The Westernization of Diets:
The Assessment of Impacts in Developing Countries – with special reference to China

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DRAFT

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"The Chinese [now face] the problem of…nutrition excess… Animal fat intake…should be reduced…for the overweight population. Good traditional eating habits…– plant protein meals –…should be promoted." After: Chen & Xu (1996)

Introduction

This paper contrasts the impacts of traditional and 'Western' food production and consumption, as they relate to health and environment. It also proposes solutions for all stakeholders concerned: governments, development agencies, the private sector, and especially individual consumers – poor, rich, and in between.

Consumers are the ultimate agents in determining patterns of food consumption – and therefore production as well. More than ever, they are also personally responsible for their health, especially in developing countries, many of which have constrained public health budgets. As a result, it is in their interest to make responsible dietary choices that will maintain their good health.

As long as governments and development agencies invest to any extent in nutrition and public health programs, they have an interest in making dietary recommendations to the public that will lead to optimal outcomes. While the U.S. Department of Agriculture makes dietary recommendations with the objective of improving the public health impacts of agriculture, the agriculture ministries of many developing countries do not yet routinely consider the public health impacts opposes the dietary recommendations of the public health ministry. Conflicting goals between ministries are to be expected, but the public good should prevail. In addition, private health insurance companies as well as governments have strong interests in lowering medical costs resulting from diseases that are attributable to unhealthy diets [1] and can be prevented through healthy diets, as described in this paper.

Private sector companies that invest in agricultural projects must also assess the environmental impacts of their projects. As long as governments and development agencies continue to invest in agriculture, they too must assess environmental as well as health impacts. Food production and consumption also may have impacts on equity among people, which governments and development agencies may also want to assess.

The poor in developing countries spend up to 80% of their incomes on food, yet are often malnourished because of inadequate access to food. Malnutrition also occurs as the Western diet displaces the traditional diet, due to the excess of some harmful nutrients and the deficiency of some essential nutrients in the Western diet. The world has reached an historic turning point. For the first time the number of malnourished worldwide who are overweight (1.1 billion) equals the number who are underweight. Effective public health strategies must adapt to that sea change. Cases of malnutrition – cases related to poverty as well as cases related to Western diet – contribute to maternal, infant, and child morbidity, decreased learning capacity, lower productivity, and higher mortality rates.

Poverty, as well as malnutrition of both the underweight and the overweight, can best be reduced through "traditional diet." For the poor, a major advantage is that traditional diets cost less than Western diets. 'Traditional' diet is here used to mean a diet that is mainly plant based, rich in grains, legumes, vegetables (plus their oils), and fruit, with little or no animal products. 'Western' diet is an evolving concept. The prototypical Western diet currently includes significant amounts of meat and dairy, low intake of unrefined grains, vegetables and fruits, and high intake of fats, salt, sugars and processed foods. However, the U.S. Department of Agriculture's dietary guidelines have started to promote higher

[1] The top three leading causes of death in the US in 1999 are first heart disease, second cancers and third stroke, with diabetes mellitus sixth. These are all Western diet-related and account for nearly two-thirds of all US deaths, according to CDC (cdc.gov/nchs/fastats). According to Barnard (1995), in the U.S., 22%-68% of hypertension can be attributed to meat consumption; omnivorous diets (which include meat and milk) account for 29% of heart disease in the under 65 group, 40% of cancer mortality is attributable to an omnivorous diet, and 38% of female obesity and 47% of male obesity is attributable to meat consumption.

levels of grain, legume, vegetable and fruit consumption. In 1995, the USDA guidelines stated, for the first time, that meat and dairy products are **not** needed for human nutrition. But to most people USDA recommendations remain aspirational.

Today's Western diet has adverse impacts on health, equity, and the environment. Such impacts derive from both the production and consumption of foods that make up the Western diet. The main feature of the Western diet *versus* the traditional diet is the displacement of grain and vegetables (in the traditional diet) by meat and dairy consumption (in the Western diet), which inevitably entails large-scale, grain-fed livestock production, which is so inefficient in resource use. Family- and small-scale livestock production on natural range inappropriate for more productive crops tends to have much lower impacts, hence could be supported where its impacts are low. The general case against large-scale animal production and consumption in developing countries is well known (Durning & Brough 1991, Goodland 1997, 1998a, 1998b; Goodland and Pimentel 2000). However, that case has not yet included a specific focus on **dairy** production and consumption. Therefore, this paper summarizes the general case against large-scale livestock production, and then focuses on the particular case of dairy.

The purpose of this essay is not to persuade readers to eschew or minimize their consumption of animal products. While that may be one result among some readers who were not previously aware of the facts presented here, the main purpose is to persuade those who are actively promoting the spread of large-scale livestock and dairy production to developing countries to cease such promotion – for health and environmental reasons. Providing a healthy diet for the 2-3 billion people now living on $2/day, plus the increase of 2 billion people expected to populate the world in the next 20 years, can only be achieved through efficient traditional diet. Livestock products are among the least efficient sources of food.

Large-Scale Livestock Production

Demand for meat in developing countries has been increasing dramatically (Gill 1999). The International Food Policy Research Institute (IFPRI) asserts that a "Livestock Revolution" is taking place, and projects that by the year 2020, developing countries will consume 100 million metric tons more meat and 223 million metric tons more milk than they did in 1993, dwarfing developed-country increases of 18 million metric tons for both meat and milk (IFPRI 1999). The only way this demand will be met will be through large-scale grain-fed production.

Demand for these meat and milk in developing countries stems largely from the urban affluent. These products are widely understood not to be part of the package of products consumed in order to meet the basic needs of the urban or rural poor. With rapid population growth, the number of poor rises; the number of people worldwide living on less than one dollar a day has increased to nearly 1.5 billion. About 800 million people, including 200 million children under the age of five, are malnourished today, in terms of insufficient caloric consumption, and this figure is increasing as of 2001.

Most malnutrition among the poor arises from inequitable food access, rather than inadequate food production. Livestock products in developing countries are too expensive for the poor to be able to afford, except in rare cases (e.g., when pastorally produced). In developing countries, most poor people who eat properly consume little or no livestock products, yet their diet – largely grains, legumes, vegetables, and fruits – meet all nutritional requirements. Far more poor people can eat such a diet for the same cost as the number who can eat a diet that includes increased amounts of livestock products. Further, producing livestock and feed on a large scale is capital intensive rather than labor intensive, whereas the production of legumes, fruits, and vegetables is usually more labor intensive, thus providing more income for the poor.

The transition from the traditional diet to the Western diet increases by three times (some say by five times or more) the land area needed for food production. In some categories of environmental damage, large-scale livestock production now constitutes the largest source of adverse impacts, with the impacts continuing to increase in magnitude. The main categories of environmental damage caused by large-scale livestock production are (Goodland et al. 1984; Goodland & Pimentel 2000; Steinfeld et al. 1996):

- Deforestation and loss of biodiversity as tropical forests and other relatively intact ecosystems and habitats are converted to cattle ranches, and as arable lands are converted to cattle pasture.

