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Global Topics Paper

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Ethical Challenges & Potential Solutions to Global Protein Sustainability

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By the year 2050, the world's population is expected to surpass nine billion (Kunzig, 2014). In the next four decades, due to this global population surge, it is projected that global food production will need to double to meet the demand. This significant increase in food production will create its own feedback inhibition, and thus compromise food security, food safety, and food sustainability (Aiking, 2014).

Definitions of sustainability address aspects of society, ecology, and economy (Sabate and Soret, 2014), alternatively referred to as "people, planet, and profit" (Aiking, 2014). According to Sabate and Soret (2014), "sustainability has different meanings depending on the context, as consumers, farmers and food manufacturers are likely not to define a sustainable diet in the same way." The Food and Agriculture Organization of the United Nations, in 2010, defined a sustainable diet as "those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources" (Sabate and Soret, 2014).

Pimentel and Pimentel (2003) reported that about 50% of the total United States (U.S.) land area, 80% of the fresh water, and 17% of the fossil fuel energy is used by the U.S. food production system. Since the advent of industrial agriculture, enormous inputs of energy from fossil fuel and high amounts of chemicals, and oil are used to produce nitrogenous fertilizers and irrigation water, but are nonrenewable sources of energy. Although this energy has greatly increased food production, energy imbalance

has resulted, as reported by the Center for Sustainable Systems (Sabate and Soret, 2014). Twenty-one percent of the total system energy is the result of on-farm production, while the total agriculture production of energy that goes into making chemical fertilizers and pesticides is 40%. Additionally, processing, transporting, storing and serving food also requires large amounts of energy. It is estimated that for every 10.3 quads of total energy used to produce food, only 1.4 quads of food energy is created (Sabate and Soret, 2014). Thus, the United States (U.S.) food system, whether meat- or plant-based, is not sustainable long term (Pimentel and Pimental, 2003).

A bias toward calories and vitamins exists from the perspective of food security and nutrient adequacy, while from the perspective of food sustainability, the bias is toward climate change (carbons and calories) (Aiking, 2014). According to Aiking (2014), “nitrogen, or protein, is an often disregarded macronutrient that has a pivotal role in biodiversity loss, climate change, and human health risks.” About a fifth of total greenhouse-gas emissions worldwide, mostly from livestock production, contributes to climate change and its adverse health consequences. This also threatens food yields in many regions of the world (Aiking, 2014). The nitrogen cycle is strongly linked to both terrestrial and aquatic biodiversity loss, with unintended fertilization of ecosystems unable to cope with the nutrient inflow (Pimentel and Pimentel, 2003). Because dietary protein is nutritionally crucial, and is primarily acquired via the nitrogen cycle, and essential to human DNA, RNA, and cell protein synthesis (Aiking, 2014), every aspect of human security is at risk.

Further threats to food sustainability and the risks imposed by livestock production, includes resistant bacteria (e.g. methicillin-resistant *Staphylococcus aureus*, extended spectrum beta lactamase) that is mostly caused from antibiotics used in intensive livestock production (Aiking, 2014). There is a five-fold increase use of antibiotics used in livestock than used in human health care, according to Aiking (2014), and in the European Union, approximately 25,000 people have died due to antibiotic resistance at a cost of approximately 1.5 billion Euros per year. Other threats to human health, as a result of livestock products, include emerging zoonotic diseases, such as Bovine Spongiform Encephalopathy, avian influenza, Q fever, and enterohemorrhagic Escherichia coli (Aiking, 2014).

In order to benefit biodiversity, human health, and a rapidly changing climate, according to Pimentel and Pimentel (2003), it is necessary to reduce the losses of reactive nitrogen compounds in the food chain and make it stand out as a top priority to achieve sustainability. The meat-based food system requires significantly more energy, land and water resources than the plant-based food system. The production of 1 kcal of plant protein requires an input of about 2.2 kcal of fossil energy, verses 25 kcal of fossil energy input for 1 kcal of meat-based protein produced (an 11 times greater fossil energy required to produce meat-based protein than plant-based), and thus the plant-based food system has greater sustainability than the average American meat-based diet (Pimentel and Pimental, 2003). In the “Health Council of The Netherlands, 2011 report,” it was advocated that a diet transition toward fewer animal products would result in a tremendous reduction in the pressure on land, freshwater,

and biodiversity resources, while also providing benefits for human health and animal welfare (Aiking, 2014).

According to Sabate and Soret (2014), food security and food sustainability are on a collision course. Despite a marked growth in food production in the past half century, allowing for a dramatic decrease in world-wide hunger, one in seven persons consume diets that are not adequate in protein and energy. With the threat of lower food yields due to substantial climate change, but with a world population having a greater appetite for meat, these intersecting challenges will not only require radical changes in the way food is produced, processed, stored, distributed, and assessed, but also in the types of food consumed. Previous solutions to food shortages are no longer sustainable options (Sabate and Soret, 2014).

Closing the food yield gap will require the adaptation of conventional agriculture to more low-input and precision practices, including identifying and minimizing waste and losses along the supply chain, decreasing environmental degradation, and improving food yields (Sabate and Soret, 2015; West et al., 2014), but these practices are still not enough. More food can be delivered by realigning agricultural and dietary preferences, and thus shifting diets from animal-based to plant-based at the global level is of paramount necessity (Sabate and Soret, 2015). It was recently estimated that by shifting 16 major crops from the current mix of uses (including human consumption, livestock feed and biofuels) to human consumption only, has the potential to increase the global food supply by 28%, or the equivalent of a 49% increase in dietary energy for human consumption (Sabate and Soret, 2014). In addition, major environmental benefits would result. Data also now support the health benefits of most plant-based

diets as being superior to meat-based diets and result in greater longevity and less chronic diseases (Sabate and Soret, 2014).

Up until this past century, large segments of the world's population thrived on diets with little or no meat. Unfortunately, the present psyche and culture of the meat-loving Western countries, and many other cultures and nations, will find this changing course to a downward shift in meat and dairy consumption, extremely challenging, ground-shaking and revolutionary—yet this dietary shift is an inevitable strategy, since other approaches are insufficient to make the global food system sustainable (Sabate and Soret, 2014).

I believe that the authors referenced in this paper have provided a significant amount of research and background to support the urgent need for a global transition to a mostly plant-based society, understanding the political, economic, ecologic and societal challenges that are inevitable. I agree with Sabate and Soret (2014) that the proposed transition does not need to be an "all or nothing" process, since even incremental steps could help solve the challenges of food availability and sustainability. As a nutritional healthcare professional, it is clear that diet and nutrition planning alone for my clients is incomplete without also helping them understand the urgent global crisis we are facing regarding food production, security and sustainability. I believe that it is my responsibility to begin the process of educating my clients, as well as the public about this extremely important topic, since a transition of this magnitude will require years and likely decades to become embedded in the minds and palates of people worldwide, and the process must commence now, as there is no time to waste. To begin this endeavor, I have written a blog at the highlighted link on this topic, with the help of my class resources.

References:

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