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The Effects of School Garden Experiences on Middle School–Aged Students' Knowledge, Attitudes, and Behaviors Associated With Vegetable Consumption

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This study describes the effects of garden-based education on children's vegetable consumption. As part of a pre–post panel study, 236 students complete the Garden Vegetable Frequency Questionnaire and 161 complete a taste test. Results indicate that school gardening may affect children's vegetable consumption, including improved recognition of, attitudes toward, preferences for, and willingness to taste vegetables. Gardening also increases the variety of vegetables eaten. Future research should explore whether effects persist over time and if and how changes in children's behavior affect the behavior of their caregivers. Implications of study findings for policy and practice are discussed. Suggestions for applying results to future health promotions are provided.

Keywords: *school garden; vegetable consumption; food preferences; garden-based education*

Consumption of the recommended amount of fruits and vegetables is associated with prevention and control of many chronic conditions such as diabetes, hypertension, obesity, cardiovascular diseases, and some cancers (Hung et al., 2004; Roberts & Barnard, 2005; Van Duyn & Pivonka, 2000). Because national consumption rates of fruits and vegetables are lower than recommended, efforts are under way to identify innovative and effective approaches to increase intake (Guenther, Dodd, Reedy, & Krebs-Smith, 2006). Interventions that target children living in low-income urban communities are particularly important because adult eating patterns are developed early in life, because these populations are burdened with higher rates of preventable diseases linked to poor diets and nutritional intake, and because these communities often have less access to affordable healthy foods, especially fresh fruits and vegetables (Morland & Filomena, 2007; Morland, Wing, Diez Roux, & Poole, 2002; O'Dea, 2004; Sandeno, Wolf, Drake, & Reicks, 2000; Story, Kaphingst, Robinson-O'Brien, & Glanz, 2008; U.S. Department of Health and Human Services, 2000; Zenk et al., 2005). School garden programs have been identified as an intervention that may successfully and cost-effectively address these problems.

School garden programs pair classroom instruction with garden-related activities in which students plant,

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nurture, harvest, and often consume produce grown in the schoolyard. These programs may promote academic achievement, fruit and vegetable consumption, physical activity, ecoliteracy, and positive youth development. Most recently, school garden programs are being designed to simultaneously achieve gains in all of these areas. Educators use garden-based pedagogy in a broad range of subjects, including science, math, social studies, language arts, environmental studies, nutrition, and physical education, and as part of community service projects (Desmond, Grieshop, & Subramaniam, 2002; Graham, Beall, Lussier, McLaughlin, & Zidenberg-Cherr, 2005).

School garden programs have several advantages over other types of health promotion and nutrition interventions. They are relatively inexpensive to establish and maintain and take place on-site. Work in the garden can be integrated into and enhance existing curriculum. Because garden education can support educational goals while addressing multiple, interrelated issues associated with health, they are more likely to be adopted by teachers (Alexander, North, & Hendren, 1995; Canaris, 1995).

Gardens may enhance a school's curricular, physical, and social learning environments in ways that are predicted by the social cognitive theory to influence children's knowledge of, attitudes and preferences for, and consumption of vegetables. Specifically, the social cognitive theory's multiple constructs (e.g., observational learning, self-efficacy, and reciprocal determinism) describe the dynamic interaction between environmental, personal, and behavioral factors to explain people's behaviors (Bandura, 1986). These constructs, together with additional model building research to further explain fruit and vegetable consumption in children (Reynolds, Hinton, Shewchuk, & Hickey, 1999), suggest that the presence of a garden alters the school's learning environments in ways that may directly and indirectly influence children's vegetable consumption. For example, gardens enhance a school's curricular learning environment by providing engaging hands-on education that reinforces nutrition education. Gardens also alter the school's physical and social learning environments by increasing the availability and accessibility of fruits and vegetables while improving student's self-efficacy for consuming them, and by providing opportunities for adult and peer modeling of the preparation and consumption of fruits and vegetables (Morris, Briggs, & Zidenberg-Cherr, 2000).

A recent review of garden-based youth nutrition interventions in the United States suggests that these programs have the potential to improve students' vegetable intake, willingness to taste fruits and vegetables, and preferences for them; however, it also reveals that the literature is sparse and suffers from many limitations (Robinson-O'Brien, Story, & Heim, 2009). Few peer-reviewed studies that examine the effects of school gardens have been published, resulting in a serious gap between research and evidence-based practice (Ozer, 2007).