- Overgrazing, accelerated soil erosion, loss of topsoil, soil compaction, decreased percolation rates of rain into soils, depleting water tables, and desertification. Overgrazing by China's 127 million cattle and 279 million shoats are expanding China's desertification by 2330 sq. kms. a year (Brown 2001).

- Feedlot runoff, eutrophication, pollution of rivers and coastal waters (red tides); decrease in fish and other aquatic harvests; diminished availability of unpolluted water.

- Slaughterhouse and meat-packing factory water use, effluent disposal; the pollution of soil and air.

- Greenhouse gas production, the use of fossil fuel for the production, transport and export, processing, waste disposal and packaging of livestock products.

An epidemiological transition is occurring in nutrition and public health, whereby the number of people of developing countries afflicted by infectious diseases is being overtaken by the number afflicted by non-communicable diseases – of which degenerative diseases are the most significant (WHO 1996). By 2020, non-communicable diseases will account for 57% of all disability and 70% of all deaths in developing countries. Public health specialists are especially concerned about increases in degenerative diseases because the cost of treating each case is significantly higher than the cost of treating an infectious disease. Therefore, degenerative diseases pose massive risks to poverty alleviation and to the overall economic development of developing countries. The costs of treating degenerative disease attributable to the Western diet probably exceed the costs of treating diseases attributable to smoking (Barnard et al. 1995; Sturm 2001).

The detailed review of epidemiological literature by Hu and Willett (1998) found that "higher red meat [beef, pork, and lamb] consumption probably increases risk of coronary heart disease, colon cancer, and prostate cancer, and possibly breast cancer" (all of which are degenerative diseases). The China-Oxford-Cornell Diet and Health Project – the world's most comprehensive project ever to study diet and disease – found strong correlations between degenerative diseases in China and a relatively small increase in the consumption of livestock products among people who previously had eaten little or none of such products (Chen et al. 1990). The World Cancer Research Fund/American Institute for Cancer Research (1997) found that dairy products possibly increase the risks of prostate and kidney cancers.

More than one third of pre-school children are stunted in many developing countries (Glewwe & King 2001). Childhood growth rates and adult heights, often considerably lower in developing countries than in developed countries, are best improved by improving maternal nutrition, and by the control of childhood infectious and parasitic diseases, known to cause permanent stunting, rather than by adding livestock products to diets in those countries (Campbell 1997b). Studies carried out during the 1980s in 65 counties in China showed that the heights of adults are strongly associated with the intake of plant-based foods, rather than livestock products. China reduced infant mortality by about 80%, while childhood growth rates were increasing as rapidly as those observed in Japan during the 1950s-1980s (Piazza 1986). This occurred while diets in China contained, on average, only 3-6% of total caloric intake in the form of livestock products.

Several times in recent years, large-scale poultry production has had severe impacts on China. In May 2001, the Chinese territory of Hong Kong was forced to slaughter all 1.2 million poultry in the territory to prevent an outbreak of "bird flu." The order to kill all of Hong Kong's fowls came after the government reported nearly 800 chickens in three public markets carried the virus, and it was discovered to be spreading rapidly. It was the second time in less than four years that Hong Kong has killed all its poultry. In 1997, the government slaughtered 1.4 million birds when a different bird flu virus killed six people. In the latest episode, the government of the Hong Kong territory asked mainland China to halt exports of live birds to Hong Kong. 70 percent of the chickens consumed in Hong Kong come from the mainland. The May 2001 slaughter was expected to cost Hong Kong US$10.3 million in compensation to dealers and farmers (CNN.com 2001).

Dairy as a Subset of Animal Products

The case against the consumption of animal products is so strong that it has led even conservative policy agencies to publish official recommendations to reduce the consumption of animal products. The scientific evidence against the consumption of animal products is strengthening every year. But official policy only slowly catches up with the hard scientific findings.

It is difficult to disaggregate the case against the consumption of animal products from that specifically against dairy. Not enough people have been monitored who consume dairy but not meat, partly because there are relatively few such people. Nevertheless, there are some studies that do disaggregrate the effects of dairy from those of meat. It turns out that the effects are similar, but with some notable differences, which we outline below.

Dairy is an animal food, with a nutritional profile similar to that of meat. It has similar amounts of saturated fat and protein as meat. Like meat, dairy completely lacks the fiber and hundreds of phytochemicals which are contained in plant-based foods, and which have been found to be protective against degenerative diseases such as coronary heart disease and cancers.

The only scientific basis <u>for</u> the consumption of dairy products is a small number of studies linking milk consumption to bone growth, reduced blood pressure, and reduced risk of colon cancer. However, the two diseases most highly correlated with dairy – coronary heart disease and breast cancer – are the two most serious public health issues of our times. These issues are examined in “Diseases Correlated with Dairy Consumption” below. Osteoporosis, also a serious disease, is examined in the calcium section of “The Nutrient Value of Dairy” below.

The production of meat and the production of dairy are strongly linked; one can be called a by-product of the other. Increasing dairy consumption is similar in its health effects to increasing the consumption of other animal products, such as meat and suet. While low-fat dairy products might sound more healthful, the fat removed in the manufacturing of such products is never wasted. Rather it is consumed as butter, cream, ice cream, or processed foods, so the net positive effect on public health is zero.

Dairy Production

The environmental impacts of large-scale dairy production generally fall into the categories outlined under “Livestock Production” above. However, there are some impacts that are particular to dairy. The ruminant’s extraordinary ability to digest cellulose can be valuable. When dairy cattle are not fed, but rather scavenge for most or all of their food – as in much of India, their impact is lower. In such cases, if cattle recycle what would otherwise not be used, they often have much lower impact, while providing manure that can reduce soil depletion and provide fuel. However, these cattle produce very little milk. In addition, recent evidence suggests that where India’s dairy herd are fed lopped forest leaves or where the cattle feed in the forests, India’s forest and biodiversity loss worsens.

Cattle grazing on natural range produce little milk, and none prior to weaning, albeit possibly more than scavenging cattle. Range cattle are not useful for milking commercially, in part because they are distant from markets for dairy products, although they may supply their herders' families with dairy products. Where range cattle supply small quantities of dairy products to adjacent villages, the cash flow can be useful for the pastoralists. Range cattle usually do not provide attractive opportunities for dairy investments by development agencies.

The poor in developing countries may, under certain conditions, consume insufficient amounts of fat, so small amounts of fat in limited whole-milk consumption can be beneficial to lactose-tolerant people. As this is a poor choice of fats, this should be an exception. Small-scale projects promoting the family milch cow, mainly for domestic consumption, thus might be exceptions that could be financed. Selling small amounts of milk from the family cow can generate a small revenue stream that is important to the poor. Development assistance can boost fat consumption for those poor in developing countries who need it at lower financial, social and environmental cost – and at lower risk – by investments in plant-based oil production. The use of the family cow for plowing or traction, and the use of its manure for fertilizer, can be useful niche roles. However, the widespread use of manure for fuel accelerates agricultural and environmental decline.

