

## **Agricultural Production and Nutrition**

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### **Regional Dietary Guidance: Is the Northeast Nutritionally Complete?**

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Much of what Americans eat every day has little if any connection to their local environment. By one estimate, food consumed in this country travels an average of 1,300 miles from point of production through processing to point of consumption (Rodale Institute, 1981). Today, no region of the United States is self-sufficient in food production, and consumers have come to depend upon many imported products that can be produced only in climates and soils outside their regions (Lyson and Green, in press).

As Kloppenburg et al. (1996, p. 35) put it:

Ironically, the global food system is at once decentralized and centralized. It is decentralized inasmuch as production tends to be globally dispersed and any given food item is likely to have been grown and processed far from its point of consumption. The food system is centralized in the sense that any given agricultural product is grown in an increasingly limited number of areas on a decreasing number of farms, and is processed and retailed by a narrow set of transnational agribusinesses in which economic and political power are being progressively concentrated.

These trends, which obviously are of questionable energetic efficiency, might be viewed as merely harmless distortions of the system if the system as a whole were functioning sustainably—that is, if the overall trends in accelerating agricultural resource use and global food demand could continue without permanently damaging the ecosystem relationships on which all living systems depend. Clearly they cannot (Brown, 1996; Gardener, 1996).

Several environmental concerns, including fossil fuel depletion and global warming, are intensified by the unceasing movement of food that characterizes our food system. Moreover, the progressive distancing of food is causing, among other effects, a dangerous decline in farming, especially in areas where year-round open-air food production is not an option. Despite population growth in the northeastern United States, for example, the numbers of farms in that region and total land area in farming have declined steadily since the turn of the century.

#### **Northeastern and New York State Agriculture**

As a part of that global system limited by climate to seasonal production, northeastern agriculture is increasingly specialized and declining. Much of the region's production

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is becoming more concentrated on a decreasing number of large farms. One state, New York, has been estimated to have lost 20 farms each week-more than 1,000 annually-for the last decade. The amount of farmland in the state decreased by 66% since the early 1900s, from 22 million acres in 1910 to 7.5 million acres in 1992 (Table 1). In addition to decreases in number of farms and total land in farming, there has been a decline in gross sales of agricultural products throughout the century. In 1910 the gross value of all agricultural commodities produced in New York put it in the top four in the nation, exceeded only by Illinois, Iowa, and Texas. By the mid-1990s New York had fallen to 25th in gross agricultural sales. Between 1950 and 1992, agricultural sales increased by 69% nationally, but in New York, sales actually decreased by 5% in the same period (Lyson, in press).

Moreover, most farms in the state are now highly specialized, many producing only one or two commodities for the market (Lyson, in press). Early in the century, most farms had diversified operations, and there were many more farms producing any given crop. For example, in 1910 over 85% of all New York farms grew potatoes and 79% grew vegetables. In 1992, fewer than 2% grew potatoes and only 9% sold vegetables. Not only are fewer farms producing any given crop, but overall production of crops that are grown has declined (Table 2). Similar delocalizing trends can be seen in the food processing arena.

Table 1. Trends in Farmland and Number of Farms in New York State, 1910-1992.

<b>Year</b>	<b>Farmland (million acres)</b>	<b>Number of Farms</b>
1910	22	215,597
1950	15.8	124,000
1969	10.1	51,000
1983	9.5	49,000
1988	8.6	41,000
1992	7.5	32,306

Source: New York State Department of Agriculture, 1994

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Table 2. Decline in production of selected agricultural products in New York State.

