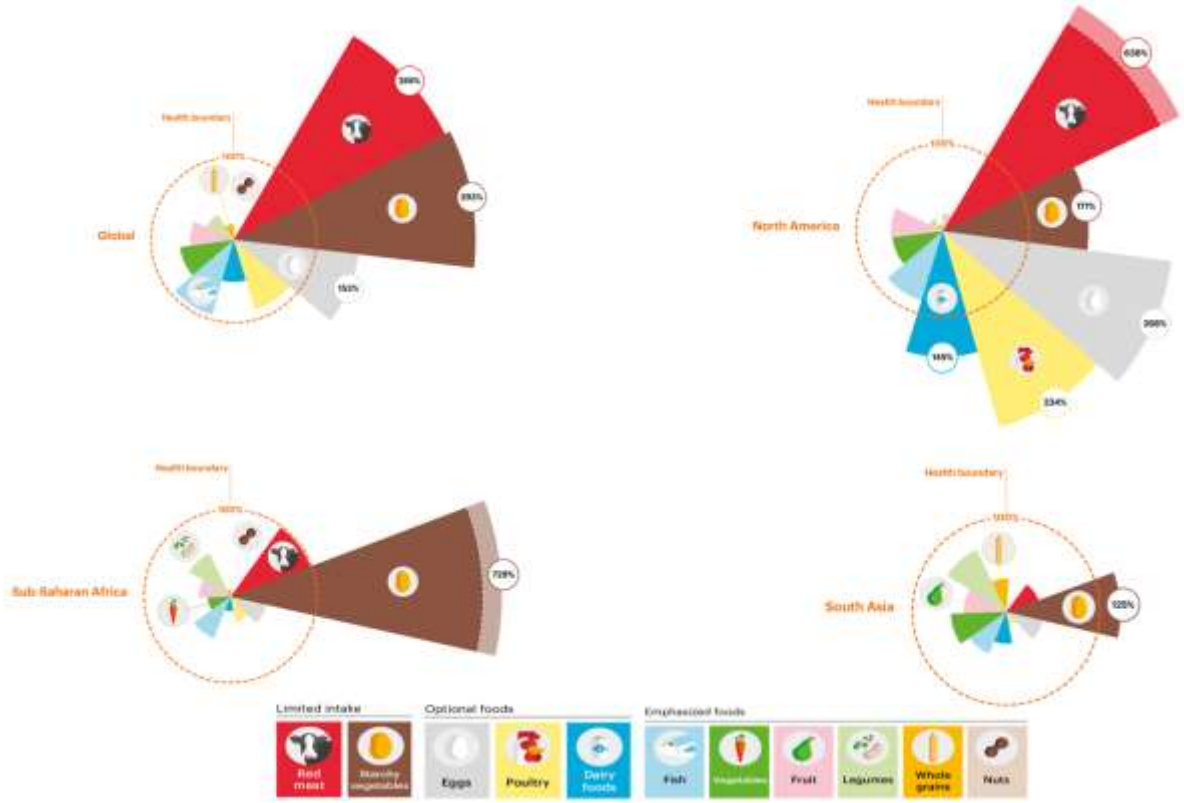
Figure One: Food Systems and Their Drivers Influence Our Dietary Choices and Health Outcomes



