

# The 100-Mile Diet: A Community Approach to Promote Sustainable Food Systems Impacts Dietary Quality

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**ABSTRACT.** Locally produced foods are perceived by some consumers to provide important societal, environmental, and personal benefits. In this pilot study, 19 adults living in Virginia attempted to consume a diet based

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exclusively on locally produced foods (i.e., a local food diet) for 4 weeks during the summer and fall of 2006. For this study, a local food was defined as a food produced within 100 miles of an individual's residence. Food records were used to assess each participant's compliance with the local food diet as well as the impact of following the diet on the intakes of energy, macronutrients, and fruits and vegetables. Body weight was assessed at baseline and immediately following the 4-week period. Compliance with the local food diet varied considerably, but the average intake of local foods increased from 15% of calories at baseline to 81% of calories during the local food diet. Compared to participants' baseline values, following the local food diet for 4 weeks significantly ( $p < 0.05$ ) reduced reported intakes of energy and protein and increased reported intakes of dietary cholesterol, saturated fat, and servings of fruits and vegetables. Results from this pilot study suggest that individuals attempting to follow a local food diet vary in how they execute a local food diet and that following a local food diet may result in a reduction of energy intake. Future research into the impacts of following a local food diet on dietary quality is needed.

**KEYWORDS.** Local food, dietary intake, 100-mile-diet

## ***INTRODUCTION***

Consumers in the United States are becoming more supportive of foods produced and distributed using sustainable production and distribution practices, including organic and locally produced foods. Researchers using consumer surveys have found that consumers who purchase organically grown foods often do so because organic foods are perceived to be healthier, taste better, and benefit the environment when compared to similar conventionally produced foods.<sup>1,2</sup> Consumer surveys of individuals who value locally produced foods indicate that many consumers are supportive of local foods because of the high quality and taste of local foods, and because purchasing local foods supports local farmers and protects the environment.<sup>3-5</sup> A local food could be defined as a food that was grown, raised, or produced within a relatively short distance from the place where the food was purchased by a consumer; however, there is no definition of exactly what distance from the farm to the food market constitutes a food that can be considered "local."

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The local foods movement has been fueled by the fact that most foods purchased for consumption in the United States travel well over 1,000 miles from the farms where they are produced to the plates where they are ultimately consumed.<sup>6</sup> In response to this statistic, and in an attempt to raise awareness and motivate more consumers to adopt a diet containing more local foods, there has been a recent surge in books and Web sites advocating the benefits of a diet consisting of locally sourced foods.<sup>7-13</sup> One of these Web sites—the 100-Mile Diet—chronicles the efforts of many citizens attempting to follow diets consisting only of foods produced within 100 miles of their residences. The term “locavore” has emerged recently and refers to individuals who intentionally select locally produced foods, to the fullest extent possible. This word was selected as the 2007 word of the year by the Oxford University Press because of the growing local foods movement, characterized by individuals who intentionally seek out locally grown and seasonal ingredients from local farms and farmers’ markets. The local food movement is a part of a worldwide trend in which many consumers are becoming motivated to use their food purchases to support a sustainable food system. These “food citizens”<sup>14</sup> intentionally purchase foods that promote a sustainable food system, such as locally produced, organic, and seasonal foods instead of shopping primarily for taste, cost, and convenience.

The American Dietetic Association (ADA) encourages food and health professionals to support the ecological sustainability of the food system through environmentally responsible practices, including the purchase and promotion of local foods. The ADA also suggests other strategies that food and nutrition professionals can use to promote ecological sustainability including encouraging the consumption of plant-based diets, using energy-efficient appliances, and becoming aware of federal food and agricultural policies.<sup>15</sup> A survey of registered dietitians living in Minnesota found that many dietitians believe that their clients’ health can be influenced by food production and distribution methods, but most (87% of those surveyed) reported that they did not discuss sustainable food choices with their clients.<sup>16</sup> Despite the growing interest and awareness of the benefits associated with supporting a sustainable and localized food system, there is a lack of research into the dietary and other health-related impacts of following a diet that is based on promoting sustainability. The exception to this statement would be the documented health benefits associated with following a plant-based diet.<sup>17</sup> A diet containing primarily locally produced foods is one example of a diet plan that could be used to promote sustainability in our globalized food system. It could be hypothesized that a diet containing locally produced foods would lead to healthy

food choices, because of the avoidance of processed and refined foods and the reliance on freshly harvested foods. However, no research exists to support this statement. The purpose of this pilot study was to examine the nutritional adequacy and dietary impacts in adults following a local food diet in southwestern Virginia.