Nutritional Value of Dairy

This section outlines recent scientific findings that question the nutritional value of dairy products. The science is now converging that dairy products have no benefits not better obtainable elsewhere, and that their consumption poses major risks that contribute to morbidity and mortality.

Fat: Fats are quantitatively the most structural component of the brain and nervous system, and second most important in all other soft tissues. Non-essential storage or saturated fat is visible in cells, bulges around our waists, and is solid at room temperatures, such as in tallow candles, suet, and butter. Essential structural, 'invisible', unsaturated or liquid fat is the main part of the cell membrane, which does the manufacturing, recycling and transport. Cows' gut microorganisms convert cellulose into energy and protein; the large amounts of hydrogen produced during this anaerobic fermentation convert essential fatty acids into saturated fat.

Adequate amounts of dietary fat are essential for health. In addition to their contribution to meeting energy needs, intakes of dietary fat must be sufficient to meet requirements for essential fatty acids and fat soluble vitamins. The minimum intake consistent with health varies throughout a person's life and among individuals. Adequate intake of dietary fat is particularly important prior to and during pregnancy and lactation. For most adults, dietary fat should supply at least 15% of their energy intake (FAO 1993), which amounts to 34g in a diet of 2000 calories per day. (2000 calories per day is the recommended daily amount for an average person weighing 150 pounds or 68 kg.) The USDA recommends that no more than 30% of an adult's calories come from fat, which amounts to 67g in a diet of 2000 calories per day (USDA 2001). The US National Institutes of Health recently lowered the limit of calories to come from saturated fat from 10% to 7%, which amounts to 16g in a diet of 2000 calories per day (NIH 2001).

Milk is about 87% water. Of the solids fraction, about 50% of milk's calories come from fat. One cup of whole cow's milk contains about 8g of fat. Around two-thirds of the fat in whole cow's milk is saturated. This means that just one cup of whole cow's milk contains about 5g of saturated fat, or fully one-third of the NIH-recommended limit of daily saturated fat. 'Low fat' milk contains from 24% to 33% of its calories as fat, or 4-6g per cup. (The '2%' figure is misleading as it refers to weight, but milk is mainly water.) One cup of '1%' milk contains 2-3g of fat, and skim milk about half that. "Non-fat" milk contains 0.4g of fat per cup.

The fat content of most cheeses varies from 7g to 10g per standard (1oz; 28.35g) serving, and rises to 15g in some varieties. More than half of the fat in most cheeses is saturated. 'Low fat' cheese contains 2g to 4g of fat per serving. Most cheeses provide 40% to 70% of calories from fat – though in some, the figure is 90% – of which most is saturated. Butter's calories are 100% from fat, and is high in both cholesterol and saturated fat. The composition of ice cream varies considerably, but typically provides about 60% of its calories as fat. Ice cream consists 10%-20% fat, of which more than half is saturated. The USDA's latest dietary guidelines (2000) recommend low- and non-fat dairy products (USDA 2000) – but reduced-fat dairy products (e.g., skim milk) are generally not available in poor developing nations.

Infants need more fat. The FAO recommends breast feeding for infants, and breast-milk provides between 50-60 % energy as fat. During the weaning period (that is, the transition from full breast-feeding to no breast-feeding), care needs to be taken to prevent dietary fat intakes from falling too rapidly or below the required levels. The use of fat, especially vegetable oils, in the foods fed to weanlings and young children is an effective way to maintain the energy density of their diets.

There are large disparities in fat consumption among geographic regions (FAO 1993). In 1990, the amount of total fat available in Asia and Africa was less than 50g per person per day; in South America it was 74g. In the former USSR, the amount of total fat available was 107g per person per day; in North and Central America it was 126g. In Europe it was 143g per person per day, more than twice USDA's Recommended Daily Allowance (RDA). In some Western countries (e.g., Australia), dairy consumption in the form of ice cream, milk and cheese may contribute more saturated fat to the diet than meat consumption. Clearly, the Western diet includes far too much fat, while developing countries average less than the recommended limit but more than the recommended minimum.

The healthiest sources of fat, with the least environmental impact, are the plant oils, all of which contain about 14g fat per tablespoon, of which 30%-60% is polyunsaturated fatty acids, with no cholesterol. Most plant oils contain about 2g of saturated fat, with canola oil (rapeseed, *Brassica napus*, colza) at only 1g/tblsp. The two exceptions are from tropical trees, with palm oil at 7g and coconut oil at 12g of saturated fat.

Protein: Under the Western diet, the average person consumes about double the protein her or his body needs. The RDA for protein for the average adult is 8% of caloric consumption, or 40g per day in a diet of 2000 calories per day (Munoz de Chavez 1999, Robbins 1992). Estimates of the minimum required are as low as 4-5%, or 20-25g per day in a diet of 2000 calories per day. Protein needs are increased for women who are pregnant or breastfeeding, and for especially active people.

Whole cow's milk contains about 3g of protein per cup. While that is not a large portion of the RDA of protein for an adult, people who consume substantial amounts of dairy are usually consuming a Western diet, which on average includes 15% of calories in the form of protein, which is excessive and contributes to the development of coronary heart disease, cancers, and osteoporosis (Barnard 1999). For infants, a diet of cow's milk is unnaturally high in protein, as it contains three times as much protein as breast milk (Fig. 5).