Across the country, school garden programs are increasingly popular. Meanwhile, existing and pending policies on the local, state, and national levels demonstrate an increase in and potential for funding and support of school gardens (California Instructional School Gardens, 2006; Child Nutrition and WIC Reauthorization Act, 2004). There is a need for evidence-based studies to understand the impacts of school gardens and to inform development of programs and policies. Policy makers, and the teachers they support, need to better understand if and how school gardens improve children's well-being.

This paper reports on a study that investigated the impact of participating in a school garden program on low-income, racially and ethnically diverse urban middle school–aged students' ability to identify, willingness to try, preference for, and overall consumption of vegetables.

METHOD

This study used a quasi-experimental, pre–post panel design. The study sample consists of 320 sixth-grade students 11 to 13 years of age enrolled at two intervention schools ($n = 170$) and one control school ($n = 150$) in the San Francisco Unified School District. More than 90% of the study population consists of students of color (22% African American, 29% Asian American, 9% Filipino American, 30% Latino, 3% Pacific Islander,

TABLE 1
Description of Intervention, Including Rationale for Intervention, Projected Outcomes, and Students' Exposure to Garden-Based Learning Experiences

Average dose	• 1 hr/week for 13 weeks. Each hour-long session consisted of approximately 20 min of instruction followed by 40 min of hands-on garden experiences
Conceptual framework	• Social cognitive theory constructs and additional model building research to further explain fruit and vegetable consumption in children (Bandura, 1986; Reynolds, Hinton, Shewchuk, & Hickey, 1999)
Learning objectives and content covered	• Science concepts taught included soils, photosynthesis, decomposition, cycles, food web, and climate change • Health concepts taught included nutrients, food labels, the Food Guide Pyramid, and goal setting
Projected outcomes	• Garden experiences will improve students' ability to correctly identify vegetables, their willingness to taste them, the variety they eat, and their consumption of them.
Curricular and gardening activities	• Jaffe & Appeal (1990) • Morris & Zidenberg-Cherr (2001) • Bruton, Ong, & Geeting (2000)
Planting activities	• Students planted seeds, transplanted starts, and planted mature plants at least four times • Students planted flowers, herbs, and vegetables
Tending activities	• Students watered during class at least five times • Students were permitted to water the garden without direct teacher supervision if they completed the required class assignments satisfactorily • Students weeded during class at least five times • Students dug new beds at least five times • Students covered garden paths with mulch at least five times • Students mixed compost with soil to prepare beds at least three times
Harvesting activities	• Students collected seeds for next year at least once • Students harvested, washed, and prepared garden-grown vegetables at least four times
Preparing and consuming activities	• Students ate vegetables raw from the garden at least three times • Students prepared and cooked ethnically diverse meals in class using garden-grown produce at least four times
Community events	• Students hosted a "salad day" where they served 75 heads of lettuce that they grew to the entire student body during lunchtime in the cafeteria • 30 students, along with their families, friends, administrators, and teachers, participated in an optional Saturday garden work party

and 7% White [not Hispanic] or other). Of these, 22% were English-Language Learners; 35% were overweight, based on body mass index; and 64% were low-income, based on eligibility to receive free and reduced-price lunch.

Students at both intervention sites participated in garden-based learning sessions that were integrated into their regularly scheduled science class. The total session time was approximately 1 hr a week across a 4-month time period, for a total dose of 13 hr. Each hour-long session consisted of approximately 20 min of instruction in either the classroom or garden, followed by 40 min of hands-on experiences in the garden. Selection of intervention activities was informed by existing theory developed in partnership with teachers at the two school garden sites (Bandura, 1986; Reynolds et al., 1999). Preexisting garden-based learning activities were paired with science and health education learning objectives for sixth-grade students (Bruton, Ong, & Geeting, 2000; Jaffe & Appeal, 1990; Morris & Zidenberg-Cherr, 2001). Garden activities were chosen to maximize students' exposure to vegetables and peer and adult modeling through the cyclical garden activities of planting, tending, harvesting, preparing, and consuming produce. Community events were also included to allow students in the garden group an opportunity to model behaviors to their peers and family as well as an opportunity to expose family, friends, and caregivers to garden activities. Table 1 details the intervention and students' exposure to the specific garden activities.

Intervention Site 1 had a garden space of approximately 1500 square feet. The garden at Intervention Site 2 was approximately 10,000 square feet. Despite the difference in garden size, garden-based learning activities implemented at each site were similar. The control school site covered the same health and science learning objectives but did not include a gardening program.