## **METHODS**

### ***Overview***

To accomplish the purpose of this study, it was essential to define a “local food,” since there is currently no consensus on what exactly constitutes a local food. For the purpose of this study, the researchers defined a local food as a food that was grown (plant foods), raised (animal foods), or processed within 100 miles of an individual’s current residence. This definition was used because of the clarity of description of “local” and because of the growing popularity of the “100-Mile Diet.”<sup>7,8</sup> Nineteen adults who were willing to follow a local food diet (100-Mile Diet Challenge) for 4 consecutive weeks anytime during August and September 2006 were recruited.

### ***Study Participants***

Participants were recruited through newspaper advertisements, e-mail announcements, and recruitment flyers. Participants were screened prior to participation in the study to determine their eligibility. Exclusion criteria included age (adults only); the use of prescription medications for the treatment of heart disease or diabetes; dietary restrictions, such as a food allergy; a desire to lose weight; a family (or household) member already participating in the study; or subjects who reported already consuming a diet consisting primarily of locally grown foods. The study protocol was approved by the university’s institutional review board, and informed consent was obtained from all participants prior to their participation in the study. All participants received incentives to encourage their compliance with the study’s protocol and to cover any additional costs incurred by following the diet. At the beginning of the intervention, each participant received a box of local, staple food items (valued at approximately \$25) and \$25 in cash. Following the completion of the diet and all required measurements, the participants received an additional \$50 in cash.

### ***100-Mile-Diet Challenge***

All participants were expected to follow the local food diet (as previously defined) for 4 weeks. Due to some limitations in the dietary variety available within the 100-mile range, participants could also choose to consume foods that were produced within the state (Virginia) or one of the surrounding states (North Carolina, West Virginia, Tennessee) if they were not able to completely restrict their dietary intake to the 100-mile radius. Coffee and tea consumption was permitted, and participants were also able to purchase and consume any foods for sale at local farmers' markets (e.g., baked goods), even if these foods were not grown locally. These defined exemptions to the diet were permitted to encourage compliance with the restrictive diet plan and to ensure that the participants would be able to meet their dietary needs. Researchers informed participants that they were expected to comply with the local foods diet to the fullest extent possible and to fully disclose any discrepancies throughout the 4-week interval on their food records.

The researchers developed a resource guide to help the participants locate foods and markets and to plan menus while following the local food diet. This guide was given to the participants when they began the 100-Mile Diet Challenge along with articles about the benefits of eating locally produced foods, recipe cards, and a guidebook by a local author about local food markets in the region. In addition, the researchers used e-mail to communicate with participants providing further information and tips to encourage compliance. An e-mail listserv was also created to provide participants an avenue for communicating and sharing ideas with each other. Participants received a box of foods that were grown or processed within 100 miles and, therefore, acceptable while following the diet. This box contained locally grown produce, eggs, milk, butter, and honey and locally processed flour, cornmeal, apple cider, and potato chips. Participants were instructed to contact the researchers if they experienced any problems following the diet or finding enough foods to eat.

### ***Measurements***

Demographic information was obtained from all participants from a written questionnaire administered at baseline. Height (cm) and weight (kg) were measured by the researchers at baseline and after the completion of the 4-week intervention to measure body mass index (BMI) and to assess energy balance during the local food diet.

