



# Prices and Incomes Affect Nutrients Consumed

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Americans are increasingly concerned about their nutritional and health status. There appears to be a trend toward more healthful diets, as measured by increased consumption of lowfat and nonfat foods and leaner cuts of meat. But a considerable gap still exists between dietary recommendations and consumers' nutrient intakes. According to the *Third Report on Nutrition Monitoring in the United States*, many Americans' diets remain too high in fat, saturated fat, and cholesterol and too low in fiber, calcium, and iron.

Since the release of the *Dietary Goals for the United States* in 1977 and the most recent 1995 *Dietary Guidelines for Americans*, Federal nutrition-education efforts have provided advice to help Americans make more healthful food choices. The Food Guide Pyramid helps consumers implement the Dietary Guidelines. These education efforts assume that consumers make food choices based on health concerns.

But economic factors, such as food prices and consumers' incomes, also are important influences in the decision whether to purchase a particular food, how

often, and how much to purchase. For example, if the price of beef goes up while the price of chicken remains the same, consumers likely will buy less of the relatively more expensive beef and buy more of the relatively less expensive chicken. Consumption of other foods could also be affected. If consumers buy less beef, such as hamburger meat, they also buy less cheese and fewer hamburger rolls because of their complementary uses in cheeseburgers.

A change in the price of a particular food or in per capita income affects the quantities demanded for all foods through the interdependent relationships between foods. Because different foods provide different nutrients, changes in food purchases due to food prices or consumer incomes likely translate into changes in nutrient availability and thus affect the nutritional quality of consumers' diets.

This analysis provides a way to determine how a price or income change affects the availability of a particular nutrient, as well as the simultaneous effects on other nutrients. These estimated price and income effects help policymakers understand what changes might occur in the amount of different nutrients consumed if a policy that reduced supplies of a particular

food caused its price to increase. The analysis also provides insights as to how policies that affect incomes may affect nutrient intakes.

This article uses average per capita food consumption, or "disappearance," data for 1989 to 1993. The data represent the quantities of food supplies moving through U.S. marketing channels. The foods are reported mostly in their raw commodity form, such as wheat flour or meats in retail-weight equivalents, rather than as finished food products, such as baked goods or ground round. The data, therefore, measure average food consumption at the aggregate level, rather than at the individual or household level. Food prices used in this article are obtained from the U.S. Department of Labor.

All foods were classified into seven groups: grains, which include wheat flour, rice, and cereal products; vegetables, including potatoes and fresh and processed vegetables; fruits, including fresh and processed fruits and fruit juices; dairy, including fluid milk, evaporated and dry milk, cheese, and frozen dairy products; meats, including red meats, poultry, fish, eggs, dry beans, and nuts; fats, including butter, mar-

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garine, lard, and salad and cooking oils; and sweeteners, which include sugars and corn sweeteners.

Nutrient values were compiled from USDA's 1996 Nutrient Data Base SR 11 on the nutrient content of 5,635 food items. This article focuses on 12 nutrients: food energy (calories), protein, fat, saturated fat, cholesterol, dietary fiber, vitamin A, vitamin C, vitamin E, folate, calcium, and iron.

### Sources of Nutrients in the Food Supply

No single food group provides all the nutrients and other healthful substances that people need (table 1). Energy is provided mainly by grains, meats, and fats, with each group contributing slightly less than a quarter of the total energy available. Major sources of protein are meats (48 percent), and dairy and grains (about 25 percent each). Fat comes mostly from the fats group (51 percent) and meat group (33 percent), with meats providing 35 percent of total saturated fat and most of the cholesterol (75 percent).

More than 50 percent of dietary fiber comes from grains, with an additional 46 percent provided by vegetables and fruits. Major sources of vitamin A are vegetables (37 percent) and dairy (31 percent), while fruits and vegetables contribute 92 percent of total vitamin C. The largest share of folate (a B-vitamin) comes from grains, although vegetables, fruits, dairy, and meats also contribute considerable amounts. Vitamin E comes mainly from fats (83 percent), while dairy is the major source of calcium (contributing 84 percent of the total). Grains and meats contribute about 62 percent and 23 percent, respectively, of iron.

