

Do Farm-to-School Programs Make a Difference? Findings and Future Research Needs

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ABSTRACT. Farm-to-school programs are increasing in number across the United States, yet research and evaluation of programs is limited, with only a few studies published in refereed journals. For this article we

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reviewed 38 studies and report on 15 studies that met the inclusion criteria. These preliminary findings are related to the impacts of farm-to-school programs on behavior of students, school teachers and administrators, food service, farmers and producers, and parents, as well as knowledge gains and attitudinal changes. Further evaluation and research are needed to improve practice and assist programs in meeting their goals.

KEYWORDS. Farm to school, school meal programs, dietary behaviors, obesity, agriculture, local foods

INTRODUCTION

Farm-to-school programs have increased dramatically in number over the past decade, rising from fewer than 10 in 1998 to more than 1,100 in 2007.¹ The visibility of these programs in policy, educational, and agricultural communities has also increased. Farm-to-school is broadly defined for the purposes of this article as a school-based program that connects schools (K-12) and local farms with the objectives of serving local and healthy foods in school cafeterias or classrooms, improving student nutrition, providing health and nutrition education opportunities, and supporting small and medium-sized local and regional farmers. Comprehensive farm-to-school programs engage in a variety of activities to achieve these goals. For example, in Riverside, California, elementary school students participate in a Harvest of the Month program in the classroom, learning about and tasting fruits and vegetables that are locally grown and seasonally available. Students also see these foods on their daily farm-fresh salad bar in the cafeteria.² The Wisconsin Homegrown Lunch is bringing locally grown produce into meal and snack programs;³ it also includes farm field trips and fundraisers incorporating locally grown items.⁴ In northeast states such as New Hampshire and New York, local apples are making their way into school cafeterias.^{2,5} No matter where they are located, farm-to-school programs have the potential to create connections among classrooms, cafeterias, and gardens, involving teachers, students, cafeteria workers, parents, administrators and farmers in activities that support good health, nutrition, agriculture and the local economy.

Farm-to-school programs can be discussed in the larger context of health and environmental and agricultural crises that are gaining public attention and threatening the long-term sustainability of food systems. Specifically, recent changes in the food system have had impacts on

human health and small and medium-size farm viability and are addressed below.

The prevalence of obesity and overweight has been elevated to a major public health concern in the United States. Between 1999–2000 and 2003–2004, the prevalence of overweight rose from 13.8% to 16.0% among girls and from 14.0% to 18.2% among boys.⁶ Corresponding diet-related diseases, such as type 2 diabetes, are also increasing in prevalence⁷ and are of concern to health professionals and policymakers.

A variety of school-based obesity prevention efforts have been implemented and evaluated with varying degrees of success in increasing students' consumption of healthy foods, such as fruits and vegetables. Nutrition education programs have yielded slight increases in fruit and vegetable consumption among students, ranging from 0.2 to 0.99 servings/day.^{8,9} Research on salad bar offerings showed no significant difference in fruit and vegetable consumption between self-serve and preportioned salad bar meals. Researchers did find, however, that the greatest variety of items offered led to the greatest number of fruit and vegetable servings consumed.¹⁰ School gardens are another strategy for improving nutrition and educational outcomes in school settings, but scant research has been conducted to evaluate outcomes associated with gardening programs.¹¹ There is evidence to suggest that teachers perceive gardens to be "somewhat to very effective at enhancing academic performance, physical activity, language arts, and healthful eating habits."¹² In comparing the impacts of classroom-based nutrition education and hands-on gardening activities, research conducted with fourth-graders documented a significant and lasting increase in knowledge and preference for vegetables among students who received nutrition education and those who participated in nutrition education combined with gardening, as compared to a control group.¹³

In addition to changes in health and weight status, the agricultural industry has also undergone major changes in recent decades, as it has become increasingly marked by global competition and U.S. agricultural and trade policies that favor large farms. Small farms are experiencing hardships due to inaccessible markets, cheap imports, and high packing and distribution costs per unit for small volumes.¹⁴ According to the 2002 U.S. Census of Agriculture the number of small farms decreased about 4% between 1997 and 2002. Farms with sales under \$2,500 (the smallest category) and those over \$500,000 (the largest farms) increased in number, but farms with sales in all categories between \$2,500 to \$499,999 decreased in number.¹⁵ This phenomenon has been called "the disappearing

middle." With changing conditions, some small and medium-sized farms have sought alternative markets, such as farmers markets, cooperatives, and community-supported agriculture. Institutional markets are another venue for small and medium-sized farms, as the demand for local and sustainably produced food is increasing at schools, colleges and universities, and hospitals nationwide.