All participants received forms to record their dietary intake for 7 consecutive days prior to taking the 100-Mile-Diet Challenge (baseline),

and for 2 of the 4 weeks during the 100-Mile Diet Challenge. The researchers trained each participant individually in how to correctly complete the food records and provided the participants with examples of both complete and incomplete food records to emphasize the importance of accurate recording of food intake. Participants recorded on the food record where each item that they consumed was purchased and whether or not each item consumed was grown or processed within 100 miles. All participants also completed 7-day physical activity records during the weeks they recorded their dietary intake. Physical activity was recorded in minutes per day spent in activity, and the activity records were used by researchers to assess whether or not observed changes in body weight were a result of dietary changes. All participants were instructed to maintain their normal activity level while following the local food diet.

### ***Statistical Analysis***

Food records were entered into Nutritionist Pro<sup>18</sup> to estimate each participant's average daily intake of total energy (kcal/day), protein (g/kg body weight), total fat (percentage of total kcal), saturated fat (percentage of total kcal), and cholesterol (mg/day). Fruit and vegetable servings (cups/day) were determined by the researchers using the serving units recommended by MyPyramid.<sup>19</sup> To determine what proportion of the participants' diets were from local foods, the researchers used the food records to calculate each participant's percentage of calories from locally grown, locally processed, and non-local foods and beverages. Baseline values were compared to an average of the 2 weeks of reporting during the local foods diet using paired t-tests. Changes in physical activity patterns (minutes spent in physical activity/day) and body weight (kg) were also compared. All data were analyzed using Microsoft Excel<sup>20</sup> with statistical significance set as  $P < 0.05$ .

Using self-reported food records often leads to an underestimation of actual dietary intake, so the researchers compared each participant's self-reported energy intake to their estimated energy expenditure (EER) using standard formulas to estimate energy requirements in adults<sup>21</sup> in an attempt to improve the accuracy of the resulting data. Using the procedures explained by Goldberg,<sup>22</sup> the researchers identified participants whose self-reported energy intake was below 75% of their EER and therefore likely underreported their actual dietary intake. Data are presented both with and without these "underreporters."

## RESULTS AND DISCUSSION

Nineteen adults met all eligibility criteria to participate in the study and completed the 4-week local food diet. The 19 participants varied in age from 21 to 69 years (mean age = 40.5 years); 79% were female; 69% were married; 79% had earned a college degree (or higher); all were Caucasian; and all participants reported consuming some locally produced foods at baseline. The average BMI of the participants was 24.2 kg/m<sup>2</sup> (range: 19.1–32.3 kg/m<sup>2</sup>). The 4-week diet was effective in significantly ( $p < 0.05$ ) increasing local food consumption, as measured by the average intake of calories from locally grown and processed foods (Table 1). Compliance with the local food diet varied in study participants from a low of 56% of total energy consumed up to 99% of total energy consumed. Five participants were considered to be underreporters because their self-reported energy intake was well below their EER.

The local food diet led to a significant reduction in self-reported intakes of energy and protein, as well as a significant increase in the intakes of saturated fat, cholesterol, and daily servings of fruits and vegetables (Table 2). With the exception of total fat intake, these changes remained significant both with and without including the underreporters in the analysis. Changes in body weight, however, were significantly different only after removing the underreporters from the analysis ( $n = 14$ ).

TABLE 1. Compliance with a local food diet in adults living in Southwest Virginia\*

	All Participants ( $n = 19$ )		After Removing Underreporters ( $n = 14$ )	
	Baseline (%)	During 100-Mile Diet (%)	Baseline (%)	During 100-Mile Diet (%)
Intake of locally grown/raised foods (% kcal)	13 ± 12	60 ± 17 <sup>†</sup>	13 ± 10	57 ± 15 <sup>†</sup>
Intake of locally processed foods (% kcal)	2.2 ± 2.1	22 ± 11 <sup>†</sup>	2.1 ± 1.8	24 ± 11 <sup>†</sup>
Intake of non-local foods (% kcal)	85 ± 12	18 ± 12 <sup>†</sup>	85 ± 9	19 ± 12 <sup>†</sup>

\*All data are reported as means ± SD.

<sup>†</sup>Significantly different than baseline values, based on paired t-test ( $P < 0.05$ ).