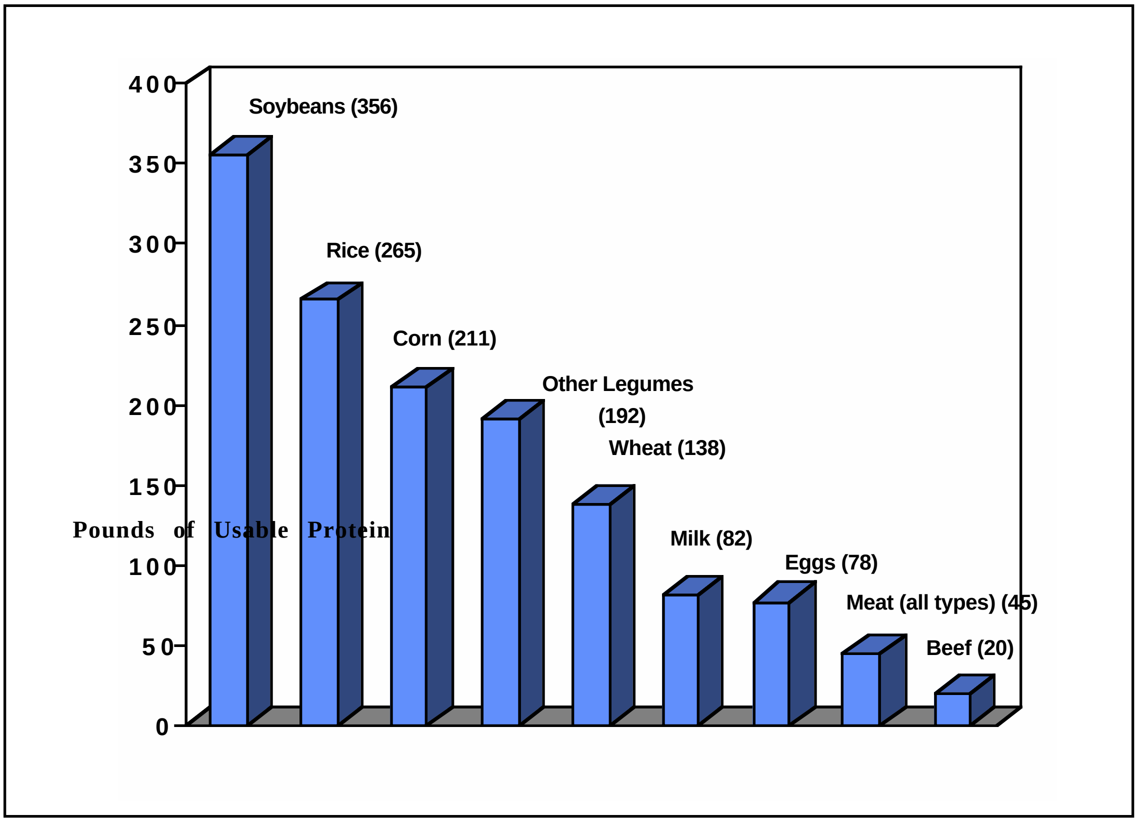
The protein of cow's milk is approximately 85 per cent casein and 15 per cent whey protein (lactalbumin and lactoglobulin). Milk protein is implicated in some cases of diabetes, allergies, migraines and arthritis (Barnard 1999). Casein has been shown to enhance tumor growth in experimental animals (Youngman & Campbell 1992), and has been shown to increase blood cholesterol levels in experimental animals in many studies (Terpstra et al. 1983). Dairy protein is said to be more effective than saturated fat in exacerbating cancers and increasing blood cholesterol (Campbell 2001).

Protein deficiency was thought to be a grave problem worldwide until fairly recently. There are still some pockets of protein deficiency in developing countries, but its cause is inadequate caloric intake. If sufficient calories are consumed, it is almost impossible not to consume enough protein. Even potatoes contain about 2g of protein per serving, so a person would consume sufficient protein if they ate only potatoes, as long as the amount of potatoes were enough to supply the amount of calories needed. Therefore, assuring sufficient caloric intake, rather than focusing on protein deficiency, should be the priority.

Dairy (and meat) are expensive and inefficient ways to provide calories, so would not be an efficient investment as a means of assuring sufficient caloric intake, and therefore sufficient protein intake (Figure 1). The best solution will vary from place to place, but will generally hinge on legumes and grains. Leafy vegetables, too, are useful sources of protein (2-5 g/serving), without the risks associated with dairy protein.

Figure 1: Land-Use Efficiency:
Useable Protein Yields Per Acre From Different Foods

Source: USDA; FAO/WHO/UNICEF Protein Advisory Group



Vitamins: Vitamin A deficiency is a problem in some developing countries. About 250 million children under five are affected by sub-clinical deficiency. Vitamin A is required to survive measles, but stores are depleted by chronic diarrhea. Vitamin A deficiency also causes 500,000 new cases of corneal lesions each year. This nutritional component is difficult to acquire from dairy without also ingesting much animal fat. Vitamin A needs are met more healthfully from the carotenoids common in vegetables, such as carrots, squash, sweet potato and tomato. Many carotenoids, such as beta-carotene and lycopene, are antioxidants, which inhibit the oxidation of lipoproteins, thus reducing the risk of heart disease.

Dairy products are relatively rich in riboflavin (vitamin B_2, 0.18mg/100g whole cow's milk). But riboflavin is easily available at low risk from soybeans, green leafy vegetables, and especially sea vegetables. Riboflavin deficiency is rare worldwide, except in the institutionalized elderly.

Only microorganisms – bacteria, fungi and algae – synthesize Vitamin B_{12}; other plants and animals cannot produce any B_{12}, although plant roots can readily absorb generous levels of B_{12} when grown in organically healthy soils. B_{12} is ingested in animal products if the animal eats foods containing B_{12}, and in plant products contaminated with B_{12}-producing bacteria. Human gut bacteria produce much B_{12}, although it is not clear how much is absorbed. WHO recommends 1.0(g daily. Because so little B_{12} is needed, B_{12} deficiency due to inadequate intake is rare; 95% of today's B_{12} deficiency worldwide occurs in individuals unable to absorb it, typically in old age. Those who do not consume any animal products need to be especially careful to obtain adequate B_{12}. However, one tablespoon of yeast provides 4(g, while a cup of milk contains 0.9(g. B_{12} supplements and folate fortification are becoming more available at low cost in developing countries.

As vitamin D is manufactured less by dark-skinned people, they need more sun than do light-skinned people. Rickets, a disease associated with Vitamin D deficiency, is now rare except in some highly polluted northern cities where children do not get enough ultraviolet light for their bodies to manufacture enough vitamin D. Many commercial cereals are rich sources. Most of the vitamin D in milk comes from fortifying the milk; soymilk and ricemilk are often fortified too.

Essential Fatty Acids: Cow's milk differs greatly from human milk in its marked deficiency of essential fatty acids, including the often limiting essential fatty acid, namely alpha-linolenic acid. Cow's milk contains the most myristic acid of any food, except coconut oil. Myristic acid is very high in butter and is four times as effective as palmitic and lauric acids in raising plasma cholesterol levels. This is much of the reason that milk consumption raises blood cholesterol levels.

Calcium: The science of calcium nutrition is controversial. The USDA's RDA of 800 milligrams is almost twice that of the WHO's RDA. A curious fact is that bone fractures are highest where animal protein (e.g., milk) intake is highest. Milk, cheese and yogurt contain relatively rich levels of calcium (119mg/100g in whole cow's milk), yet substantial milk consumption does not seem to reduce bone fracture rates significantly. The Harvard Nurses' Health Study, which followed 75,000 women for 12 years, showed no protective effect of increased milk consumption on fracture risk. In fact, increased intake of dairy calcium was associated with higher fracture risk (Fescanich et al. 1997). This was subsequently corroborated in an Australian study (Cumming & Klineberg 1994). The reason is that most dairy calcium neutralizes the acidity brought on by milk and other animal protein (Fescanich et al. 1996). When protein (especially animal protein) metabolizes to acidic products, calcium is needed for buffering. This renders such calcium unavailable for nutrition.

Does milk and dairy consumption tend to weaken bones or to strengthen them? The global problem of osteoporosis suggests answers to this controversy. Calcium in milk may not be as helpful against osteoporosis as calcium in a more available form. Osteoporosis is complicated by the fact that dairy calcium intake and hip fracture rates are directly correlated. A further complication is that calcium may be assimilated only in the presence of magnesium, which is very low in cow's milk. There seems to be no protective effect of dairy calcium on bone (Huang et al. 1996; Cummings et al. 1995).