Knowledge, attitudes, and behavior toward vegetables were measured by two self-administered surveys, the Garden Vegetables Frequency Questionnaire (GVFQ) and the Taste Test. The GVFQ, a self-report, paper-and-pencil survey instrument was created to measure consumption of and preferences for vegetables typically grown in school gardens and likely to be consumed by an ethnically and culturally diverse population. It includes pictures and names of 22 vegetables and blank spaces for students to add other vegetables that they might have consumed. The appropriateness of the vegetables chosen was confirmed in a focus group with high school students who were asked about the vegetables that caregivers would prepare and serve to their younger siblings in the target range. The GVFQ, which takes approximately 15 min to complete, assesses the types of vegetables consumed the previous day, the frequency with which they are typically consumed, and preferences for each one. Students can complete the test in the classroom.

The vegetable consumption component of the questionnaire was pretested with 53 youth in the target age range, who completed both the GVFQ and a 24-hr recall. Based on random assignment, half took the GVFQ first and half completed the recall first. Those who took the GVFQ first reported consuming an average of 1.8 (±1.9) vegetables, whereas those who completed the 24-hr recall first reported consuming an average of 1.8 (±1.6) vegetables. Based on pretest findings, the GVFQ was considered comparable to the recall from a practical (clinical) standpoint and a reasonable measurement tool to assess vegetable consumption for this study.

The methodology to assess food preferences through a taste test was adapted from previous work (Birch, 1990; Morris & Zidenberg-Cherr, 2002). For the taste test, students were asked to name, taste, and rate their preferences for five raw vegetables (carrots, string beans, snow peas, broccoli, and Swiss chard) on a 5-point Likert-type scale on a form provided to them. Children were also asked whether they ate these vegetables at school and at home. The five vegetables were chosen because they grow well in the study site area, are readily available at grocery stores, and can be served raw. Carrots were chosen because they were considered very familiar to the students; chard was chosen because it was quite unfamiliar.

Of the 320 students who participated in the study, 236 completed the GVFQ in November 2003 (pretest) and in June 2004 (posttest). Of those students completing the GVFQ, 137 were in the garden group and 99 in the control group. The taste test was completed by 152 students, 99 in the garden group, and 62 in the control group. Attrition occurred for a variety of reasons, including lack of parental consent, absence during presurvey questionnaire administration, incomplete survey questionnaires, or because students moved from the study site. Independent samples t tests were used to detect significant differences in the change (posttest minus pretest) in vegetable knowledge, preferences, willingness to taste, and consumption between the garden and control groups. The Tufts University Institutional Review Board and the San Francisco Unified School District's Office on Human Subjects approved this study.

RESULTS AND DISCUSSION

This study found that garden-based learning has several positive impacts. First, after gardening, students were better able to identify vegetables. Children increased the number of different vegetables that they correctly identified significantly more than those in the control group (Table 2, $p = .002$). More importantly, preference for vegetables increased. Students who participated in garden-based learning significantly increased their preference for vegetables generally (Table 3, $p = .029$) and for those that were grown in the school garden ($p = .017$), as measured by the GVFQ. Students participating in the garden program were more willing to taste vegetables. Results from the GVFQ demonstrate that after their experiences, students in the garden group reported having tried significantly more varieties of vegetables than those in the control group (Table 3, $p \leq .001$), including both vegetables grown in the school garden ($p \leq .001$) and those that were not ($p = .025$). The taste test did not confirm this result as there was no difference between the two groups' willingness to taste the vegetables. This lack of confirmation may be explained by the design of the taste test, which included fewer vegetables than the GVFQ, as well as the administration of the taste test, which included far fewer respondents.

Gardening had an impact on the variety of vegetables consumed more than once a month. Based on responses to the GVFQ, students in the garden group significantly increased the average number of vegetable varieties they consumed more than once a month (Table 3, $p = .001$), both for the vegetables they grew ($p = .005$) and those they did not ($p = .001$), compared

TABLE 2
Taste Test Measuring the Effect of Garden Based Learning on Identification, Willingness to Taste, Preference for, and Consumption of Five Vegetables[a]

	M *Change* ± SD		
	*Garden Group (*n = *99)*	*Control Group (*n = *62)*	p
Ability to identify vegetables	0.6 ± 1.4	–0.03 ± 1.2	.002*
Willingness to taste vegetables	–0.2 ± 1.3	–0.4 ± 1.3	.286
Preference for vegetables	0.4 ± 1.0	0.2 ± 0.8	.279
Consumption of vegetables at school	0.5 ± 2.1	–0.3 ± 1.7	.010*
Consumption of vegetables at home	0.1 ± 1.6	–0.3 ± 1.8	.122

a. Vegetables included broccoli, carrots, green beans, snow peas, and Swiss chard.
*$p \leq .05$ (independent sample *t* tests).