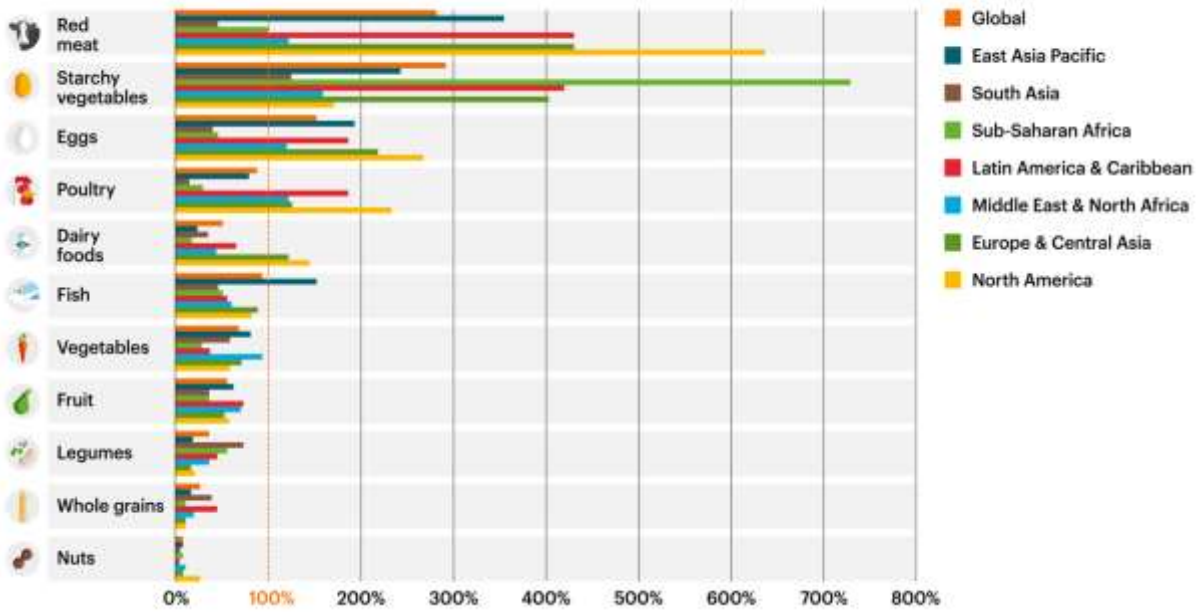
Source: HLPE 2017 (5)

Figure Two: Regional dietary intakes compared to the EAT-Lancet healthy reference diet



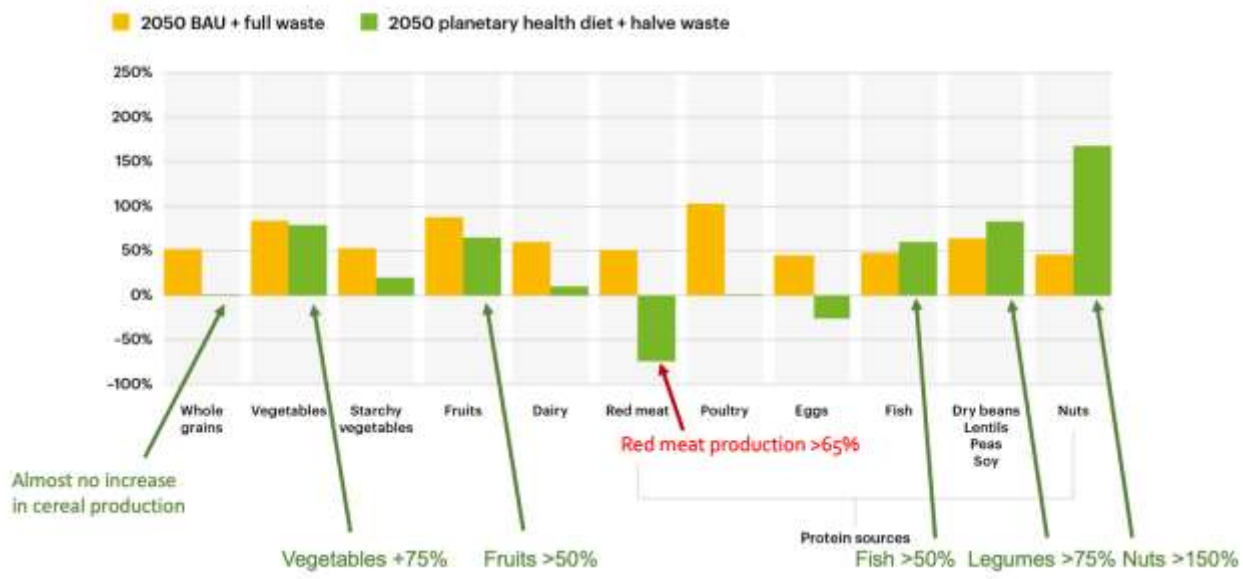
Source: Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A. and Jonell, M., 2019. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), pp.447-492. Credit: EAT Foundation

