School-based community gardens: Re-establishing healthy relationships with food

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Abstract
The discipline of nutrition involves many complex relationships between humans and food. The changing food supply has affected our understanding of the origins of food and its role in our lives. Supermarket shopping and television advertising are examples of major influences on public perceptions of food origins. Although much less present in contemporary urban life, gardening also offers a vehicle to explore food origins firsthand. Previous research indicates that community gardening involves three major environmental influences on longevity: diet, physical activity and psychosocial fulfillment. Several evaluations at Brisbane's Northey Street City Farm indicate that community gardening can influence these environmental factors in disadvantaged groups such as the long-term unemployed. School-based community gardens are not uncommon in Queensland. In a recent survey, 24% of primary schools in the Logan region of south-east Queensland reported having a functioning vegetable garden. Face-to-face interviews were conducted with teachers responsible for each of these gardens to develop an insight into their origins and functions. School-based community gardens represent a significant opportunity to embed nutrition, physical activity and environmental sustainability into mainstream curricula.

Introduction
There are many well established health benefits of consuming a wide variety of vegetables and fruit. In Australia, and other industrialised countries, cardiovascular disease and cancer are the two leading causes of morbidity and mortality (Perrin et al., 2002; Stables et al., 2002). Increased consumption of vegetables and fruit has been associated with a marked decrease in the risk of these diseases (Steinmetz & Potter, 1996; Perry et al., 1998; Australian Institute of Health and Welfare [AIHW], 2002; Perrin et al., 2002; Stables et al., 2002), as well as type 2 diabetes, constipation, and cerebrovascular accidents (AIHW, 2002). Consuming more fruit and vegetables may also reduce the risk of obesity by displacing less desirable nutrients in the diet such as fat and refined sugar (McPherson, Montgomery & Milton, 1995; Margarey & Daniels, 2001). A recommendation to increase consumption of vegetables and fruit is included in the Australian Dietary Guidelines (National Health and Medical Research Council [NHMRC], 1998).

A range of potential barriers to children adopting healthy diets has been summarised by O'Dea (2003) and include availability, convenience, taste preferences, peer pressure and parental/school support. Knowledge of food can have important influences on food consumption. For example, expansion of knowledge of fruits and vegetables enhances their consumption in children (Morris, 2002). The media represents an important source of information about food and nutrition in industrialised society (Nestle et al., 1998). As an example of the potential influence of media on food consumption, the duration of television viewing is inversely correlated with vegetable and fruit consumption in adolescents (Boynton-Jarrett et al., 2003). It seems that the media, television in particular, has replaced traditional sources of information about food such as family and local community.

Community gardens provide an agricultural environment within city limits, where vegetables and fruit are produced, and in some cases livestock is cultivated. They are...
either owned and farmed by members of the community or subdivided into allotments cultivated by individuals. Thus, gardening offers an insight into the food production process, a topic being lost as city populations grow, rural populations decrease, and the gap between food producer and consumer widens (Blair, Giesecke & Sherman, 1991; Wandel, 1995; Hatloy, Torheim & Oshaug, 1997; Germov & Williams, 1999; Madaleno, 2001).

Gardening in general has been linked to beneficial psychosocial, environmental, economic and physical effects (Hackman & Wagner, 1990; Armstrong, 2000; Brown & Jameton, 2000; Franco, 2001; Morris, 2002). Access has been identified as a major barrier to adequate vegetable and fruit consumption (James, Nelson, Ralph & Leathley, 1997). Individuals involved in community gardening have previously been reported to enjoy a more nutritious diet than non-gardeners (Blair, Giesecke & Sherman, 1991; Hatloy et al., 1997; Madaleno, 2001; Tucker, 2002). They have greater access to fresh nutritious foods and therefore to meals that promote nutritional health (Blair et al., 1991; Wandel, 1995; Hatloy et al., 1997; Madaleno, 2001). In one United States study, community gardeners consumed significantly more vegetables and fewer sweets than non-gardeners (Blair et al., 1991). Gardening can positively influence diet and therefore may represent a vehicle for dietary intervention (Blair et al., 1991).


In one New York-based study, coordinators of a community garden program identified their motivations for participation in community gardening (Armstrong, 2001). These included access to fresh/better tasting food, enjoyment of nature, mental health benefits, providing a food source for low-income households, practice of traditional culture, lack of access to land, and exercise (Armstrong, 2000). Similar motivations were reported in a separate American study of community garden participants in Philadelphia (Blair et al., 1991). Our own local data on long-term unemployed subjects participating in the Brisbane-based Northey Street City Farm (Burton, Sendra & Somerset, 2003; Diversi et al., 2003) indicate similar positive effects on psychosocial factors that contribute to food choice.

Community gardening provides benefits beyond direct dietary effects. The sharing of produce with neighbours and friends suggests a wider community benefit (Armstrong, 2001). Urban dwellers report community gardening as not just a means of producing wholesome food, but a means of interacting with the local community in a relaxed and safe environment (Pfeiff, 2001). Thus, there is a substantial overlap between psychosocial factors that have previously been associated with enhanced vegetable and fruit consumption (Brug, Debie, van Assema & Weijts, 1995; Johansson & Anderson, 1998; Milligan et al., 1998; Devine, Wolfe, Frongillo & Bisogni, 1999; Schafer, Schafer, Keith & Bose, 1999; Thompson, Margetts, Speller & McVey, 1999; Li et al., 2000; Lindstrom, 2001) and those identified above as motivations or self perceived benefits of community gardening. Such psychosocial benefits provide useful scaffolding for initiating dietary change.