While the Chinese people on average consume 500 mg of calcium per day (above WHO's RDA but below USDA's RDA), the rate of bone fractures in China is among the lowest in the world, while dairy consumption per capita is also among the lowest. On the other hand, the rate of bone fractures in China has been rising in recent years, at exactly the same time as dairy consumption has been rising. The rise in consumption has been encouraged by China's new Dietary Guideline (1999) to "drink milk frequently."

There are differences of opinion among researchers as to whether calcium intake among the Chinese people needs to be raised (Campbell 2001). Attention to the declining level of physical activity among urban Chinese could be the best way to solve the increase in the bone fracture rate. For those in China who need to raise calcium intake, calcium fortification of foods has the lowest cost, the least health risk, and the lowest environmental impact. China has to decide the best balance between increasing dairy consumption on the one hand, and on the other hand, promoting the traditional diet, reducing sodium, fortifying staples (soy milk, rice milk, also fruit juices) with calcium, and more exercise.

Widespread intolerance of lactose (Fig. 3) may prevent the Chinese from sliding very far down the slippery slope toward the U.S. level of dairy consumption.[2] However, to the extent that consumption of dairy products is

2 The average American consumed 932 pounds of milk and dairy products in 1995. This sum was distributed among the top five dairy products (by converting the product back into the weight of milk that went in to its production) in pounds annually as: (1) Cheese 277, (2) Ice-cream etc 247, (3) Liquid Milks 207, (4) Butter 95, (5) Nonfat milk powder 42. The balance was in cottage cheese, cream, condensed milk, dry whole milk powder and dried whey to total 932 lbs./capita. That translates into 2.55 lbs. per American per day from 153 billion lbs of milk in 1995 according to USDA (Cohen, 1998).

increasing in China, there must be an increase in the availability of 'by-products' such as butter, beef, suet, and ice cream. Chinese who are starting to drink milk may not in fact need the extra calcium, and in any event, may end up consuming the excessive amounts of it that many Westerners do. Western dairy producers market dairy products with little regard to its public health impacts, and government regulators have encouraged such consumption, resulting in excessive consumption among Westerners. That pattern could be repeated in China, if measures are not taken to prevent it.

Exercising more, and reducing animal protein and sodium intakes, reduce calcium loss. Green vegetables are rich in calcium and magnesium in the proportion that enable both to be assimilated. Calcium is obtainable at much lower risk from broccoli, kale and other green leafy vegetables, and especially tofu, than from dairy products. More people can be helped at lower cost by promoting plant foods high in assimilable calcium, and investing in calcium fortification of staples.

A recent study financed by the dairy industry claims that drinking three 8-oz servings of milk a day could improve older adults' skeletal health (Heaney et al. 1999). Nearly half of the 132 women in the milk-drinking control group of the study were on conventional menopause therapy to prevent bone loss by taking steroid hormones. But only 31% of the control group women – those not drinking milk – were on steroid therapy, so the whole study is questionable (Cohen 1999).

Iron: Iron deficiency and anemia affects 3.5 billion people; maternal anemia is a pandemic. The best remedy is to reduce parasite loads. Plant-based diets generally contain as much iron as do animal-based diets. Traditional Chinese and Mexican (vegan) diets average 34mg of iron. The RDA of 10mg for men and 15mg for women can be fully met from a diet including one cup of tofu, or two oranges. Many unprocessed plant foods are rich in iron. Half a cup of cooked sea vegetables would supply more than twice the RDA. Iron fortification of staples (e.g., flour) is cheap and effective. Targeted iron supplements, especially for pregnant and lactating women and adolescent girls are highly cost effective.

Zinc: Zinc deficiency contributes to the stunting of pre-school children in many poor countries. WHO's RDA of 4mg of zinc can be met by traditional diets mixing whole grains, legumes, soy, and sea vegetables. One serving of peanuts meets WHO's RDA. Targeted micronutrient supplements are highly cost effective.

Diseases Correlated With Dairy

Coronary Heart Disease

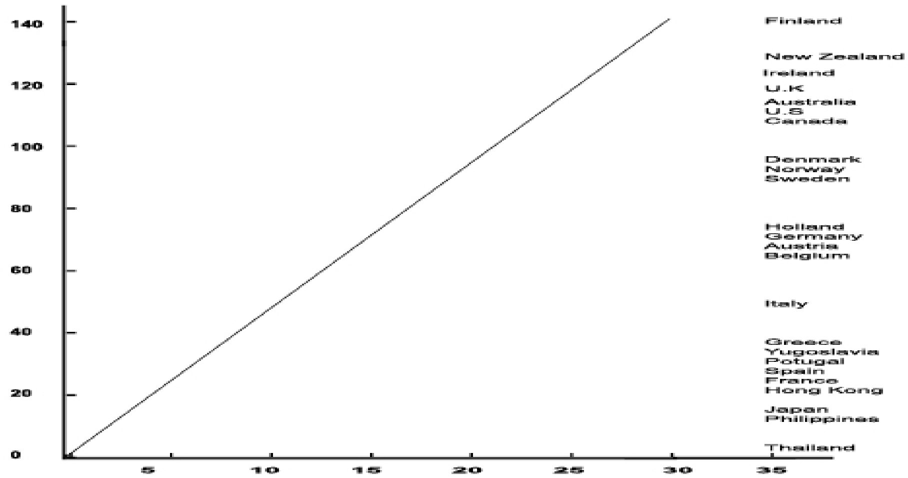
> *The combined coronary artery disease mortality rates for both genders in rural China were inversely associated with the frequency of intake of green vegetables… Apolipoproteins, in turn, are positively associated with animal protein intake and the frequency of meat intake and inversely associated with plant protein, legume, and light-colored vegetable intake. There was no evidence of a threshold beyond which further benefits did not accrue with increasing proportions of plant-based foods in the diet*. (Campbell, Parpia and Chen, 1998).

Coronary heart disease (CHD) is the most important public health issue in most OECD nations, because of its incidence, cost of treatment and mortality. It is the leading cause of death in the United States, and is rapidly intensifying in many developing countries. Of the emerging public health priorities in developing countries with enormous long-term consequences, CHD is at or near the top. There is general agreement that the consumption of meat increases the risks of CHD.

Of the dairy risks, part stems from the high levels of saturated fats in most dairy products. The other dairy risk factor contributing to CHD is milk protein (Fig. 1). While it is difficult to disaggregate dairy from Western diet epidemiology, the correlations of dairy with CHD (Fig. 2) and with breast cancer (Fig. 2) appear to be strong warnings. Myocardial infarction patients have elevated levels of antibodies to milk protein compared with healthy people (Davies 1980). Dairy consumption has been correlated positively with blood cholesterol, as well as with coronary mortality (Law & Wald 1994). The contributions of saturated fat and cholesterol (contained in high levels in dairy products) to CHD risk are inescapable. Milk consumption correlates positively with coronary mortality rates in 43 countries, and with myocardial infarction in 19 regions of Europe (Segall 1977, 1994). A synthesis of 428 peer-reviewed scientific papers concluded that milk drinking is a health hazard, 'even a threat of death' in later years, according to Gordon (1999).