Figure Three: Detailed view of the dietary intake of different food groups across the region as compared to the EAT-Lancet healthy reference diet



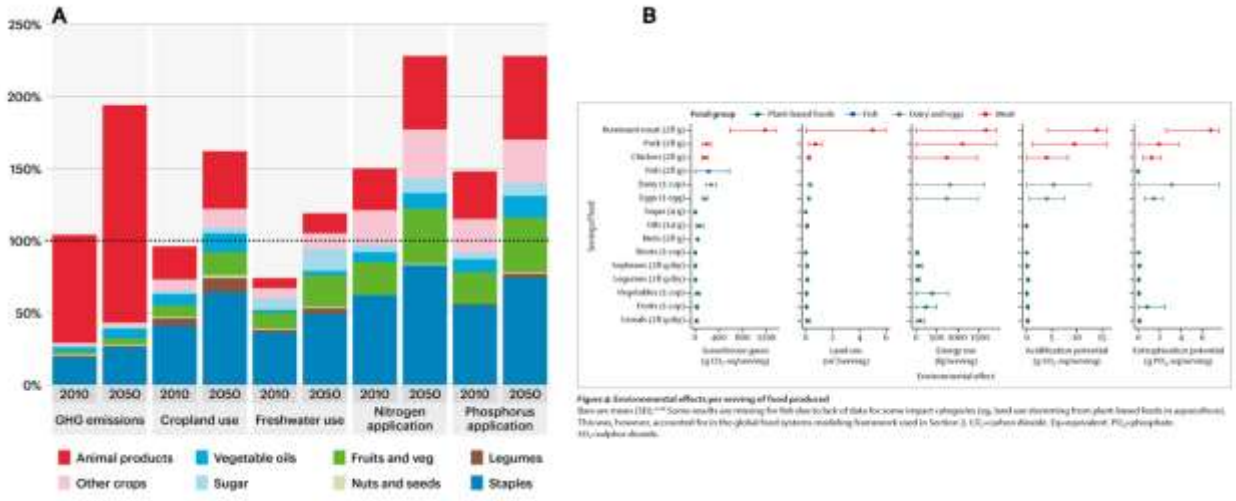
Source: Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A. and Jonell, M., 2019. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), pp.447-492. Credit: EAT Foundation

Figure Four: Necessary changes in global food production by 2050 in BAU with full food waste (yellow) and to deliver the EAT-Lancet healthy reference diet with half food waste (green)



Source: Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A. and Jonell, M., 2019. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), pp.447-492. Credit: EAT Foundation

Figure Five: (A) The impact of different food groups on environmental indicators in 2010 and 2050 Business as Usual; (B) Detailed impact of different foods on environmental indicators in 2010



Sources: Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B.L., Lassaletta, L., De Vries, W., Vermeulen, S.J., Herrero, M., Carlson, K.M., Jonell, M., Troell, M., DeClerck, F., Gordon, L.J., Zurayk, R., Scarborough, P., Rayner, M., Loken, B., Fanzo, J., Godfray, H.C.J., Tilman, D., Rockström, J., Willett, W., n.d. Options for keeping the food system within environmental limits. *Nature.* doi:10.1038/s41586-018-0594-0