As farmers, school districts, and communities begin to see the potential in forming partnerships, a variety of interesting models have developed. While a variety of evaluations have been conducted on farm-to-school programs, most are not widely published, and because the data have not been collected in consistent ways it has been difficult to compare results across studies. The purpose of this article is to consolidate and evaluate emerging evaluation research, discuss the strengths and weaknesses of evaluation findings, and suggest a future research agenda to better understand the impacts of farm to school programs.

APPROACH

Thirty-eight farm-to-school evaluation reports and studies were reviewed for this article. Most of them were written as progress or evaluation reports to funding agencies. Only 4 were peer-reviewed, though 3 of those did not address program outcomes and impacts. A smaller set of 15 studies was selected for the purposes of this article, based on the following criteria:

- The study included quantitative data on outcomes, particularly behavioral outcomes.
- The study was comprehensive in approach.
- The study described the methods for gathering the data.
- Data was gathered in consistent ways including the use of surveys, interviews, focus groups, and other standard methods.

This article includes data from the 15 selected studies on behavioral outcomes at an individual level, as well as broader changes in practices at the institutional level that are a result of farm-to-school programs. As we read through all 15 studies focusing on the behavioral changes, 3 basic categories emerged—individual changes, school food operational changes, and financial changes at the farm level. Individual behavior changes include changes in diets and other behaviors of school students,

teachers, food service staff and parents; changes in food service operations and ways of serving local foods; and changes in farm sales transactions. Where relevant, knowledge and attitudinal changes associated with farm-to-school programs have also been reported, as these could lead to longer-term behavior changes.

FINDINGS AND ANALYSIS

We reviewed 15 studies¹⁶⁻³⁰ that include data on behavioral outcomes associated with farm to school programs, including dietary changes, consumption patterns, and other behavioral changes in students, teachers, food service staff and parents; student and teacher participation in the school meal program; serving methods and purchasing decisions made by food service staff; food sales by farmers; grocery shopping and frequency of home-cooking by parents. These studies also highlight knowledge and attitudinal changes among the above mentioned groups of people.

Changes in Students

Changes in student dietary behaviors related to fruit and vegetable consumption are most relevant to farm-to-school since most programs incorporate local produce, though some programs also include other local items such as meat, eggs, dairy products, and honey. Also pertinent are changes students make related to healthy lifestyles and school meal participation and gains in knowledge and attitudes about local foods and nutrition. Evaluation study designs vary greatly, though findings consistently indicate that the farm-to-school approach results in students eating more fruits and vegetables per day in the cafeteria, classroom, or at home, making positive lifestyle changes, as well as improving knowledge and attitudes about healthy eating and sustainable agriculture. Table 1 highlights various evaluation study designs and indicators used to assess (a) changes in student behaviors, (b) knowledge and attitudes, and (c) weight/height changes. Specific outcome data on these indicators is detailed below.

Student Dietary Behaviors—see Table 1, Column A1

Of the total 15 studies reviewed for this article, 11 assessed student dietary behavior changes resulting from a farm-to-school program. Of those, 10 studies^{16-23,25,26} corroborated the hypothesis that positive dietary behaviors result when students are served more fruits and vegetables,

TABLE 1. Farm to school studies reporting changes among students

Study Sites(s)	Types of Student Changes/Indicators Used			Research Study Design	Citation #
	(A) Student Behaviors	(B) Student Knowledge & Attitudes	(C) Weight/Height Changes		
School District/City, State School(s)					
	(1) Increase in Fruit & Vegetable (FV) Consumption	(2) Increase in School Meal Participation	(3) Positive Lifestyle Changes		
	At school				
	Outside school				
Portland, OR Abermethy Elementary School	Food production records used as proxy	School records		Control-experimental	16
Olympia, WA Pioneer & Lincoln Elementary Schools	Food production records used as proxy	School records	Increase in Knowledge about Local Foods, Nutrition, Health	Pre-post for meal participation; control-experimental for FV consumption	17
Riverside, CA Jefferson Elementary School	Food production records used as proxy	School records	Positive Attitudinal Changes Regarding New, Healthy Foods	Pre-post	18
Compton Unified, CA Willard & Caldwell Elementary Schools	Food production records used as proxy Digital photos of school lunch trays	School records		Control-experimental	19