TABLE 3
Garden Vegetable Frequency Questionnaire Measuring Factors Associated With Garden-Based Learning

	M *Change* ± SEM		
	*Garden Group (*n = *137)*	*Control Group (*n = *99)*	p
Preference			
All (*N* = 24)	0.7 ± 0.3	–0.2 ± 0.3	.029*
Grown in school garden (*N* = 11)	0.5 ± 0.2	–0.1 ± 0.2	.017*
Not grown in school garden(*N* = 13)	0.2 ± 0.2	–0.1 ± 0.2	.23
Willingness to taste			
All (*N* = 24)	1.9 ± 3.5	–0.1 ± 3.7	<.001*
Grown in school garden (*N* = 11)	1.5 ± 0.2	0.2 ± 0.2	<.001*
Not grown in school garden (*N* = 13)	0.4 ± 0.2	–0.3 ± 0.2	.025*
Eaten more than once per month			
All (*N* = 24)	1.1 ± 4.1	–0.9 ± 4.6	.001*
Grown in school garden (*N* = 11)	0.5 ± 0.2	–0.3 ± 0.2	.005*
Not grown in school garden (*N* = 13)	0.5 ± 0.2	–0.6 ± 0.3	.001*

*$p \leq .05$ (independent sample *t* tests).

to the control group. Consumption of vegetable varieties at school increased. Findings from the taste test indicate that after the gardening experience, children in the garden group ate a significantly greater variety of vegetables at school than those in the control group (Table 2, $p = .01$). Increased consumption may have been influenced by the increased availability of vegetables provided by the school garden program. The study did not investigate where within the school environment students consumed the vegetables. The increase in the number of vegetable varieties students reported consuming at school may have been due to either lunchtime consumption, consumption during garden activities, or both.

Consumption of vegetables at home did not appear to be affected, with no significant difference between the two groups. This may be because the vegetables were not available at home, or if they were, they may not have been prepared in a manner appealing to children. However, students did increase their consumption of vegetable varieties not grown in the school garden, which may indicate that the garden experience affects students' willingness to taste and eat more vegetables outside the school setting.

For all but one of the outcomes measured, statistically significant differences between the garden and control groups were attributable in part to a decrease in the control group's willingness to try, preference for, and consumption of vegetables. A decline in control group's vegetable consumption is consistent with trends observed by McAleese and Rankin (2007) and may point to a larger phenomenon in this age group. Once children begin middle school they often have more control over what they are eating. If that is true, the results from this study suggest that garden-based education may play a maintenance role for adolescents' preferences for and consumption of vegetables. In addition, it is not known if the failure to find a larger increase in the garden groups' vegetable consumption is in part due to the scope and duration of the garden-based learning activities themselves.

A limitation of this study is that it measured the number of different vegetable varieties consumed, but not the actual amounts. Therefore it is not known if the garden-based learning experiences increased the number of vegetable servings that students consumed.

This research adds to the growing literature on the positive effects of garden-based education on students' knowledge, attitudes, and behaviors associated with vegetable consumption. Results from this study indicate that hands-on garden-based learning experiences can increase low-income urban middle school–aged students' ability to identify vegetables correctly, increase the variety that they eat, and increase their consumption of different vegetable varieties at school.

Conclusions and Implications for Future Practice and Research

This study has several implications for policy and practice. First, school gardens can substantially contribute to the fulfillment of federally mandated school wellness policies. The Child Nutrition and WIC Reauthorization Act of 2004 requires each local education agency participating in the National School Lunch Program to design and implement their own wellness policy (Child Nutrition and WIC Reauthorization Act, 2004). School gardens are an appealing intervention strategy for carrying out wellness policy goals because they are relatively inexpensive, promote academic achievement and health, and support positive youth development (Alexander et al., 1995; Harmon, 2001). Although a few school districts across the country have already incorporated garden programs to meet wellness goals, the vast majority are in the early stages of design and should consider the benefits of school gardens as they complete implementation.