As stated, the estimates (table 1) are based on foods in their raw commodity form rather than as final food products. For example, the grain group is naturally low in fat, and in its raw commodity form, provides less than 2 percent of the total fat available for consumption at this aggregate level. Nutrient shares would differ considerably at the final food level, since preparation methods that incorporate added fats may result in a high fat content for

many of the final grain products (such as baked goods). In this analysis, because of difficulty in measuring the amount of oil used in frying that may be thrown away after cooking, the fats and oils used in baked goods and other processed foods are counted in the fats group.

### Food Choices Influenced by Prices and Incomes

Consumers adjust their food choices to changes in prices and their incomes. The adjusted food choices are then translated into changes in nutrient levels. We used a model to estimate how nutrient levels change in response to changes in the price of a particular food group. The model shows effects from those foods whose prices change, effects on other foods, and effects from changes in income.

We estimated the percentage change in the availability of 12 nutrients in response to a 10-percent decrease in the price of any one food group, holding the prices of other food groups constant (table 2). All the prices of food commodities within a food group are assumed to

Table 1  
A Mix of Food Groups Are Necessary To Get All the Nutrients Needed for a Balanced Diet

Nutrient	Grains	Vegetables	Fruits	Dairy	Meats	Fats	Sweeteners
<i>Percent of each nutrient</i>							
Energy	25.22	2.74	2.53	13.67	21.52	22.88	11.44
Protein	22.87	3.18	.89	25.45	47.48	.12	.01
Total fat	1.28	.23	.18	14.36	33.33	50.63	0
Saturated fat	.65	.11	.11	27.28	35.22	36.64	0
Cholesterol	0	0	0	20.35	74.90	4.75	0
Dietary fiber	51.42	30.73	15.76	0	2.09	0	0
Calcium	3.60	5.01	1.57	84.08	5.15	.38	.21
Iron	62.42	9.15	1.66	3.12	23.05	.06	.54
Vitamin A	0	36.89	1.31	31.32	13.53	16.94	0
Vitamin C	0	45.82	46.51	5.76	1.89	.02	0
Folate	26.95	21.56	16.97	14.70	19.69	.13	.01
Vitamin E	.95	3.63	1.86	2.74	7.71	83.11	0

Note: Food groups are grains (wheat flour and rice), vegetables (fresh and processed vegetables, including potatoes), fruits (fresh and processed fruits), dairy (milk, cheese, and frozen dairy products), meats (meat, poultry, fish, eggs, dry beans, and nuts), fats (fats and oils), and sweeteners (sugars and corn sweeteners).

Table 2

**Nutrient Availability Changes in Response to a 10-Percent Decrease in Food Prices or a 1-Percent Increase in Income**

Nutrient	10-percent decrease in price							1-percent increase in income
	Grains	Vegetables	Fruits	Dairy	Meats	Fats	Sweeteners	
<i>Percent change</i>								
Energy	0.22	0.18	0.50	0.16	0.52	0.34	0.25	0.26
Protein	.25	.01	.35	.69	1.82	-.04	.21	.27
Total fat	.24	.30	.53	.03	.34	.70	.28	.37
Saturated fat	.27	.20	.50	.55	.88	.71	.23	.38
Cholesterol	.40	-.13	.24	.20	1.46	.17	-.08	.31
Dietary fiber	.13	.59	1.10	-.38	1.31	.13	.20	.21
Calcium	.08	-.03	.86	2.60	.95	-.02	.47	.32
Iron	.33	.27	.33	-.24	1.89	-.02	.24	.21
Vitamin A	1.10	-.65	.66	-2.32	-.26	.30	.63	.35
Vitamin C	-.59	1.49	4.57	-.13	2.31	-.39	-.04	.35
Folate	.07	.44	1.44	-.11	1.42	-.24	.14	.26
Vitamin E	.22	.71	.94	-.56	-1.47	1.12	.47	.38

