Understanding the Links between Agriculture and Health

Agriculture, Food, and Health: Perspectives on a Long Relationship

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2020 VISION FOR FOOD, AGRICULTURE, AND THE ENVIRONMENT

Focus 13 • Brief 2 of 16 • May 2006

Agriculture produces food fundamental for human health. It therefore seems obvious that agriculture, food, and health are related! Agriculture affects whether people have enough food to eat, whether it is of sufficient nutritional value, and whether it is safe, all of which affect human health. But it is not so simple: history has taught that there are different ways of looking at the relationships between agriculture, food, and health. Agricultural connections to food and health are mediated by the natural environment, human culture, and technological change. The challenge today of how to achieve equitable food production that delivers optimum nutrition for health requires an ever better understanding of the interplay between agriculture and environment, culture, and technical capacity, and how it has changed over time.

AGRICULTURE AND FOOD REVOLUTIONS

There have been a number of waves of change in food supply. Arguably, the most significant was the gradual process of developing settled agriculture. Around 10,000 years ago, rather than going out for food and relying on what was there, humans began to produce food near to where they lived. This Neolithic Revolution emerged from a process of experimentation with seed planting, the domestication of livestock, and the development of tools over preceding millennia.

The development of agriculture had a direct impact on food consumption and health. In the region with the first certain evidence of subsistence agriculture—the Fertile Crescent stretching from present-day southern Turkey to Iraq—wheat, barley, peas, lentils, vetch, and flax were developed. These crops altered what people ate and their capacity to override exigencies of climate and circumstance. Other crops developed in Africa, the Americas, Asia, and Europe, changing diets and advancing health.

Subsequent technical advances in farming consolidated the first great transition from hunter-gathering to domestic food production, enabling both a cultural transition from social systems based upon family structures (tribe/clan) to towns and villages and a dietary transition from local food to a different range of foods traded beyond local bioregions. Further revolutions in biology, society, and technology changed what people ate; what was grown; how it was grown, processed, and transported; and where, why, and how it was cooked and consumed. The table maps some of these changes and their impacts on farming and food-related health.

Animals, plants, foods, and culinary tastes were spread around the globe through trade, invasions and wars, and cultural exchange. The pace of change became more rapid over time, particularly once transportation developed, with implications for environment and health. The spread of beans from China to Europe at the end of the first millennium CE, for example, simultaneously improved soil fertility (environment) and allowed humans to store highly nutritious food over the winter, thereby reducing the impact of the hungry months of spring (health).

CHANGING POLICY FRAMEWORKS LINKING AGRICULTURE, FOOD, AND HEALTH

Although landownership has been politically delicate in all societies since time immemorial, systematic and formal policies on agriculture are comparatively recent, often driven by industrialization's need to ensure security of supply. Only in the past two centuries has farming been subject to either local or national government policy frameworks, and only in the 20th century did cross-border policy frameworks emerge. The Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) were created mid-century, and in 1994 the first binding agreement on agriculture was created under the auspices of the General Agreement on Tariffs and Trade (GATT), which created the World Trade Organization (WTO).

Since the mid-20th century, agricultural policy has been dominated by a paradigm centered on maximizing production. The FAO and regional and national governments have focused on increasing agricultural production capacity, through agricultural subsidies, for example, as well as through technical and scientific aids to efficiency such as plant breeding. For much of this period, nation-states assumed responsibility for controlling the food supply and the institutions that affect it. But by the mid-1970s, this statist orthodoxy was in decline and market mechanisms were in policy ascendancy. The GATT, the WTO, and regional and bilateral trade agreements created frameworks for market-oriented agricultural policies, such as privatization of domestic agricultural markets and liberalization of international trade, to enable, in theory, agricultural production to become more responsive to market conditions.

What role has food-related heath played in these policy frameworks? In practice, consideration of food and health has been limited in agricultural policy, with macroeconomic concerns in the policy driving seat. Food and health were incorporated only insofar as it was assumed that increased output and greater economic growth would lead to less malnutrition and gains for health. But negotiations and both public and corporate policy generally have not paid nutrition due consideration and are now criticized for failing to resolve food insecurity and exacerbating overnutrition by giving primacy to cheapening food and encouraging a consumerist perspective.

In 1963 the FAO and WHO set up an international standard-setting body for food—the Codex Alimentarius Commission—whose mandate includes the protection of consumer health. But even here the conception of food-related health is rather narrow, focusing more on food safety than on nutrition or health-driven dietary change. The persistence of food safety problems in the developing world and their re-emergence in rich countries, too—despite Codex—brought back some measured recognition that government involvement in setting food standards can be valuable and that a public dimension to markets is desirable.

IMPACT ON FOOD-RELATED HEALTH

The waves of change in agricultural policy and practice have increased the world's capacity to feed its people through increased output, more types of food, and less dependency on seasonality. Food prices have tended to fall with rises in productivity, thereby in theory enhancing food affordability and leaving consumers with surplus income to spend on other improvements in living standards.