Davis Joint Unified, CA Elementary Schools Winters Joint Unified, CA Rominger & Waggoner Elementary Schools	Food production records used as proxy Plate waste study	School records	Control- experimental	20,25
Los Angeles Unified, CA 5th Street, Castelar, & 49th Street Elementary Schools	24-hour dietary recall	24-hour dietary recall	Pre-post	21
Chicago Public Schools, IL Lozano Bilingual Charter School Burlington, VT Elementary & Middle Schools	Informal class polls Student surveys	Informal class polls Student surveys	Pre-post	22
Philadelphia, PA Kindergarten Classrooms	Parental survey (no change observed)	Parent surveys	No control schools or pre-tests conducted Control- experimental	23
		Surveys (no change observed)	(no change observed)	24
		Student surveys (increased knowledge on health and nutrition issues; mixed results on food source)	Student surveys	
Ventura Unified, CA Juanamaria Elementary School	Observation of salad bar trays Plate waste study	Student surveys School records	Control- experimental	26
Berkeley Unified, CA Martin Luther King Jr. Elementary School		Student interviews and surveys	Pre-post	27
Wyoming, MI Wyoming Public Schools		Student poll Student poll	No control schools or pre-tests conducted	28

especially when the product is fresh, locally grown, picked at the peak of their flavor, and supplemented by educational activities, and one reported no substantial changes in student dietary behaviors as a result of the farm to school program.²⁴ Of the 11 studies, 8 reported on programs with a farm-to-school salad bar in the cafeteria,^{16-21,25,26} one incorporated local foods in the cafeteria without a salad bar model,²³ and two conducted classroom-based education using local foods.^{22,24} Of the 8 salad bar programs, 7 found an increase in the range of 25% to 84% more fruit and vegetable servings consumed by students.^{16-21,25} One study reported that 75% of students receiving the farm-to-school salad bar chose a balanced meal without adult intervention as compared to 46% of control students.²⁶ Another of the 8 salad bar programs also reported a reduction in the amounts of total calories, cholesterol, and total fat in students' daily diets as a result of the farm to school program in the cafeteria.²¹ The program with the non-salad bar model in the cafeteria found that 60% of the students reported eating more fruit as compared to a previous year when the farm to school program was not operational.²³ Of the two programs using local foods in classroom-based education, one demonstrated that 51% of the students reported eating more fruits and vegetables as a result of the classroom activities,²² while the other reported no changes in fruit and vegetable consumption among students.²⁴

It is important to note that although farm to school is predominantly a school-based intervention, some programs aim to influence dietary behaviors outside of school. Five of the 11 programs studied student dietary behaviors outside of the school, with 4 finding increases in fruit and vegetable consumption outside of school.^{21-23,26}

School Meal Participation—see Table 1, Column A2

Another measure of student behavior is participation in the school meal program. Analysis of school meal participation has been used by farm-to-school researchers to study impacts on food choices. This indicator is relevant both when the farm-to-school meal is the only choice in a school cafeteria and when there are other options available for students. A total of 7 studies reported a substantial increase in student participation in the school meal program, ranging from 1.3% to 16.0% for all meals (free, reduced, and fully paid meals).^{16-20,25,26} The average increase in student meal participation based on data from 6 of these studies is 9.3%,^{16-18,20,25,26} with the seventh site being a Provision II district,¹⁹ where all students eat lunch free. An increase in meal participation is particularly important

because more students eating school meals may increase revenue for the school food service program. One study reported that the farm-to-school salad bar was more popular than all 12 hot entrees offered on salad bar days, since twice as many students chose the salad bar over the hot entrees on any given day.²⁶ Another study interviewed students and found that 44% preferred the farm-to-school meal over what was served before the program was initiated at the school.¹⁶ It has been observed that meal participation rates in farm to school programs typically peak when the program is initiated and decline somewhat after the novelty factor has worn off but are maintained at levels higher than pre-farm-to-school program.²⁵