Note: Food groups are grains (wheat flour and rice), vegetables (fresh and processed vegetables, including potatoes), fruits (fresh and processed fruits), dairy (milk, cheese, and frozen dairy products), meats (meat, poultry, fish, eggs, dry beans, and nuts), fats (fats and oils), and sweeteners (sugars and corn sweeteners).

change at the same rate as the group price. For example, a 10-percent decrease in the price of the meat group would mean that the prices of beef, poultry, fish, eggs, dry beans, and nuts all decrease by 10 percent.

A 10-percent decrease in the price of the meat group would increase daily per capita availability of protein by 1.82 percent, saturated fat by 0.88 percent, cholesterol by 1.46 percent, and iron by 1.89 percent, as consumers buy greater quantities from the meat group. A change in meat prices affects the consumption of meats as well as other foods through the cross-commodity effects of how people adjust their purchases of other foods in response. For example, although meats contribute little to the total availability of fiber, calcium, or vitamin C, a 10-percent reduction in the price of meats also increases overall daily per capita availability of fiber by 1.31 percent, calcium by 0.95 per-

cent, and vitamin C by 2.31 percent. On the other hand, it reduces the overall availability of vitamins A and E.

Increasing consumers' incomes raises consumption of all nutrients, as consumers generally buy more foods. But the levels of all nutrients do not increase equally. A 1-percent increase in income would have the greatest effects on fat, saturated fats, and vitamins A, C, and E (table 2). Intakes of nutrients consumed by Americans in insufficient amounts—calcium, iron, and various vitamins—improve slightly with increased incomes. However, consumption of nutrients overconsumed by Americans—energy, saturated fats, and cholesterol—would also rise slightly with increased incomes. Therefore, the net nutritional effect of increasing consumer income is mixed.

These percentage changes of nutrients (table 2) become even more pronounced once translated

into quantity changes per person, per day (table 3). A 10-percent decrease in the price of the meat group increases daily per capita availability of energy by 15.61 calories, total fat by 0.52 gram, saturated fat by 0.44 gram, cholesterol by 5.75 milligrams, calcium by 8.89 milligrams, iron by 0.27 milligram, vitamin C by 1.58 milligrams, and folate by 2.65 micrograms. This same price decrease also reduces daily per capita availability of vitamin A by 2.24 retinol equivalents and of vitamin E by 0.23 alpha-tocopherol equivalent. A 10-percent decrease in dairy prices increases the daily availability of calcium by 24.39 milligrams, and the same price decrease in the fats group increases the daily availability of total fats by 1.08 grams.

A 1-percent increase in income would cause daily per capita nutrient increases, including: energy, 7.82 calories; protein, 0.24 gram; satu-

Table 3

**Changes in Nutrient Availability Due to a 10-Percent Decrease in Food Prices or a 1-Percent Increase in Income Even More Pronounced Once Translated into Quantity Changes per Person per Day**

Nutrient	Recom- mended- amount	10-percent decrease in price							1-percent increase in income
		Grains	Vegetables	Fruits	Dairy	Meats	Fats	Sweeteners	
	<i>DV</i> <sup>1</sup>	<i>Daily per capita change in quantity</i> <sup>2</sup>							
Energy	2,000	6.65	5.37	14.95	4.87	15.61	10.19	7.59	7.82
Protein	50	.23	.01	.32	.63	1.66	-.03	.19	.24
Total fat	65	.37	.46	.80	.05	.52	1.08	.42	.57
Saturated fat	20	.13	.10	.25	.28	.44	.36	.12	.19
Cholesterol	300	1.57	-.52	.94	.80	5.75	.68	-.32	1.24
Dietary fiber	25	.01	.06	.11	-.04	.14	.01	.02	.02
Calcium	1,000	.75	-.26	8.09	24.39	8.89	-.21	4.39	2.97
Iron	18	.05	.04	.05	-.03	.27	-.00	.03	.03
Vitamin A	1,500	9.52	-5.62	5.67	-20.07	-2.24	2.60	5.43	3.06
Vitamin C	60	-.40	1.01	3.11	-.09	1.58	-.26	-.03	.24
Folate	400	.13	.83	2.69	-.20	2.65	-.44	.26	.49
Vitamin E	20	.03	.11	.15	-.09	-.23	.18	.08	.06