	<b>Former Level</b>	<b>Current</b>	<b>Ratio</b>
Potatoes (1000 acres)	435 (1904)	27,000	6%
Raspberries (1000 acres)	10 (1909)	<1,000	10%
Apples (million bu.)	54 (1896)	26	Half
Poultry (million birds)	17.5 (1944)	<5	<1/3
Wheat (million bu.)	>15 (1878)	6	40%

The disappearance of local agriculture has severed the once strong links between farmers and consumers, who at one time essentially were neighbors. Commodities grown anywhere in the world are now brought year-round by refrigeration and rapid transportation to consumers anywhere else in the world who can afford them. In the Northeast, linkages between local production and local consumption have been broken for almost all commodities, except fluid milk and some dairy products (Lyson, in press). Most of America's northeastern states import over 70% of their food (Messing, 1981). Lyson and Green (in press, p. 3) have commented that "the local marketplace in the Northeast was transformed from a more locally interdependent system of production and consumption to a more globally oriented system where production was uncoupled from consumption." Thus, the Northeast, like other areas of the United States, relies on domestic and international food imports to maintain a highly varied and consistent food supply.

Nearly half the fresh fruits and vegetables consumed domestically are produced in California (Messing, 1981). Often, food products are imported into states where they also are locally produced (Howard, 1995), a trend that sometimes produces astonishing market distortions. For example, New York State produces about 26 million bushels of apples per year, making it the second only to Washington State. Yet despite the fact that the state's orchardists produce nine times the average quantity of apples utilized by the New York City market, three-quarters of the city's fresh apples come from Washington State, California, and overseas (Howard, 1995). According to a recent report, less than 4 % of all the apples produced in New York State go to the New York City fresh and processed apple markets, which are now served primarily by other states and countries. Thus, knowingly or not, consumers participate more and more in the global food system and allow the local food system to decline as it will.

Several studies have failed to find much consumer interest in the source of produce as a factor in their fruit and vegetable purchases (Brooker et al., 1987; Brumfield et al., 1993). However, nearly all respondents (98.2 %) in a telephone survey of 500 northeasterners agreed that keeping farms viable in the Northeast was important, and a majority felt that buying local produce was an effective way to do that (Wilkins et al., 1996). The majority of respondents also felt that local fruits and vegetables were fresher (88 %),

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looked better (60%), and tasted better (62 %) than those imported from other places, and

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that freshness, quality, and taste were important purchasing criteria. These responses suggest that given the opportunity, consumers would be open to using local produce.

A major barrier to consumer support of northeastern agriculture, however, is their lack of knowledge about how to eat seasonally. In the same study mentioned above (Wilkins et al., 1996), northeastern consumers were largely unfamiliar with several very common northeastern winter vegetables and showed poor understanding of what fruits and vegetables one should expect to find from local sources, and when. To help teach consumers which foods could be locally available during various seasons, as well as to provide a tool for producers and retailers to promote local produce, the Northeast Regional Food Guide was developed by Cornell Cooperative Extension and made widely available throughout the region (Wilkins and Bokaer-Smith, 1996).

The guide consists of a poster showing a pyramid similar to the USDA Food Guide Pyramid (USDA, 1992) but picturing only foods of the Northeast. Beneath this pyramid are seasonal lists of fruits and vegetables available either through the conventional market or through a direct marketing arrangement such as a Community Supported Agriculture farm or a farmers' market. The poster is accompanied by fact sheets that explain the justification for and approaches to emphasizing local foods in choosing diets.

The Northeast Food Guide does not, however, provide any information about the nutritional adequacy of a "Northeast Diet." In exploring consumers' attitudes toward local eating, Wilkins et al. (1996) found a concern that the northeast diet would be nutritionally inadequate. Seventy-two percent of respondents believed it would be necessary to import fruits and vegetables to get enough variety for a healthy diet in the winter, although only 20 % believed it would be necessary in summer. But if nutritionists and those in the sustainable agriculture movement wish to enable consumers to eat more locally, especially in other than the usual growing season, some attention must be given to what we mean by local diets, and whether diets that are entirely or largely local can be nutritionally adequate.

The objective of the study reported here was to evaluate the nutritional adequacy of ovo-lacto vegetarian and nonvegetarian diets based on the Northeast Regional Food Guide, using actual menus to explore how local such a diet ought rationally to be.