Credit: EAT Foundation

Figure Six: Key Dimensions in Sustainable Food Systems

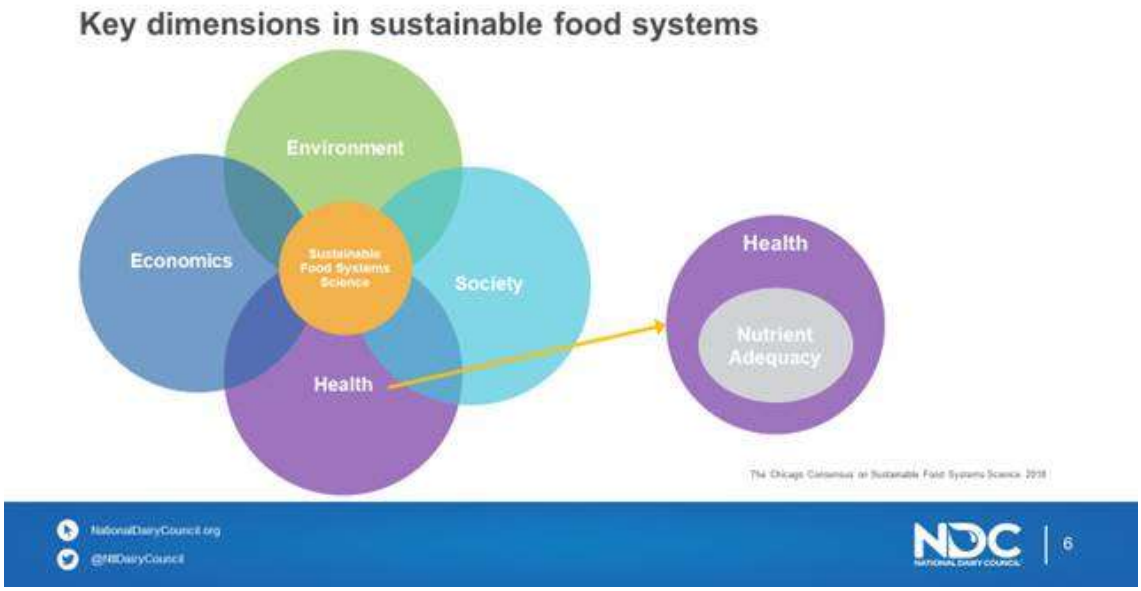


Figure Seven: Energy Dense Food Can be Nutrient Poor