TABLE 2. Dietary impacts when following a local food diet in adults living in Virginia\*

Dietary Variable	All Participants		After Removing Underreporters	
	Baseline (n = 19)	During 100-Mile Diet (n = 19)	Baseline (n = 14)	During 100-Mile Diet (n = 14)
Total calories (kcal)	1799 ± 260	1645 ± 340 <sup>†</sup>	1880 ± 200	1769 ± 279 <sup>†</sup>
Protein intake (g protein/kg body weight)	1.2 ± 0.3	1.1 ± 0.3 <sup>†</sup>	1.3 ± 0.2	1.1 ± 0.3 <sup>†</sup>
Total fat (% kcal)	36.3 ± 5.9	38.9 ± 7.0	36.5 ± 6.8	40.5 ± 7.3 <sup>†</sup>
Saturated fat (% kcal)	12.5 ± 1.8	14.4 ± 2.4 <sup>†</sup>	12.5 ± 2.0	14.9 ± 2.4 <sup>†</sup>
Cholesterol (mg/day)	325 ± 131	454 ± 218 <sup>†</sup>	332 ± 129	448 ± 160 <sup>†</sup>
Fruit and vegetable intake (cups/day)	3.0 ± 1.4	4.4 ± 1.4 <sup>†</sup>	3.0 ± 1.4	4.3 ± 1.6 <sup>†</sup>

\*All data are reported as means ± SD.

<sup>†</sup>Significantly different than baseline values, based on paired t-test (P < 0.05).

Eleven of these 14 participants (79%) lost weight during the 4-week diet, and the mean change in body weight for these 14 participants was  $-0.8$  kg (range:  $-3.5$  to  $+1.1$  kg). Minutes spent in physical activity did not change significantly when compared to baseline values, indicating that the observed changes in body weight were likely related to the reported changes in energy intake. Despite the reduction in protein intake while following the local food diet, protein intake remained well above the 0.8 grams per kilogram body weight needed to meet dietary protein requirements.<sup>23</sup> The increase in the intakes of saturated fat and dietary cholesterol is due to the limited availability of foods containing healthy fats within the 100-mile radius of southwestern Virginia. There were no vegetable oils, olive oil, nuts, seeds, or fresh sources of seafood available, so the participants replaced these foods with locally available options including butter, dairy, lard, beef, poultry, and pork (see Table 3 for a list of foods/food groups available). This observation suggests that diets restricting all foods not available locally may lead to adverse health consequences. However, since blood samples were not obtained from participants, it is unclear what impact the diet ultimately had on the study participants' blood lipid concentrations or other biomarkers of their health status.

The most positive result from this study was the significant increase in fruit and vegetable consumption. Compared to baseline values, the study participants increased their intake by almost 1.5 cups per day (based on

TABLE 3. Examples of foods available and unavailable for purchase within 100-mile diet range during August and September 2006 in Southwest Virginia

Food Group	Locally Grown/Raised Foods	Locally Processed Foods*	Popular Foods Not Available
Grains	None available	Flours (wheat, buckwheat), cornmeal, biscuit mixes, grits, breads from farmers market	Rice, pasta, ready-to-eat cereals, crackers, oats
Vegetables	Corn, cucumbers, lettuce, peppers, potatoes, squash, onions, eggplant, okra, greens, string beans, sweet potatoes, tomatoes	Potato chips	Out-of-season items, French fries
Fruits	Apples, blackberries, blueberries, grapes, melon, peaches, pears, raspberries	Apple juice/cider	Bananas/tropical fruits, citrus fruits, strawberries
Dairy products	Milk, butter, goat cheese, select varieties of cow's milk cheese	Ice cream	Yogurt, most types of cheeses
Meats/beans	Eggs, poultry, beef, lamb, pork, rabbit, venison	Sausage	Dried beans, nuts, seeds, fish
Fats/oils	Butter, lard, beef tallow, chicken fat		Vegetable oils, olive oil, margarine, avocados
Other food products	Honey	Beer, wine, peanut butter, any foods for sale at the farmers market	Chocolate, sugar, baking products, soda, salt/spices

\*Locally processed foods include foods that are processed within 100 miles but are not made exclusively from locally grown ingredients.