### **Methods**

We intended to design and analyze two two-day menus (one ovo-lacto and one including animal flesh) for each season using only foods that could probably be

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grown in sufficient quantity in the Northeast if demand existed. We believed -correctly, it turned out- that attempting to design attractive seasonal menus based entirely on local foods would force us to confront the dilemmas that would arise for anyone who actually attempted to eat locally.

We began with the intention of including in the menus foods that are actually or potentially produced locally. However, we quickly faced the reality that some foods, especially major grains, were not likely under any circumstance to be grown in quantity in the Northeast. Although we do not assume that the Northeast can become self-sufficient in grains, we do see a role for local markets to sustain production of the 25 to 30 different grains that are already produced there on a small scale. Also, there is some justification for "importing" grains, despite the energy costs of transport, since unlike fruits and vegetables, which consist of up to 90% water and must be shipped under refrigeration, grains require little fossil energy to preserve, are shipped almost dry, and can be carried by energy-efficient rail transport rather than polluting truck transport, since they are not as perishable. Therefore, we decided to allow wheat and corn in our northeast diets as required. However, we did substitute buckwheat noodles and groats in several of the recipes that would normally call for pasta and rice, since buckwheat is grown in significant quantities in the Northeast and its production could readily be increased (NYSDA, 1992).

Following similar logic, we did not restrict the use of seasonings, which are used in small quantities to yield much culinary interest. While most herbs can be locally grown, most spices cannot. However, as Tudge (1980, p. 11) has noted, tropical spices "require little land, are cheap to transport, and yet are valuable [so they] should be used and made available worldwide, with the profit going to the producer countries. Tomorrow's food should be spicy, and where there's spice there's flavor." As for meat and dairy products, while the Northeast is not ideally suited to grazing, a wide variety of livestock are produced in commercial quantities. The region is well suited to pastured dairy cows, sheep raising, pastured chickens, and pastured hogs.

The foods most often mentioned as problems in "local" diets, as Wilkins et al. (1996) show, are fruits and vegetables. Consumers are convinced that the largely summer fruits and vegetables normally imported to the Northeast are essential to the nutritional quality of their diets. In the human diet, the role of fruits and vegetables is normally to provide vitamins, minerals, fiber and an increasing number of substances only recently recognized as contributing to well being. In addition to their nutritional importance, fruits and vegetables, whether fresh or frozen, have a major impact on the sustainability of the food system, since they require a large amount of energy to keep cold and ship.

In designing our menus, therefore, we first established the following parameters and assumptions:

- All fruits, vegetables, meats, and dairy products must be locally available in commercial quantities at present, and capable of having their production increased significantly if the demand were created. This criterion was based on current and historical production data for the region.

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- Grains and spices may be imported, but efforts will be made to substitute local herbs and locally produced grains where possible.
- Since vegetables and fruits were the most obvious constraint, especially in the cold seasons, we restricted our menus to fall, winter, and spring only. The supply of fresh produce can normally be assumed to be adequate in this region in the fall also, but since some parts of the region would need to rely more on storage crops earlier in the calendar year than others, we also have provided menus for this season. We assumed that although they currently are limited, local winter vegetables from stored sources could be made more available.

We reviewed several cookbooks for recipes that incorporated as major ingredients fruits and vegetables available from regional sources in the seasons of interest. Ingredients from the other food groups, except spices and grains as noted above, needed to be available in the region, but no seasonal variability in their availability was imposed on the recipe selection and menu planning. Substitutions were made for ingredients that did not fit the regional or seasonal criteria and where the quality and character of the dish would not be compromised (e. g., celeriac for celery). Menus included the recommended number of servings from each food group (USDA, 1992). For each season, two days of menus were designed for each diet type-ovo-lacto vegetarian and nonvegetarian. The menus were reviewed by a panel of dietitians to assess balance, variety, and acceptability. A moderate level of cooking skill was assumed. (The menus are available from the first author.)