Most of the world has become urban and more sedentary than fifty years ago, when the world was primarily rural and active. Because of this change in activity, milk for adults poses an even greater health risk. CHD is not an inevitable consequence of diets high in dairy; other dietary factors (such as antioxidants and omega-3 fatty acids), physical activity, and other factors can lower CHD risk. However, WHO data have shown mortality most closely correlated with dairy consumption, second with animal protein, and third with animal fat (Seely 1981). For coronary heart disease, liquid cow's milk itself seems to be the main risk of dairy consumption. CHD risk seems to be somewhat reduced in cheese consumption.

Figure 2: Correlations between Coronary Heart Disease and the Consumption of Unfermented Milk Protein (Abscissa is consumption of unfermented milk protein in g/day; ordinate shows standardized male CHD mortality rates. USA 1977 = 100. Sources: Gordon 1999; Seely 1981)



Breast Cancer

Breast cancer is the most common cause of cancer death in women, and the third most common cancer overall. The incidence of breast cancer is increasing worldwide; about one million new cases are diagnosed annually. Only half of all diagnosed cases survive more than five years, even with appropriate treatment. Breast cancer is presently much less common in developing countries than in developed countries.

Correlations between breast cancer incidence and dairy production are stark (Figure 3; Harris 1999; Outwater et al. 1997). There is a significant correlation between breast cancer mortality and milk consumption (R=.55, p=.001). This supports the hypothesis that estrogens and the insulin-like growth factor (IGF-I) in cow's milk stimulate breast cancer. It has also been shown that milk produced with recombinant bovine growth hormone (rBGH), now commonly used in a number of countries, raises IGF-1 levels in human blood (Heaney 1999). This is consistent with other bone mineral acquisition findings (Cadogan et al. 1997). Soy consumption reduces the incidence of breast cancer (Potter 1998).

Carcinogens in Milk: In cancer research, pinpointing a singular mechanism that triggers tumor growth is invariably an elusive quest. Each cell where cancer may develop passes through several precancerous stages; some may have mechanisms in common and yet have other pathways peculiar to one bodily organ — lymph nodes, say, or brain cells. There are likely many mechanisms (Hivley 2000). In the case of breast cancer, milk protein may be a major factor (as described in the section on protein above). Another major factor may be fat. Milk fat acts as a sink for a wide range of environmental pollutants that contaminate range, pastures, forage, and all other sources of cattle feed. Contaminants include carcinogenic biocides, industrial chemicals, and air-borne pollutants such as from coal-fired power plants, or from aerial and other crop spraying (Epstein 1998).

Fat-soluble contaminants (e.g., DDT) bioaccumulate in fats. Lipophilic pollutants in both human and cow's milk (e.g., PCBs, dioxins[3], DDT) transfer from the air (e.g., incinerators, disease vector control, pesticides, fungicides etc.) to forage, thence to meat and milks. The contaminants in milk fat reflect the pollution falling on cows' feed, thus are highly variable. However, the list of such pollutants in milk is long and growing. These carcinogens are found worldwide in air, soil, sediment, fish, meat, and dairy (Roeder et al. 1998; Ejobi et al. 1996). The residues or metabolites of carcinogenic pollutants in cow's and human milks can exceed the safe minima set by FAO/WHO (Kannen et al.1997). Zhuo and Watanabe (1999) closely correlated colon and rectal cancer with diet, including eggs, meat and fish, in 65 counties in China. Ovarian cancers have been linked to the milk lactose breakdown product, galactose (Cramer et al. 1989). Part of breast and prostate cancers are linked to the insulin-like growth factor (IGF-1) in cow's milk (Chan et al 1998).

[3] US EPA's science advisory board leaders, W.Glaze & M. Lippmann, urged release of EPA's decade-long "Dioxin-Cancer Study" in June 2001, because even small amounts of dioxins in dairy and other animal fats produce cancer risk as high as 1 in 1000, and other disorders.

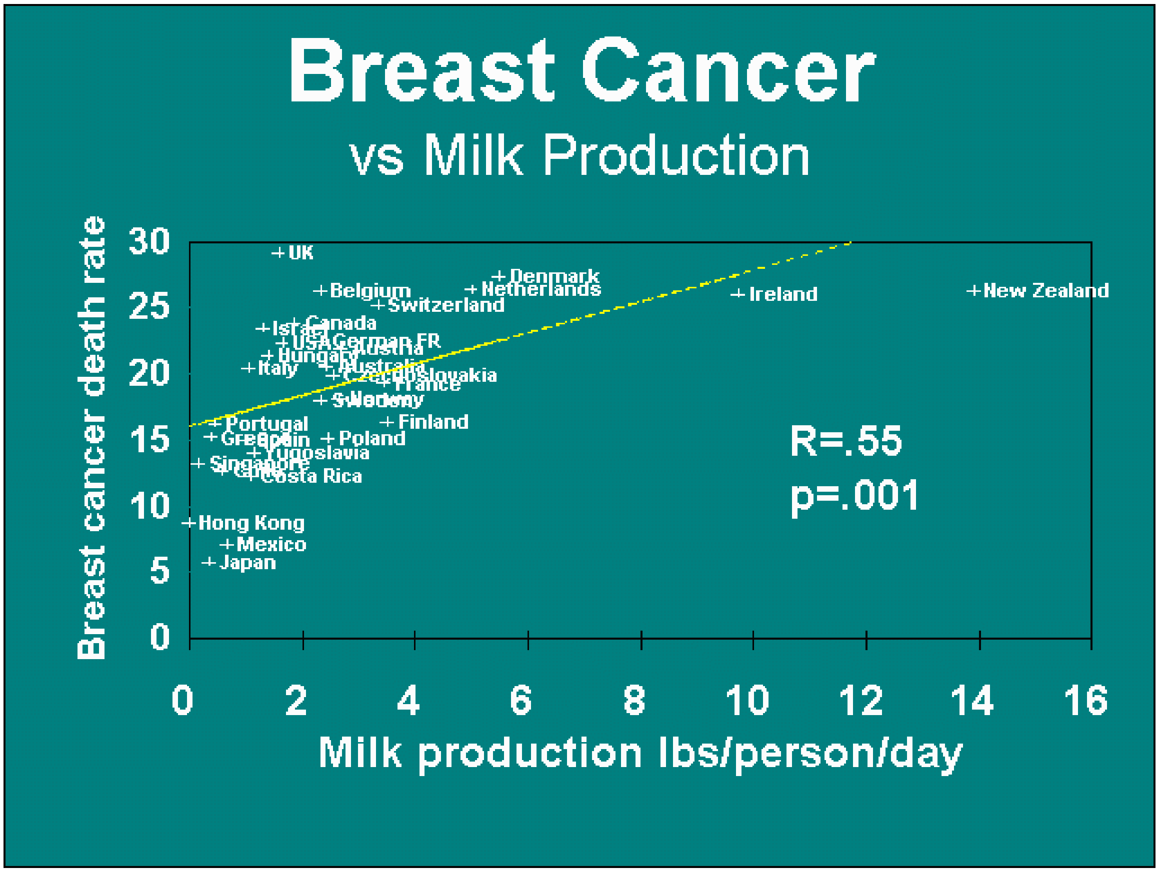


Figure 3: Correlation between Breast Cancer and Milk Production

Source: William Harris, M.D., 1999 (adjusted for age and other confounding factors).