MyPyramid serving sizes/classifications of fruits and vegetables). This could lead to a significant reduction in chronic disease risk, and future studies may explore the impact of shopping at farmers' markets on fruit and vegetable intake in other populations. This study took place during the peak of the harvest season when there was a great variety of fresh produce items available at local farmers' markets; following a local food diet during the winter months may not lead to the same results due to the reduced availability of fresh fruits and vegetables. Other researchers have

shown increases in fruit and vegetable consumption in parents and their children involved in home gardening, likely a result of the increased availability of fresh produce in the home of families involved in gardening and to the positive role-modeling displayed by the parents who also consumed fresh produce.<sup>24</sup> Adolescents participating in a “garden-based” nutrition education program increased their consumption of fruits and vegetables more than their peers who received nutrition education without the additional garden activities.<sup>25</sup> These other studies lend support to the potential benefits of incorporating local and homegrown foods into future nutrition interventions.

A variety of national food assistance programs use locally produced foods either to promote healthy eating or to raise awareness about the significance of consuming local foods and their role in a sustainable food system. The Special Supplemental Nutrition Program for Women, Infants and Children (WIC) Farmers’ Market Nutrition Education Program is one example of a program that provides vouchers for the purchase of local produce to limited resource women and their families in certain states.<sup>26</sup> This program aims to benefit women of child-bearing age and their families through increasing the purchase (and hopefully consumption) of fresh fruits and vegetables. The Senior Farmers’ Market Nutrition Education Program provides eligible seniors with vouchers that can be used for the purchase of local produce at select farmers’ markets in the United States.<sup>27,28</sup> This program aims to improve the dietary quality of low-income seniors through the increased consumption of fresh produce items. Local foods are also on the menus in schools around the country, in part due to the efforts of local citizens and organizations such as the National Farm to School Program. The farm-to-school movement aims to incorporate fresh and local produce, meats, and other food items into meals served at public and private schools.<sup>29</sup> This program creates links between children, schools, and farms and has the potential to improve the diets of children, educate children about farming and where foods come from, and benefit farmers who are able to distribute their farm products directly to participating schools. All of these programs are great examples of the potential role that locally produced foods can play in promoting healthy food choices in different sections of the population (particularly improving fruit and vegetable consumption patterns). However, evaluations of these programs have not clearly demonstrated the potential positive dietary impacts on participants.

Many of the observations reported in this article are based on an analysis of the nutrient content of the foods and beverages consumed by

participants using NutritionistPro, a program using USDA data (as well as data from specific food brands). Many of the food items that the participants consumed were produced using sustainable food production methods including organically produced items, animals raised on pasture (as opposed to grain), and food items collected from the wild (including berries, mushrooms, and wild game). Recent research suggests that sustainable food production methods may improve the nutrient content of various food items. For example, research on fruits and vegetables grown using organic practices often reports higher levels of antioxidant compounds including vitamin C and phenolic compounds in organic varieties when compared to conventional varieties.<sup>30-32</sup> Additional research suggests that the essential fatty acid content is higher in beef, poultry, and eggs produced from animals that were raised on pasture as opposed to grains. For example, hens raised on grass as opposed to grain produce eggs with higher concentrations of omega-3 fatty acids and vitamin E,<sup>33</sup> and the meat of organic and free-range chickens provide higher levels of omega-3 fatty acids.<sup>34</sup> Beef and dairy products from animals raised on pasture are lower in total fat and higher in essential fatty acids than beef and dairy from animals raised on grain.<sup>35,36</sup> The diet analysis conducted by the researchers did not differentiate between these types of food production practices, as this information has not been incorporated into traditional food composition databases. The observation that participants in this study increased their consumption of saturated fat is based on the standard food composition database used, which did not differentiate between free-range and grain-fed animal products.