Each recipe was individually analyzed for nutrient content using the Nutritionist IV computer program (N-Squared Computing, Salem, Oregon). An individual serving of each recipe was then added to the menus, and all the menu items were then entered into the program. The nutrient content of the menus was compared with the US RDAs for the referent female age 25 to 50.

## Results

Summaries of the nutritional analysis for the two diet types (ovo-lacto vegetarian and non-vegetarian) in the three seasons of interest are shown in Tables 3, 4 and 5. The summaries are based on the two-day averages of nutrient intakes for each diet. Except for iron in the winter non-vegetarian diet, all diets provided at least 100 % of the RDA for the macronutrients and all the major or "leader" vitamins and minerals. If a diet is adequate in the vitamins and minerals shown, it is assumed to be adequate in the other known nutrients also.

According to the computer analysis, the vitamin A content was higher in the ovo-lacto fall and winter diets than the non-vegetarian diets, and was lower in the ovo-lacto spring than the non-vegetarian spring diet. The ovo-lacto diets for winter and spring provided 76% and 56% more iron than the non-vegetarian diets for the same seasons, respectively. The distribution of energy for both diet types was consistent with the U. S. Dietary Guidelines for Americans, with energy from protein ranging from 15 to 23 %,

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 carbohydrate from 56 to 66 %, and fat from 23 to 29 % of the total.

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Table 3. Adequacy of Fall vegetarian and non-vegetarian diets.

<b>Macronutrients</b>	Ovo-lacto Vegetarian	Non-vegetarian	
		<u>% Total kcal</u>	<u>% Total kcal</u>
Energy (kcal)	2259		2517
Protein (g)	83.8	14	132.3
Carbohydrate (g)	370.4	68	379.0
Fat (g)	59.7	18	64.6
<b>Vitamins and Minerals</b>		<u>%RDA</u>	<u>% RDA</u>
Vitamin A (RE)	6198	774	5505
Beta-carotene (µg)	5058	-	3975
Thiamin B <sub>1</sub> (mg)	2.272	206	2.358
Riboflavin B <sub>2</sub> (mg)	3.097	238	3.17
Niacin B <sub>3</sub> (mg)	21.35	142	39.66
Folate (µg)	746.2	414	606.6
Vitamin E (mg)	15.61	-	1.024
Vitamin C (mg)	200.2	333	191.2
Iron (mg)	20.93	139	24.28
Calcium (mg)	1994	249	1970
Zinc (mg)	18.67	155	23.87

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Table 4. Adequacy of Winter vegetarian and non-vegetarian diets.

	Ovo-lacto Vegetarian		Non-vegetarian	
<b>Macronutrients</b>		<u>% Total kcal</u>		<u>% Total kcal</u>
Energy (kcal)	2174		2219	
Protein (g)	86.9	14	96.42	16
Carbohydrate (g)	322.8	56	317.20	58
Fat (g)	74.9	27	71.68	26
<b>Vitamins and Minerals</b>		<u>% RDA</u>		<u>% RDA</u>
Vitamin A (RE)	2149	268	3638	454
Beta-carotene (µg)	1317	-	2898	-
Thiamin B <sub>1</sub> (mg)	1.896	174	2.188	198
Riboflavin B <sub>2</sub> (mg)	2.599	220	2.538	295
Niacin B <sub>3</sub> (mg)	17.55	117	18.41	122
Folate (µg)	529.6	305	327.2	181
Vitamin E (mg)	15.61	-	1.024	-
Vitamin C (mg)	128.4	213	146.6	244
Iron (mg)	24.75	170	14.1	94
Calcium (mg)	1840	245	1483	185
Zinc (mg)	14.77	131	13.56	112

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Table 5. Adequacy of Spring vegetarian and non-vegetarian diets.