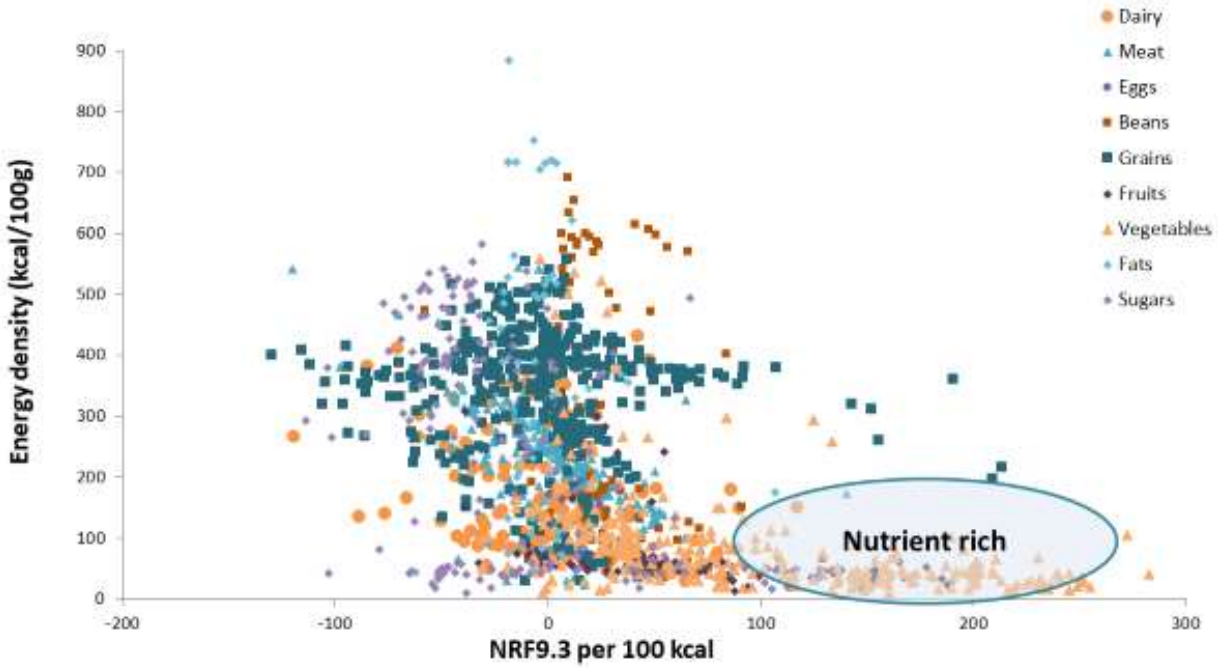


Figure Eight: Energy Dense Foods Cost Less

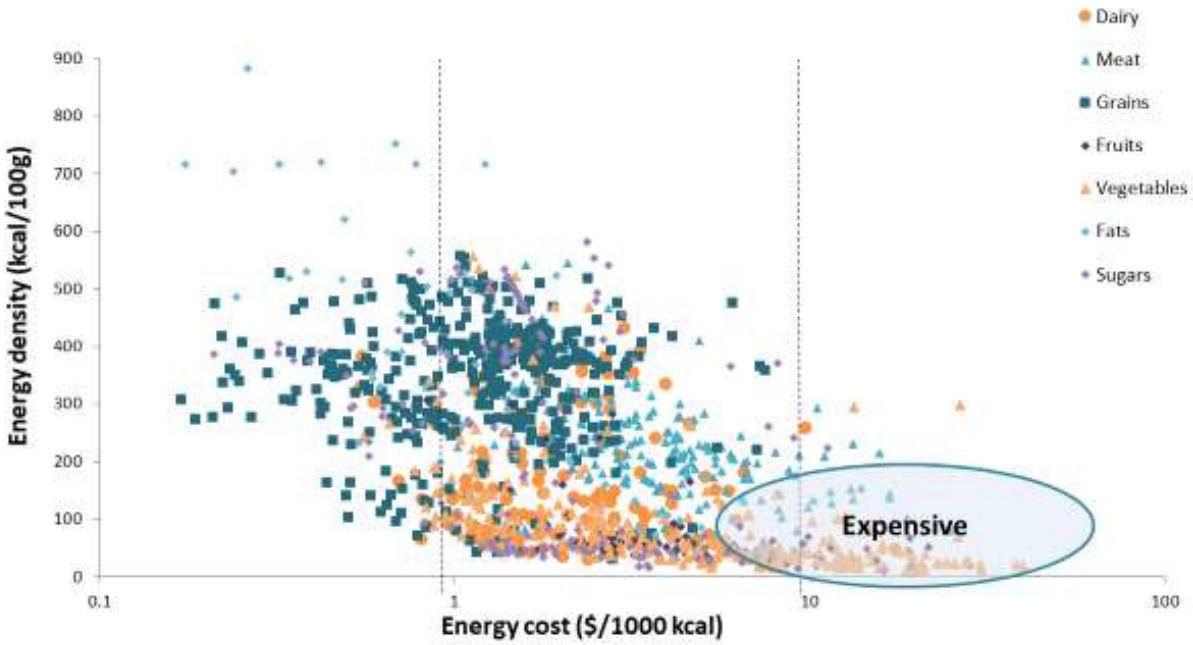


Figure Nine: What is Nova All About? Cost.