Lifestyle Changes—see Table 1, Column A3

Three studies assessed lifestyle changes beyond diet resulting from farm-to-school programs. Two studies report positively on this indicator; for example, with parents reporting positive changes in social skills and self-esteem, responsible behaviors, saving money, and an improved work ethic among children²² and students reporting increase in physical activity.²² One study reports no substantial change in lifestyle behaviors observed among control and experimental school students with respect to the number of hours spent in front of the television, playing video games, or using a computer.²⁴

Student Knowledge and Attitudes—see Table 1, Column B

Four studies reviewed revealed the impacts of farm-to-school educational activities conducted either in the classroom or outside of it, on topics including nutrition and health, local foods and agriculture, and environment and ecosystems.^{22,24,27,28} They showed an increase in student knowledge about growing cycles and sustainable agriculture²⁷ and knowledge of gardening skills with an ability to identify plants grown in the garden.²⁸ Data from one study found an 8% increase in correct student responses regarding seasonality of foods and the ability to identify foods grown in the region after the educational program was implemented.²²

Another study reported on several outcomes related to increases in student knowledge.²⁴ Before a farm trip, 33% of students responded correctly about where food comes from, and 88% responded correctly to the question afterwards. During an activity aimed at sequencing cards in the order food travels from farm to table, 12% of students responded correctly on the pretest, compared to 52% of students on the posttest.

Whereas only 50% of the students were aware of the daily fruit and vegetable consumption recommendation before the program, 80% of students were aware of this afterwards. Students participating in the program could correctly identify healthier options to buy in a supermarket (62% pre-program as compared to 90% post-program). Additionally, 88% of students in experimental schools were able to correctly identify high-sugar products by reading food labels as compared to 72% of students in control schools. However, in the same study, more students in control schools were able to correctly identify products with high-fat content than those in experimental schools.

Three farm-to-school programs that included nutrition education also reported positive changes in student attitudes about trying out new, healthy foods.^{22,24,28}

Weight/Height Changes

Only one study evaluated body mass index (BMI) as an indicator for farm to school success in impacting children's health. As a result of the one-year intervention, researchers did not find any significant decreases in BMI for students in the experimental schools.²⁴

Changes in School Teacher and Administration Behaviors

Data on school teacher and administrator behaviors are scarce, with only 3 studies including this information. In one study, as many as 71% of surveyed teachers at a school with an operational farm-to-school program reported making changes to their dietary behaviors as a result of the program.²³ Teacher and staff participation in the school meal program increased markedly at one school from 1.9% (6 lunches per month) to 28.8% (133 lunches per month), demonstrating a clear preference for the farm-to-school meal.¹⁸ At another site, teachers and school staff chose farm-to-school salad bar at an average of 14 to 1 versus the hot lunch. Interviews with teachers confirmed this preference for the farm-to-school salad bar lunch.²⁶

Changes in Food Service Behaviors

Six studies have been conducted to assess changes in food service.^{18,20,23,25,26,29} One study found that the food service program modified what was served to school children through the development and use of seasonal recipes incorporating local foods.²⁹ In another study, kitchen staff tried new ways of incorporating raw vegetables into sandwiches and found new ways of incorporating local foods into the

menu.²³ Other changes in food service operations are demonstrated through the purchase of more farm-fresh products from local farmers, distributors, and businesses. The variations in local purchasing from peak to off-peak growing season can be substantial. Regional variations in growing seasons can also greatly impact the availability of fresh fruits and vegetables. However, one common feature observed is the initial increase in local purchasing as the farm-to-school program becomes established.^{18,20,23,25,26} As the program progresses, local purchasing may decrease or level off due to financial constraints, as observed in two school districts.^{20,25}