Milk and Children

Traditional maternal nutrition is exceptionally important and influences health throughout their offspring's life. It is possible – but not at all advisable – for newborns to survive on formula. Exclusive breast feeding for six months or more, followed with complementary feeding to 24 months or more, is the widely-recommended start for a healthy life. Breast feeding is associated with significantly higher scores for cognitive development than is formula feeding (Anderson et al. 1999; Uauy et al. 1999), although formula-fed and breast-fed infants do not always diverge reliably. Fetal and infant wellness carries throughout adult life.

All infants possess lactase, but it decreases rapidly following infancy in most humans except Caucasians, as they maintain their adaptability to milk with routine consumption. Cow's milk is not necessary for growing healthy children. Today, most children in the world thrive without consuming a drop of cow's milk. Any child can thrive without cow's milk. On the other hand, there is growing evidence that milk can do more harm than good. The American Academy of Pediatrics discourages giving cow's milk to a human baby before its first birthday, because a diet of cow's milk is the leading cause of iron-deficiency anemia in infants (cow's milk is low in iron). Cow's milk may displace human milk, and may contribute to type-1 diabetes in children. Humanitarian aid supplying infant formula causes dependency, and forces families to buy cow's milk when aid infant formula supplies and breast-milk dry up.

Milk allergies are common in children, causing sinusitis, diarrhea, constipation and fatigue. Cow's milk proteins are the first foreign proteins entering the infant gut, since most infant formulas are cow milk based. Milk allergies are related to chronic ear infections, to behavioral problems, and to childhood asthma. Soymilk and rice milk cause far fewer problems.

Cow's milk combined with other foods can nourish lactose-tolerant children for a few years. This is useful if breast feeding is felt to be inadvisable for infants with HIV positive mothers, although some evidence questions this (Coutsoudis 1999; UNICEF 1999).

Milk and Menarche: Dairy consumption appears to accelerate menarche. OECD girls' menarche has fallen from 16.5 years in 1840, to 13 years in 1995, and to 11-12 years today. In Japan, it appears that dairy has helped accelerate menarche from 15.2 years in 1950 to 12.2 years in 1975. Early age at menarche is one of the few established early-life predictors of breast cancer risk (Petridou et al. 1996). In cases of early menarche, changes in diet from animal to plant-based may reduce breast cancer risks later in life. Late menarche is associated with decreased breast cancer rates later in life, decreased coronary heart disease, fewer teen pregnancies, and later first pregnancy (Rees, 1995).

Food Safety Risks

Unpasteurized and raw milks are the most widely available forms of milk consumed in most developing countries. This causes much morbidity. It has been found that most outbreaks of disease associated with raw milk occurred where raw milk sales are legal (Headrick et al. 1998).

Inequitability of Dairy Products

Inequality kills. Life expectancy is powerfully affected by the scale of income differences in each society. Life expectancy is lower in countries with a wider dispersion of incomes. The disparity in mortality levels among different populations is also based in part on inequality in the levels of health within a population (Wilkinson 1973, 1996, 2001). Of course there may be a relationship between incomes and health levels. In any event, inequality is growing in China (as in a number of other countries), and this is a factor in the increase in malnutrition, as the rich transition to a Western diet, and the ability of the poor to afford a proper traditional diet may become compromised.

The oldest major civilization, the Chinese, did not produce or consume any dairy until very recently, partly because of their widespread lactose intolerance. About 80% of Chinese become lactose intolerant by age eight. Even now, in China, dairy is consumed mainly in the north. In developing countries generally, the main groups who consume dairy products are rich élites and expatriate Caucasians. In many developing countries, most people are lactose intolerant (Fig. 4). Dairy consumption by lactose intolerant people can cause total incapacitation, extreme discomfort, or gastrointestinal problems including cramps and diarrhea. Most minorities and some of the majorities become lactase deficient in adulthood

Policymakers in the U.S. are slowly recognizing lactose intolerance. For example, in September 1999, a U.S. Senator called for alternatives to cow's milk in schools because 95% of Asian-Americans, 56% of African-Americans, and 50% of Hispanic-Americans are lactose intolerant. USDA's Dietary Guidelines, which U.S. federal nutrition programs use for nutritional guidance, still recommend two to three daily servings of dairy products (even though they could by themselves far exceed the NIH-recommended limit of saturated fat consumption). As most U.S. individuals with African, Asian, Hispanic and Native American backgrounds are lactose intolerant, the Dietary Guidelines and nutrition programs are inconsistent with those individuals' needs, hence are racially biased, according to Bertron et al. (1999a,b).

Figure 4: Lactose Intolerance in Adults of Certain Ethnic Groups
Sources: Flatz, 1987; del Prato 1990. From various studies, hence not totally consistent.

Ethnic Group		Percent Intolerant
African Blacks		85-95
Indians (in places) up to:		90
	Northwestern Indians and Pakistanis	15
	Northern Indians	27
	Southern Indians	67
Asians		40-90
North American Blacks		75
Mexican Americans		75
Mediterraneans		60
North American Whites		15
Italians (overall)		11
Southern Italians		20
Europeans (overall)		15
Swedes		1-8
Danes		3
British		6
Dutch		0
Chinese:	Northern Han	93
	Southern Han	96
	Mongols	88
Taiwan		100
Koreans		94
Fijians		100
Japan		85
Niger: Tuareg		13
Nigeria: Fulani		22
Saudi Arabia: Bedouin		23

Obesity

The World Health Organization recently described overeating as the "fastest growing form of malnourishment" in the world. Nearly 60% of Americans are overweight or obese. Obesity in the urban middle class in India is epidemic.

Obesity rates in China have quadrupled in the past decade. Spurning bicycles for cars has not helped. The global spread of diet-linked disease presents one of the greatest medical challenges of the twenty-first century. Changes in diet and activity patterns are causally linked with a rapid increase in child and adult obesity in developing countries, such as China (Popkin 2000). Urban dwellers consume diets distinctly different from those of their rural counterparts; a large proportion of urban families worldwide are now both overweight and malnourished.