A major downside has been that modern, intensive agriculture has literally mined the environment (see Brief 14). Moreover, food insecurity and malnutrition persist. The FAO estimates that in 2000–2002, 852 million people were undernourished. From the 1970s, studies showed that even in countries with overall adequate food availability, unequal distribution meant that particular areas and households still experienced food insecurity. Technical gains in food

Agricultural and Food Revolutions and Their Implications for Food-related Health

ERA/REVOLUTION	DATE	CHANGES IN FARMING	IMPLICATIONS FOR FOOD-RELATED HEALTH
Settled agriculture	From 8500 BCE on	Decline of hunter-gathering; greater control over food supply but new skills needed	Risks of crop failures dependent on local conditions and cultivation and storage skills; diet entirely local and subject to self-reliance; food safety subject to herbal skills
Iron age	5000–6000 BCE	Tougher implements (plows, saws)	New techniques for preparing food for domestic consumption (pots and pans); food still overwhelmingly local, but trade in some preservable foods (e.g., oil, spices)
Feudal and peasant agriculture in some regions	Variable, by region/continent	Common land parceled up by private landowners; use of animals as motive power; marginalization of nomadism	Food insecurity subject to climate, wars, location; peasant uprisings against oppression and hunger
Industrial and agricultural revolution in Europe and U.S.	Mid-18th century	Land enclosure; rotation systems; rural labor leaves for towns; emergence of mechanization	Transport and energy revolutions dramatically raise output and spread foods; improved range of foods available to more people; emergence of commodity trading on significant scale; emergence of industrial working-class diets
Chemical revolution	From 19th century on	Fertilizers; pesticides; emergence of fortified foods	Significant increases in food production; beginning of modern nutrition; identification of importance of protein; beginnings of modern food legislation affecting trade; opportunities for systematic adulteration grow; scandals over food safety result
Mendelian genetics	1860s; applied in early 20th century	Plant breeding gives new varieties with "hybrid vigor"	Plant availability extends beyond original "Vavilov" area; increased potential for variety in the diet increases chances of diet providing all essential nutrients for a healthy life
The oil era	Mid-20th century	Animal traction replaced by tractors; spread of intensive farming techniques; emergence of large-scale food processors and supermarkets	Less land used to grow feed for animals as motive power; excess calorie intakes lead to diet-related chronic diseases; discovery of vitamins stresses importance of micronutrients; increase in food trade gives wider food choice
Green Revolution in developing countries	1960s and after	Plant breeding programs on key regional crops to raise yields; more commercialized agriculture	Transition from underproduction to global surplus with continued maldistribution; overconsumption continues to rise
Modern livestock revolution	1980s and after	Growth of meat consumption creates "pull" in agriculture; increased use of cereals to produce meat	Rise in meat consumption; global evidence of simultaneous under-, over-, and malconsumption
Biotechnology	End of 20th century	New generation of industrial crops; emergence of "biological era": crop protection, genetic modification	Uncertain as yet; debates about safety and human health impacts and whether biotechnology will deliver food security gains to whole populations; investment in technical solutions to degenerative diseases (e.g., nutrigenomics)

production clearly do not resolve problems of hunger or food security on their own.

Food safety problems remain, too. According to the WHO, each year 1.8 million people, mostly children, die from diarrheal diseases, mostly transmitted through food and water. Inadequate support has been given to developing countries to control this problem. And in the 1980s changes in agricultural and food systems led to the growth of new food safety problems in both rich and developing economies, such as the rise of *Campylobacter* (see Briefs 5 and 9). Contamination of foods with pesticide residues is another unintended consequence of changes in agricultural practices. Ironically, food for export may achieve higher standards than food for home markets, suggesting that dual frameworks operate.

Technical advances in agriculture have also led to changes in the sources of nutrients, which have some downsides for health (see Brief 4). Improved dairy efficiency can mean raised output of undesirable fats. More calories are now derived from fat, too much of which consists of saturated fats or trans-fatty acids. There are declines in intakes of fiber and whole grain cereals and increases in added sugars, notably from soft drinks. This pattern of dietary and nutrition transition appears to be consistent as classic peasant societies become more urbanized, richer, and more aspirational. Disease patterns alter as a result, with more obesity and chronic diseases such as cardiovascular disease, some types of cancers (bowel, breast), and diabetes.

THE FUTURE

Agricultural policy today operates in a complex world where food insecurity coexists with overconsumption and where a highly technological food supply sits alongside unsafe food, even within the same societies. How will the relationship between agriculture, food, and health develop in the future? Two broad paradigms appear to be emerging. One is based on applying and integrating the life sciences to deliver another round of technical change to improve nutrition and food safety, for example, through biotechnology, proteomics, and nutrigenomics. The other centers on ecological management of food systems, through more local, "sustainable" approaches. These paradigms differ in how they conceive of tackling food-related ill health in relation to environmental and other societal food challenges. It is not certain which view will triumph, but there is growing recognition among all stakeholders that:

- current institutions do not yet adequately link policy demands across levels of governance: global, regional, national, and local;
- the coincidence of over-, under-, and malconsumption within societies is likely to remain and possibly grow, particularly if current global economic trends continue;
- nutrition will have to play a more direct part in framing farm policy and practice;
- agriculture will face renewed pressure to deliver, via sustainable methods, not just more food, but better-quality and health-enhancing foods; and
- market mechanisms need a stronger push to link health, environment, and food systems in ways that are equitable, both within and between nations, while prioritizing public health. ■

For further reading see J. Diamond, *Guns, Germs, and Steel: A Short History of Everybody for the Last 13,000 Years* (London: Chatto and Windus, 1997); FAO, *State of Food Insecurity in the World* (Rome, 2004 [new edition each year: http://www.fao.org/sof/sofi/index_en.htm]); T. Lang and M. Heasman, *Food Wars: The Global Battle for Mouths, Minds, and Markets* (London: Earthscan, 2004); A. M. McMichael, *Human Frontiers, Environment, and Disease* (Cambridge: Cambridge University Press, 2001); and V. Smil, *Feeding the World: A Challenge for the Twenty-first Century* (Cambridge, MA: MIT Press, 2000).

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