Notes: Food groups are grains (wheat flour and rice), vegetables (fresh and processed vegetables, including potatoes), fruits (fresh and processed fruits), dairy (milk, cheese, and frozen dairy products), meats (meat, poultry, fish, eggs, dry beans, and nuts), fats (fats and oils), and sweeteners (sugars and corn sweeteners). <sup>1</sup>Daily Value (DV) established by the U.S. Food and Drug Administration for nutrition labeling purposes, based on 2,000 calories a day, for adults and children over age 4. Source: Paula Kurtzweil, "Daily Values Encourage Healthy Diet," FDA Consumer (Focus on Food Labeling, An FDA Consumer Special Report), May 1993, pp. 40-43. <sup>2</sup>Daily per capita quantity changes are in calories for energy; grams for protein, fats, and fiber; milligrams for cholesterol, calcium, iron, and vitamin C; micrograms for folate; retinol equivalents (RE) for vitamin A; and alpha-tocopherol equivalent (ATE) for vitamin E.

rated fat, 0.19 gram; cholesterol, 1.24 milligrams; calcium, 2.97 milligrams; iron, 0.03 milligram; vitamin A, 3.06 retinol equivalents; and vitamin C, 0.24 milligram.

Changes in the levels of nutrient quantities in response to changes in prices and incomes are relatively small when compared to the recommended Daily Values (DV) used by the U.S. Food and Drug Administration for nutrition labeling purposes. However, the changes could exacerbate existing nutritional problems if carried over prolonged periods of time.

The effect of an income or price change on overall dietary quality is complex. For example, whereas a lower price for the meat group increases the levels of calcium and

iron (a nutritional improvement, given that these components are currently consumed in insufficient amounts), the lower price also increases fat and cholesterol levels (a dietary deterioration, given that these components are consumed in excessive amounts). Similarly, higher consumer incomes increase nutrients consumed in low amounts, as well as nutrients already being consumed in excessive amounts.

### Nutrient Response Estimates Useful, But Have Limitations

The estimated price and income effects on nutrients provide information to help policymakers understand how changes in food policies

or programs may affect the amount of different nutrients available for consumption and the overall nutritional quality of the diet. For example, proponents of using economic incentives to influence consumption of particular foods or nutrients, such as subsidizing fruit and vegetable prices to increase sales and consumption, should be aware of the interdependent nature of food choices and the ramifications for different nutrients. As another example, the estimated effects of income changes on nutrients can be a starting point in evaluating possible dietary effects when food stamp recipients' benefits are increased or cut. It should be noted, however, that the estimates in this study rep-

resent average nutrient changes. Adjustments might be needed to reflect how food purchases differ among population groups and between food spending using food stamps versus cash.

In addition, these nutrient responses were estimated at the aggregate level, based on foods in their raw commodity forms, and may not reflect the nutrient changes that occur at the consumer level. The food disappearance data commonly used by demand analysts do not account for food preparation methods, which can heavily influence the final nutrient content of foods. For example, whether the chicken is fried or roasted and whether the skin is eaten considerably affect the final nutritional characteristics of the chicken consumed.

Also, the food disappearance data are slow to incorporate changes in the nutrient composition of the com-

modities themselves, such as occurs from production of leaner meats and lowfat cheeses. Thus, the nutrient contribution of each food group underlying the study's estimates need to be revised over time. Further collaborative research between economists and nutritionists is needed to improve the data on prices, quantities, and nutritional profiles for final food products and make the demand model more reflective of nutrient changes at the consumer level.

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