Changes in Farmer Behaviors

Farmer participation and sales data in farm-to-school programs are limited. Of the 4 studies that provided direct sales data, total annual sales for farmers ranged from \$8,000 to \$55,000,^{18,20,25,30} with programs varying considerably in size and number of sites operational. Sales were spread over 2 to 27 farmers with estimated average annual sales per farmer ranging from \$845 to \$7,650.^{18,25} Sales per farmer were higher in programs where only a few farmers were involved.¹⁸ In other cases, 8 or 9 farmers on small farms participated at different times throughout the year as well as one farmer cooperative with 18 farmers.^{20,25} For most farmers, income from the farm-to-school program remained modest and represented less than 5% of total income. For one farmer in one study, sales to the school district for a single popular fruit (kiwi) represented up to 40% of total direct sales.²⁵

Most foods were purchased directly from individual farmers with the exception of the one cooperative. One study provided data about a 3-year contract for in-state farmers to supply a large urban school district with apples (partially processed slices). Although sales averaged \$1.4 million/year, it is unclear how many farmers in the state benefited from these sales and through which distribution channels.²⁹

Despite the fact that total and individual sales were modest, most participating farmers were initially enthusiastic about the program.³² Some also conducted farm tours or classroom educational activities. They tended to see these efforts as a way to create synergy between the educational institutions, agriculture, and community, with the added potential benefit of additional sales through other venues.^{20,25,32}

Changes in Parent Behaviors

Research on changes in overall dietary behaviors of the parents and families whose children participate in a farm-to-school program is limited.

Three studies that incorporated a parent education component with the farm-to-school program have reported positive changes in parental behaviors, knowledge, and attitudes.²²⁻²⁴ Of these, one reported a slight increase in parental ease and interest in encouraging their children to eat healthy snacks and meals, and 90% of parents self-reported positive changes in grocery shopping patterns, cooking at home, and conversations with their children about food choices. The same study also reported an increase in parental knowledge and awareness about the importance of healthy foods and good nutrition in their families.²² The second study revealed that 32% of parent respondents believed that their family diet had improved due to their child's participation in the farm to school program; 32% reported buying more local foods; 45% were willing to pay more for the school's hot lunch if it contained food from local farms; and 90% believed that lessons on food, farms, and nutrition would affect children's long-term food choices.²³ The third study reported that after a year of participation in the farm-to-school program, 97% of parents self-reported via a survey that they believe buying locally grown foods was "important" or "somewhat important."²⁴

DISCUSSION AND FUTURE RESEARCH NEEDS

The findings on farm-to-school impacts are preliminary, yet they suggest some potential trends in behavior changes that could result in healthier lifestyles for children and more diversified income streams for regional growers. We also acknowledge that there are limitations to the data.

Limitations

The studies included in this analysis met our selection criteria, but because of the nascent stage of research and evaluation in this field, few employed rigorous evaluation designs. A majority of the data on impacts was gathered by people also involved in organizing the farm-to-school programs, potentially biasing the report compared to information collected by an external evaluation consultant. On the other hand, many farm-to-school programs also subscribe to the notion of participatory action research and "empowerment evaluation" in which the evaluator is a community participant and guide to help the program improve its own practices and build its capacity.³³ Due to resource constraints, many of the selected studies have assessed short-term and medium-term outcomes

instead of long-term health indicators. Another limitation of the impact data summarized here is that only a limited number of study designs included control groups and few included statistical analyses of results. Only one was peer-reviewed and published in an academic journal.²¹ Despite this, we deliberately chose studies in which the evaluation findings were backed up by clearly described methodologies and data.

If the data and methodological limitations of these studies are accepted, the findings themselves bring up a number of questions for consideration and point to future research needs.

Role of School Food Service and Teachers

The studies reviewed in this article described very little about changes in knowledge, attitudes, or perceptions of food service workers or directors as a result of farm-to-school programs. Anecdotally and in one research article,³⁴ reports have asserted that if not for the day-to-day work and communication of food service personnel with children, dietary behavioral impacts on students would not be as positive. We believe that food service workers are dietary "gatekeepers" and more research and outreach needs to be directed toward them. Another important influence in a child's day at school is the teacher. More data are needed on the role teachers can play to impact student dietary choices, such as modeling healthy eating and lifestyle behaviors and making connections between the cafeteria and the classroom.