Second, our findings suggest that interventions to increase the availability of fresh produce in schools should be coupled with hands-on experience in the garden. To tackle the obesity epidemic, schools across the country are implementing programs and policies to increase the quantity of fruits and vegetables in school meals, including innovative farm to school programs (see, e.g., www.farmtoschool.org). It is unlikely however that solely increasing fruit and vegetables in the cafeteria or classroom will lead to increased consumption (Lytle & Achterberg, 1995). Based on this study, a more successful strategy will encompass opportunities for students to taste and learn about produce through gardening activities.

Third, our finding that students' consumption of vegetables at home did not improve suggests that to maximize benefits, garden programs should include home and community components that increase access to produce and teach caregivers how to prepare it in ways that students prefer. There are numerous examples of programs that could fulfill these needs, such as school-site–based Community Supported Agriculture (CSA) programs, promotional partnerships with local grocers, and the use of school parent nights as opportunities to promote fruits and vegetables and educate families about how to prepare them in ways kids like.

Fourth, based on the authors' experience developing garden intervention activities with teachers for this study, there is also an important role for health advocates and educators in the promotion of garden-based education in schools. Because hands-on garden activities may enhance a variety of academic subjects, health promoters could partner with teachers from multiple disciplines to integrate garden activities throughout the school day (Canaris, 1995). This would reinforce nutrition education across the curriculum and increase physical activity opportunities for students during the school day. However, gardens are often viewed as an "add-on" activity that takes away from what is assumed to be more valuable instructional time. Yet a small but growing body of evidence suggests that garden-based education may be an effective method to improve students' test scores (Klemmer, Waliczek, & Zajicek, 2005), and lessons in the school garden may be exchanged for regular classroom instruction time, rather than acting as a supplementary activity. Health promoters can work directly with teachers to identify appropriate garden activities that connect to state standards and learning objectives. Although there remains a need for a compendium of garden-based activities that meet state standards and learning objectives, increasingly there are professional development opportunities for those who

seek to develop their own skill and knowledge of garden pedagogy (Life Lab Science Program, 2009).

The promise of garden-based education is bright, but additional research is necessary. Based on our findings, we suggest that future research should explore (a) whether effects persist over time, (b) whether garden experiences affect the quantity of vegetables children consume, (c) if and how changes in children's behavior affect the behavior of their caregivers, and (d) the extent to which gardening contributes to maintaining middle-school children's vegetable intake as they get older.

Comparison studies of different kinds of school garden interventions are also necessary to distinguish the most effective dimensions and components of garden-based education. To accomplish this, researchers and health educators would benefit from using a consistent format to describe their interventions. Table 1 provides a starting point for systematically describing garden-based learning interventions and students' exposure to them.

Because interest in evidence-based school garden interventions is relatively recent, a more coordinated effort among academics and advocates would strengthen programs, practices, and policies. At this point, it would be extremely useful to convene a working group (Robinson-O'Brien et al., 2009) to identify regional and national research priorities, brainstorm ideas about how to overcome methodological challenges inherent in evaluating school garden programs, and discuss how to leverage research projects to move programs and policies forward.

REFERENCES

Alexander, J., North, M. W., & Hendren, D. K. (1995). Master Gardener Classroom Garden Project: An evaluation of the benefits to children. *Children's Environments, 12*, 256-263.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Birch, L. (1990). Development of food acceptance patterns. *Developmental Psychology, 26*, 515-519.

Bruton, S., Ong, F., & Geeting, G. (Eds.). (2000). *The science content standards for California public schools: Kindergarten through grade twelve*. Sacramento: California Department of Education.

California Instructional School Gardens, A.B. No. 1535, Chapter 437 of the Statutes, California, Senate (2006).

Canaris, I. (1995). Growing foods for growing minds: Integrating gardening and nutrition education into the total curriculum. *Children's Environments, 12*, 264-270.

Child Nutrition and WIC Reauthorization Act of 2004, 42 U.S.C. §1751, Pub. L. No. 108-265, §204, 118 Stat. 729-790 (2004).

Desmond, D., Grieshop, J., & Subramaniam, A. (2002). *Revisiting garden based learning in basic education: Philosophical roots, historical foundations, best practices and products, impacts, outcomes and future directions*. Rome: Food and Agriculture Organization.

Graham, H., Beall, D., Lussier, M., McLaughlin, P., & Zidenberg-Cherr, S. (2005). Use of school gardens in academic instruction. *Journal of Nutrition Education, 37*, 147-151.

Guenther, P. M., Dodd, K. W., Reedy, J., & Krebs-Smith, S. M. (2006). Most Americans eat much less than recommended amounts of fruits and vegetables. *Journal of the American Dietetic Association*, *106*, 1371-1379.