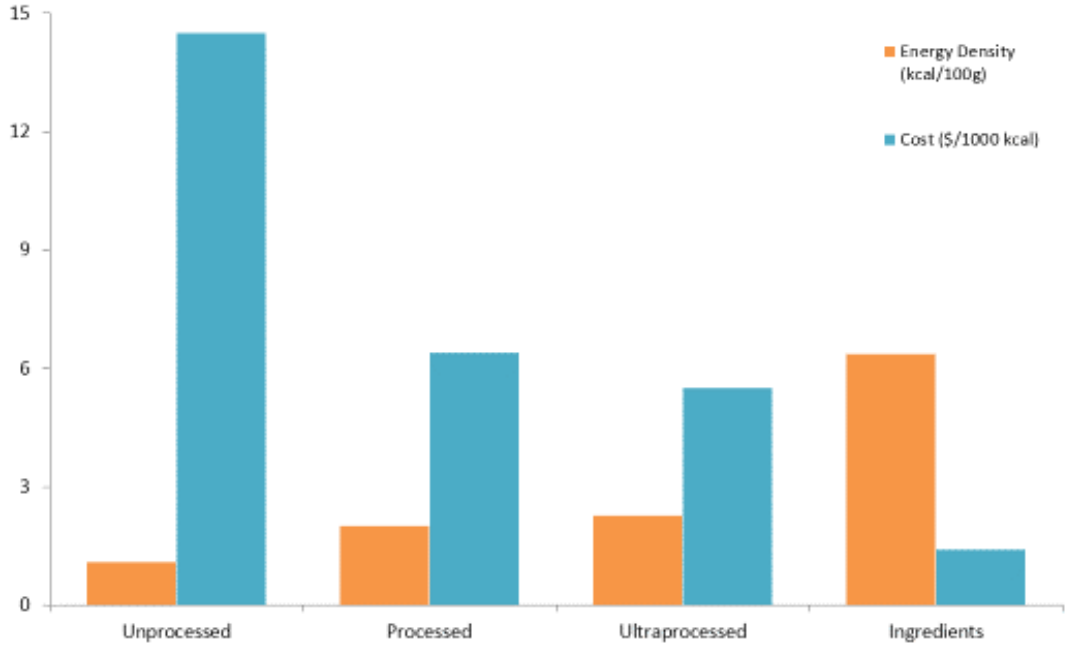


Table One: **Eat Healthy Reference Diet**

	Macronutrient intake grams per day (possible range)	Caloric intake kcal per day
Whole grains		
Rice, wheat, corn and other	232	811
Tubers or starchy vegetables		
Potatoes and cassava	50 (0–100)	39
Vegetables		
All vegetables	300 (200–600)	78
Fruits		
All fruits	200 (100–300)	126
Dairy foods		
Whole milk or equivalents	250 (0–500)	153
Protein sources		
Beef, lamb and pork	14 (0–28)	30
Chicken and other poultry	29 (0–58)	62
Eggs	13 (0–25)	19
Fish	28 (0–100)	40
Legumes	75 (0–100)	284
Nuts	50 (0–75)	291
Added fats		
Unsaturated oils	40 (20–80)	354
Saturated oils	11.8 (0-11.8)	96
Added sugars		
All sugars	31 (0–31)	120

Source: Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A. and Jonell, M., 2019. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), pp.447-492. Credit: EAT Foundation

Table 2: Achieving the EAT-Lancet modeled actions to transform the food system

Actions	Description
Dietary shift Planetary health diet	Planetary health diet
Halve waste Reduced food loss and waste	Food losses and waste reduced by half, in line with SDG target 12.3.
PROD Improved production practices Standard level of ambition	Closing yield gaps to about 75%; rebalancing N and P application; improving water management; implementation of agricultural mitigation options; and land is expanded first into secondary habitat and then to intact forests to minimize impacts on biodiversity.
PROD+ Improved production practices High level of ambition	Closing yield gaps to 90%; a 30% increase in N use efficiency and 50% recycling rates of P; phase-out of first-generation biofuels; implementation of available bottom-up options for mitigating GHG emissions; and optimizing land-use across regions to minimize impacts on biodiversity.

Source: Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A. and Jonell, M., 2019. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), pp.447-492.