Several limitations to this study must be considered. First, there was a small sample size, and all study participants were Caucasian, reported consuming local and organic foods prior to their participation in the study, and most had obtained a college degree or higher. A sample population more representative of the general public would likely produce different results. Families who were not already familiar with the local foods and local markets in the region would likely not have been able to find enough food to eat and also would not have been as motivated to comply with the restrictive diet plan. Also, the study participants were allowed to consume foods that were “processed” within 100 miles, even if all of the ingredients in that food were not grown locally (Table 3). The researchers made this decision in order to make the diet less restrictive for the participants to follow and to increase compliance with the local food diet. In particular, the region did not produce any grains for sale at local markets.

Without this exclusion, an exclusive 100-mile diet would be absent of breads, cereals, and other grains. Several of the participants indicated that they did not consider these “locally processed” foods to be true examples of local foods because all of the ingredients did not originate from local soils and local farms.

The results from our pilot study suggest that when individuals follow a diet containing primarily locally produced foods there is a reduction in energy intake, as well as a slight reduction in body weight. This may be due to the lack of available foods; the lower energy density of the foods that were available; or the additional time and food preparation skills needed to prepare meals using locally sourced whole foods. While under-reporting on food records is common, it is possible that the participants may have intentionally not reported “non-local” foods on their food records, because they had previously indicated to the researchers that they understood that the purpose of the study was to consume a diet consisting only of local foods, to the extent possible. However, the significant reduction in body weight observed after following the 4-week local food diet suggests that there was a reduction in total energy intake and validates our findings. The 5 participants who reported consuming less than 75% of their EER likely omitted many non-local foods on their food records, because these participants did not lose significantly more weight than the other participants (data not reported). The reduced energy intake observed in this study population suggests that a local food diet may not always be able to meet dietary energy requirements; however, in the face of the increasing prevalence of obesity in the United States,<sup>37</sup> there may be opportunities for creative strategies using a local food diet to promote weight maintenance when combined with nutrition education and menu planning.

## **CONCLUSIONS**

Incorporating the perceived benefits associated with the purchase of local and sustainable foods into individual counseling sessions and nutrition education programs could provide individuals with a variety of reasons to make changes in their dietary patterns. Future research studies may want to combine a “local food” campaign with a more targeted nutrition message to encourage individuals to adopt a diet based on healthy, local foods with the ultimate goal of improving the diets of Americans while simultaneously promoting a sustainable food system. This pilot

study did not emphasize a healthy eating pattern, only following a local food diet.

Conclusions about the nutritional impact of following the 100-Mile Diet cannot be made based on the foods available in only one region of the United States. Future studies are needed in other geographical regions and will likely produce very different results, due to the differences in the food options available in those other regions of the country. For example, populations living closer to the coast would have seafood available and would be less likely to see the increase in saturated fat intake observed in the present study. Food and nutrition professionals need to be aware that many consumers are interested in local eating, and that a diet comprised exclusively of locally produced foods could potentially lead to both positive dietary changes (such as an increase in fresh produce consumption) as well as potential negative consequences (such as an increase in saturated fat consumption).

Food and nutrition professionals should educate themselves about their local food system, so that they will be able to promote the healthier, local food choices, as well as be aware of specific food items or even entire food groups that may not be available locally. Many consumers want information about the foods they purchase, including where the food was produced, how it was produced, and whether or not the animals or farmworkers involved in food production were treated humanely.<sup>38</sup> Nutritionists and health professionals need to become aware of what foods are available (and what foods are not available) in their area and how these foods can be incorporated into a balanced diet. Web sites such as Local Harvest and the Eat Well Guide<sup>12-13</sup> allow users to search by their ZIP code to search for local foods produced in their area.

Currently, there is no consistent definition of a “local” food. In this study, a local food was defined as one produced or processed within 100 miles of an individual’s residence. However, this definition was chosen for its simplicity and because of the growing popularity of the “locavore” movement and the 100-Mile Diet. Local foods could also be defined by geographic borders, such as “New River Valley”; by political borders, such as counties or states; or even by the type of market structure, such as purchasing directly from farmers versus purchasing from supermarkets.<sup>39,40</sup> More research is needed to further explore both the changing consumer perceptions of sustainable and local food systems as well as the dietary and health-related impacts of following a diet based on promoting sustainability in our food system.

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