<b>Macronutrients</b>	Ovo-lacto Vegetarian		Non-vegetarian	
		<u>% Total kcal</u>		<u>% Total kcal</u>
Energy (kcal)	2443		2343	
Protein (g)	108.6	17	133.1	17
Carbohydrate (g)	381.3	58	321.4	54
Fat (g)	72.9	25	75.9	29
 <b>Vitamins and Minerals</b>		<u>%RDA</u>		<u>% RDA</u>
Vitamin A (RE)	2149	268	3638	454
Beta-carotene (µg)	1317	-	2898	-
Thiamin B <sub>1</sub> (mg)	2.617	237	2.267	206
Riboflavin B <sub>2</sub> (mg)	2.534	194	2.671	205
Niacin B <sub>3</sub> (mg)	20.89	139	31.51	210
Folate (µg)	831.1	46	690.4	383
Vitamin E (mg)	15.61	-	1.024	-
Vitamin C (mg)	278.6	464	300	500
Iron (mg)	28.2	187	19.69	131
Calcium (mg)	1671	208	1684	210
Zinc (mg)	17.56	146	18.5	154

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### Discussion

If consumers are to include considerations such as preservation of regional agriculture when making food choices, they must be familiar with what is or could be produced and processed locally, and they must be assured that diets based on local agriculture are agreeable and nutritionally adequate. The diets analyzed here, which represent a small fraction of those that could be designed using locally available foods, are palatable and highly nutritious. Both we and the panel of dietitians tested the recipes for flavor and ease of preparation and found them to be highly acceptable on both counts. As for the nutritional adequacy of a local diet in the Northeast, it is well to remember that through most of human history, including the early history of the United States, humans survived and thrived on local diets. Further, as long as one is willing to explore the seasonal variety that is or could be available, local diets need not be restrictive, and when well constructed can provide greater dietary diversity than is currently achieved by many Americans from the global food supply. Indeed, according to data from the National Health and Nutrition Examination Survey II 1976-1980, only one-third of the population consumed foods from all food groups on the survey day, and less than 3 % consumed the desirable number of servings from all five food groups (Kant et al., 1991). Failure to consume an adequate amount of foods from the dairy, meat, grain, fruit, and vegetable groups indicates a need for increased dietary diversity among various population groups (Harrison and Bond, 1984; Kant et al., 1991).

What may be surprising, even to those who question the appropriateness of the present global diet, is the very high level of nutrition that the northeast diet can provide. The antioxidant nutrients that have been of recent interest to nutritionists are abundantly available in these diets. Indeed, vitamin C, vitamin E, and beta-carotene (and by implication the other carotenoids) are present at levels well above those recommended. Vitamin A level was a good deal higher than the RDA but not by enough to be of concern. Since preformed vitamin A is present only in animal products (primarily fortified milk, cheese, butter, eggs, and liver) and fortified margarine, which are not present in large amounts in these diets, some of what is reported as Vitamin A undoubtedly is in the form of carotenoids. Iron, a nutrient frequently of concern in diets devoid of animal flesh, was adequate in all ovo-lacto diets and was in greater supply in than non-vegetarian diets for winter and spring. Since a greater proportion of the iron in these diets was nonheme, absorption may be compromised. However, given the abundance of the mineral (from 139 to 170% of the RDA) and the high levels of vitamin C (which aids iron absorption), this is not a concern in the diets we analyzed.

Values for several micronutrients (biotin, fluoride, chromium, iodine, molybdenum, selenium, copper, and manganese) were found to be below estimated safe and adequate intake levels. However, this was an artifact of the incomplete nature of the database rather than a true indication of the composition of the diet (Krzyzanowski, 1997).

Consumers and the nutrition educators who teach them should be confident that diets

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based on seasonally available foods in the Northeast can be both enjoyable and nutritionally complete. This paper does not address issues of regional self-sufficiency, nor do we promote aggressive attempts to simulate the variety produced globally in any given region. The goal is to promote a diet that supports local agriculture and to minimize, not add to, the resource costs involved in maintaining our food supply. While total self-sufficiency may not be a socially, economically or ecologically sound goal, it is useful to explore the most sustainable "mix" of global, regional, and local foods when deciding what to eat next.

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