Demand Issues: Student Behaviors

Two reports have studied food consumption (or proxy) data at two school districts for time periods longer than 2 years.^{20,25} Although consumption usually spikes during a new program, food service directors themselves admit that it is hard to maintain. A clearer understanding of what factors are responsible for maintaining high participation numbers in farm-to-school programs is needed. Comparative studies that highlight the impacts of various kinds of interventions (cafeteria, school garden, nutrition education, farm visits) on children's food choices in farm-to-school programs are needed to understand the role of each of the components of farm-to-school and of its role as a whole. Similarly, more data are needed about what dietary changes can be facilitated and sustained in home settings, such as eating and shopping patterns in children and their families, and whether or not there is a causal relationship with the establishment of a farm-to-school program. Whether a causal relationship

exists between farm-to-school programs and potential health and psychosocial outcomes is yet to be determined. Much more extensive research is required to ascertain the impacts of farm-to-school on lasting dietary behaviors that go beyond fruits and vegetables and outside of the school setting. Finally, "consumption" data for all except studies using plate waste data is based on what children "take" on their plates. More plate waste studies are needed to determine exactly what children are eating through farm-to-school programs.

Supply Issues: Farmers

One of the key dimensions of farm-to-school programs is that school cafeterias purchase foods from local growers. The definitions of local, however, are far from consistent, varying from 50–100 miles to statewide to a region. It is therefore difficult to compare results across programs unless a very broad view is taken. Additionally, the term "local" may be associated with other attributes such as "grown on a small-scale family farm" or "directly sold by farmer" or even "sustainably grown" and "organic," which may or may not be an aspect of the program. In future studies, it will be important to portray all of these dimensions as accurately as possible so the conditions under which successful programs can function best are known. Future research should assess other changes farmers might make as a result of a farm-to-school program such as planting patterns and marketing venues, product diversification, and the likelihood of expanding institutional sales to include other local institutions.

Policy Considerations

Policy contributions to institutional change can be fairly clear, but their influences on individual behavior change are indirect at best. There has been very little research focus on policy changes and how they impact programs and people in farm-to-school programs. Policies have the potential to guide program direction, and program outcomes can help in crafting relevant policies. We need more research on best practices in connecting policy and program work and effectively engaging the broader community in that process. Additional evaluation in this area could help policymakers and decision-makers considerably in the future.

Community Involvement

There are no studies that explore the relationship between farm-to-school programs and changes in the community, such as participation in

community events, partnerships, leadership development in the community, and social networks.

Factors that Contribute to Success

The studies reviewed for this article mostly focus on whether or not there was success as defined by behavioral changes. There are, of course, many other ways to measure success of farm-to-school programs such as through policy changes, institutional changes, and landscape or environmental changes. Although not measured directly in most cases, several studies suggest a few key elements that have contributed to success. They include the following:

- Leadership development: Most successful farm-to-school programs have developed or secured active leaders and champions to guide the programs forward through complex political and institutional barriers to achieve their goals.
- Complementary partnerships: Successful programs involve diverse stakeholders (including community-based NGOs, cooperative extension programs) that support the program in a variety of ways both from within and outside the school district.
- Creative, resourceful use of assets (financial, social, physical): Leaders and community farm-to-school teams have become adept at skillfully leveraging resources to deal with hurdles as they arise.

Tradeoffs: Behavior Change Versus Cost

Although the preliminary behavioral impacts of farm-to-school programs have expanded exponentially in the last decade, most schools still do not embrace the program. The main reason cited is cost. With some exceptions, farm-to-school programs cost school districts more money in labor costs to prepare raw foods, monitor salad bars, and clean up; local and/or organic food costs; transaction costs to set up new invoicing and delivery arrangements; and training food service workers in new prep/storage procedures. The question is, who should pay? Should parents pay more for school meals? Should local school districts sponsor new bonds so all taxpayers share in the cost? Should the state find resources (reallocations or new taxes) to help finance farm-to-school startups? In the current reality, school districts are expected to find new resources through grants or reallocations to fund farm-to-school programs. This puts an incredible strain on these institutions. Furthermore, farm-to-school programs

are counted as "operations" in a school district, instead of as an educational resource. Therefore, funds that are available to the rest of the institution as part of its educational mission are not available for the important experiential learning about food, agriculture, and health that children absorb in their cafeterias and school gardens. If society values children's health and the health of communities and local farmland, we must be willing to invest in it. Having more robust impact research on farm-to-school programs will help to guide those decisions.

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