Harmon, A. (2001). Building youth awareness about the food system: Putting research to work for educators. *Kids Newsletter, 6*(1). Retrieved from http://www.kidscanmakeadifference.org/Newsletter/nw2001i.htm

Hung, H.-C., Joshipura, K. J., Jiang, R., Hu, F. B., Hunter, D., Smith-Warner, S. A., et al. (2004). Fruit and vegetable intake and risk of major chronic disease. *Journal of the National Cancer Institute, 96*, 1577-1584.

Jaffe, R., & Appeal, G. (1990). *The growing classroom: Garden-based science*. Menlo Park, CA: Addison-Wesley.

Klemmer, C. D., Waliczek, T. M., & Zajicek, J. M. (2005). Growing minds: The effect of a school gardening program on the science achievement of elementary students. *HortTechnology, 15*, 448-452.

Life Lab Science Program. (2009). *Life Lab professional development offerings*. Retrieved from http://www.lifelab.org/index.php?page=professional

Lytle, L., & Achterberg, C. (1995). Changing the diet of America's children: What works and why. *Journal of Nutrition Education, 27*, 250-260.

McAleese, J. D., & Rankin, L. L. (2007). Garden-based nutrition education affects fruit and vegetable consumption in sixth-grade adolescents. *Journal of the American Dietetic Association, 107*, 662-665.

Morland, K., & Filomena, S. (2007). Disparities in the availability of fruits and vegetables between racially segregated urban neighborhoods. *Public Health Nutrition, 10*, 1481-1489.

Morland, K., Wing, S., Diez Roux, A., & Poole, C. (2002). Neighborhood characteristics associated with the location of food stores and food service places. *American Journal of Preventative Medicine, 22*, 23-29.

Morris, J. L., Briggs, M., & Zidenberg-Cherr, S. (2000). School-based gardens can teach kids healthier eating habits. *California Agriculture, 54*(5), 40-46.

Morris, J. L., & Zidenberg-Cherr, S. (2001). *Nutrition to grow on. A garden enhanced curriculum for upper elementary school children*. Davis: California Department of Education.

Morris, J. L., & Zidenberg-Cherr, S. (2002). Garden-enhanced curriculum improves fourth-grade school children's knowledge of and preferences for some vegetables. *Journal of the American Dietetic Association, 102*, 91-93.

O'Dea, J. (2004). Children and adolescents' eating habits and attitudes: Preliminary findings from the national nutrition and physical activity study. *NutriDate, 15*(4), 1-4.

Ozer, E. M. (2007). The effects of school gardens on students and schools: Conceptualization and considerations for maximizing healthy development. *Health Education & Behavior, 34*, 846-863.

Reynolds, K. D., Hinton, A. W., Shewchuk, R. M., & Hickey, C. A. (1999). A social cognitive model of fruit and vegetable consumption

in elementary school children. *Journal of Nutrition Education, 31*, 23-30.

Roberts, C. K., & Barnard, R. J. (2005). Effects of exercise and diet on chronic disease. *Journal of Applied Physiology, 98*, 3-30.

Robinson-O'Brien, R., Story, M., & Heim, S. (2009). Impact of garden-based youth nutrition intervention programs: A review. *Journal of the American Dietetic Association, 109*, 273-280.

Sandeno, C., Wolf, G., Drake, T., & Reicks, M. (2000). Behavioral strategies to increase fruit and vegetable intake by fourth—through sixth-grade students. *Journal of the American Dietetic Association, 100*, 828-830.

Story, M., Kaphingst, K. M., Robinson-O'Brien, R., & Glanz, K. (2008). Creating healthy food and eating environments: Policy and environmental approaches. *Annual Review of Public Health, 29*, 253-272.

U.S. Department of Health and Human Services. (2000). *Healthy People 2010: Understanding and improving health*. Washington, DC: Government Printing Office.

Van Duyn, M. A., & Pivonka, E. (2000). Overview of the health benefits of fruit and vegetable consumption for the dietetics professional: Selected literature. *Journal of the American Dietetic Association, 100*, 1511-1521.

Zenk, S. N., Schulz, A. J., Israel, B. A., James, S. A., Bao, S., & Wilson, M. L. (2005). Neighborhood racial composition, neighborhood poverty, and the spatial accessibility of supermarkets in Metropolitan Detroit. *American Journal of Public Health, 95*, 660-667.