Beef and dairy are relatively new in Southeast Asia. Japan's Gyokusenji Temple in Shimoda marks the spot where the first beef cow was slaughtered as recently as 1930. Increases in intakes of meat and dairy are substantial contributors to the obesity epidemic. The obese have more health problems than people living in poverty, more than even daily smokers or heavy drinkers (Sturm 2001). Chunming (2000) found that overweight and obesity are increasing among urban children in China, and are of particular concern at 11 and 12 years of age. Cardiovascular risk factors leading to hypertension, such as obesity, hypercholesterolemia and diabetes mellitus, are emerging in urbanized Taiwan due to the transition away from traditional dietary habits, including greater meat consumption, and less vegetable and tea intakes (Gao et al. 1999). A particular association has been found between overweight status and high income urban adolescents in China (Wang 1998).

Obesity and diabetes, like infectious diseases, can indeed be contained. In Singapore the nationwide 'Trim-and-Fit' Scheme, which began in 1992, has cut childhood obesity by up to 50 percent. Hawaii reaped long-term health benefits from a program emphasizing a return to traditional local foods (Shell, 2001).

Soy vs. Animal Products

Soy product labels, such as soy milk, are now permitted by the U.S. Food and Drug Administration to state that soy can reduce heart disease. In addition, soy inhibits blood-clotting mechanisms, maintains bone calcium levels with potentially beneficial effects in the prevention of osteoporosis, prevents menopausal symptoms, and reduces the incidence of breast cancer (Geissler 1999).

When soymilk is prepared with the same proportion of water as is contained in cow's milk (it is usually made with less), soymilk contains 51% more protein, 16% less carbohydrate, 12% fewer calories, 24% less fat, or 48% less saturated fat (Fig. 5). In addition, the cost of common calcium-enriched soymilk in many developing countries is one-third to one-half that of cow's milk. UNICEF, FAO and WHO fully endorse soy milk. WHO finances soymilk factories in many countries. It is well accepted by infants, can be bottled, canned, tetrapacked, powdered, condensed or fermented to yogurt or various types of soy cheese (some rivaling Roquefort and Limburger in aroma). It is widely prescribed for diabetes, heart disease, high blood pressure, and anemia.

Dr. Keyou Ge, President of the Chinese Nutrition Society and Professor of the Chinese Academy of Preventive Medicine, has pointed out that at current rates of growth in dairy herds in China, it would take 20 years for the growth to reach the level where it would supply China with an amount of milk equal to the average consumption in Asia. Soymilk could meet the demand. Cow's milk is not available to most Chinese who live in rural areas as it is restricted to a few coastal cities. It is not clear whether China's nutrition policy seeks to boost consumption of cow's milk over soymilk. However, cow's milk will not be tolerated by the approximately 80% of Chinese who are lactose intolerant. Dr. Ge wrote that "people are encouraged to drink soymilk who are overweight, or who suffer from hyperlipidemia or cardiovascular disease etc.," precisely the conditions correlated with cow's milk consumption (pers.comm. 7/16/01).

Figure 5: Comparison of Soymilk with Cow's milk and Human milk

	Soymilk	Cow's Milk	Human Milk
Water	88.6	88.6	88.6
Protein	4.4	2.9	1.4
Calories	52	59	62
Fat	2.5	3.3	3.1
Carbohydrates	3.8	4.5	7.2
Ash	0.62	0.7	0.20
Ca (mg.)	18.5	100	35
Na	2.5	36	15
P	60.3	90	25
Fe	1.5	0.1	0.2
Vitamin B_1	0.04	0.04	0.02
Vitamin B_2	0.02	0.15	0.03
Niacin	0.62	0.20	0.2

Conclusion

The growing demand for milk and meat, especially strong in developing countries, is engendering an inevitable change in the systems in which livestock are raised, from small-scale and integrated mixed farming systems, to large-scale and vertically integrated systems. This is now spreading to developing countries, with the result that the livestock sector has become more environmentally destructive worldwide than any other sector.

The impacts of large-scale milk and meat production that are arguably the most directly important to humans are the public health impacts. Diets that include milk and meat are positively correlated with degenerative diseases that are very expensive to treat and cause high levels of mortality.

The precautionary principle is essential in public health. Developing countries will benefit greatly if they are able to forego the Western experience of very expensive morbidity and mortality associated with Western diets. The diet designed to prevent cancer is strikingly similar to the diet designed to prevent CHD – and it resembles the traditional diet eaten in most developing countries. Prevention works, especially if adopted from the start. However, for those who have started down the road to a Western diet, research shows that reverting from the Western diet to a traditional diet actually reverses degenerative diseases such as CHD.

Today's burgeoning demand for milk and meat in developing countries is not inevitable; demand follows advertisements, emulation and subsidies. Education helps reverse such trends. It is clear that animal-based foods contain no essential nutrients that are not better contained in plant-based foods. Most children in the world thrive without consuming dairy products. There are many less costly and healthier alternatives to milk and meat.

The epidemiological transition taking place in developing countries, in which diseases associated with affluence (e.g., heart disease, breast cancer, obesity) are becoming more prevalent than diseases associated with poverty, is a matter of grave concern. One way to ease the transition is to work to prevent diseases of both poverty and affluence. As people strive to consolidate the gains in health for children below age 15 years (by controlling childhood communicable diseases more effectively) we should not allow those gains to be frittered away in midlife (by failing to prevent non-communicable diseases) (Reddy 1999).

The World Bank's 'best practice' conclusions (2001) confirm the argument for the traditional diet and against the Western diet. Fortification of staples and salt with iron, calcium, folic acid, vitamin A, and iodine are most economic where needed. Animal products are not mentioned. Undoubtedly, people will continue to eat animal products, but public funds should not be used to encourage them to do so.

> **Therefore, the first conclusion is that scarce development resources are better allocated to promoting less expensive foods that are more accessible to the poor, have a lower environmental impact, are more efficient in resource use, and are healthier – as well as more equitable.**

Along with family planning, exercise, reduction in smoking, and health education campaigns, it is important for the affluent in developing countries to reduce their intake of fat, while the goal for the poor is to increase the availability of micronutrients, and if possible, the full range of healthful foods that make up a traditional diet. Food pricing policy is effective: taxing worse foods and subsidizing better ones (Goodland 1997; Goodland & Pimentel 2001). Increases in the prices of pork, eggs and edible oils are predicted to lower fat intake (Guo, Popkin, Mroz & Zhai, 1999). Temporary subsidies or tax exemptions encourage the production and consumption of grains and vegetables to restore the healthy balance of the traditional Chinese diet.

> **The second conclusion is to urge governments and development agencies – public health, nutrition, environmental and agricultural officials – to unify in campaigns against malnutrition. In many cases, it will be in the interest of the private sector to join such campaigns.**
>
> **The bottom line is: Can developing countries withstand the perilous lure of the Western diet? Or can the Western diet change, to become more like the traditional diet of most developing countries? The challenge is for developing countries to reaffirm their own traditional diets – while the challenge for developed countries is to learn from developing ones.**

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