The 1995 National Nutrition Survey (McLennan & Podger, 1998) revealed that many Australians do not currently eat enough vegetables and fruit to meet the Australian Guide to Healthy Eating recommendations (Kellett, Smith & Schmerlaub, 1998). There is compelling evidence that community gardens can address many of the barriers to eating vegetables and fruits (Harris, 2000).

**Gardens in the school environment**

Adequate vegetable and fruit intake in young children has a positive effect on developing healthier food preferences later in life ( Kirby, Baranowski, Reynolds, Taylor & Binkley, 1995; Cullen, Bartholomew & Parcel, 1997; Resnicow, Smith, Baranowski & Baranowski, 1998; Margetts, 2001). The Australian Guide to Healthy Eating recommendations (Kellett, Smith & Schmerlaub, 1998) revealed that many Australians do not currently eat enough vegetables and fruit to meet the Australian Guide to Healthy Eating recommendations (Kellett, Smith & Schmerlaub, 1998). There is compelling evidence that community gardens can address many of the barriers to eating vegetables and fruits (Harris, 2000).

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Eating (Kellett et al., 1998) recommends children aged 8 to 11 years consume 1-2 serves of fruit and 4-5 serves of vegetables/legumes each day. Mean intakes by Australian children fall well below these recommendations (McLennan & Podger, 1998).

Lytle and Achterberg (1995) showed that nutrition interventions in children are more likely to be successful if they are activity-based, theory-driven, involve families, are implemented in the school environment, and involve the wider community. Many successful nutrition interventions for children have been based on these principles (Auld, Romaniello, Heimendinger, Hambidge, & Hambidge, 1998; Sandeno, Wolf, Drake, & Reicks, 2000; Franco, 2001; O'Dea, 2002).

School vegetable gardens have the potential to incorporate activity-based learning (planting, growing, eating) in the school environment. Devine et al. (1999) showed that past experiences such as eating vegetables from a garden and knowledge/skills for fruit and vegetable preparation enhance subsequent consumption patterns.

Morris (2002) compared classroom and garden-based nutrition education on vegetable and fruit preferences/knowledge in 4th grade US school children. Students who participated in garden-based nutrition education showed a higher preference for a larger number of vegetables than students exposed to nutrition education in the classroom alone. A study on kindergarten children concluded that as little as 30 minutes each week in a vegetable garden improved vegetable and fruit identification, identification of ‘best’ snack choices and increased willingness of children to taste new vegetables and fruits (Cason, 1999).

In view of general and school-specific effects, gardening may provide a useful vehicle to enhance vegetable and fruit consumption in children. We sought to investigate the nature and extent of the use of school gardens in a defined region of eastern Australia.

Method
A total of 54 schools, (29 in area A and 25 in area B) were identified from two State Department of Education school (primary) regions near the eastern Australian city of Brisbane (in the Logan area). Those primary schools with a vegetable garden were identified by a telephone survey.

All schools that answered ‘yes’ to having a vegetable garden were included in this study. Schools that answered ‘yes’ but stated that the garden was no longer operational were also included in the study only if the person who had been responsible for the project was still a staff member of the school. All schools that answered ‘no’ to having a vegetable garden were excluded. Six of the 20 schools that reported having a garden were excluded on the basis that their gardens did not meet the criteria that they were outdoors (or greenhouse) and involved growing at least one plant producing fruit or vegetables. Only one of the 13 schools with a functioning garden declined to participate.

An open-ended questionnaire was developed and a trial survey performed on two schools outside the sample group. Appropriate adjustments were made to the survey before a third trial was performed on a school outside the sample group. No further adjustments were required to the survey.

Data collected from sample group interviews were recorded by two methods. Interviewers took written notes of key responses, and interviews were audio taped then transcribed verbatim. Data were then categorised thematically and analysed.

Results
Aims of establishing gardens
Thirteen schools (24%) of the original sample (54 schools) had (or previously had) operational vegetable gardens that were suitable for this study. The reported initial aims for establishing gardens were:
• to provide practical learning for numeracy and literacy
• to improve self confidence
• to provide life skills
• to provide a teaching tool for growing cycle, health and hygiene
• a possible fundraiser
• a fun physical activity.

Participants reported:
About 2 years ago when I had a group of kids who were really keen on gardening—there wasn’t much of a garden then, so I got it off the ground.
Well, we have a few children who cannot concentrate in class, and the garden was to provide them with something physical.

Probably to give them a hands-on activity. I felt we didn't do enough of this sort of thing for the boys—the boys responded a lot more enthusiastically than the girls.

We had a bunch of kids who thrived on hands-on activity. We went for Cl vegetable garden because I knew there would be a more immediate response to it. They could pick it and feel like they had accomplished something from that.

Setting up the gardens

Teachers were identified as the main instigators of setting up the garden, often encouraged by enthusiastic students. Most (but not all) teachers had previous home gardening experience, but only one teacher had formal horticultural training.

The cost of initially setting up school vegetable gardens varied considerably (from $AUD12 to $AUD2250). Funding was supplied by teachers (personal funds), school budgets and State Education Department grants. Items such as soil, seeds, fertiliser, manure, chicken wire, timber and seedlings were often donated. Unexpected costs included mulch, tomato stakes, fencing materials, concrete slab for shed, and vandalism and theft. Some discounts from retail outlets were also received.

Participants were asked to describe the process of designing the garden and factors needing consideration. Stakeholders in designing the gardens varied from the janitor only in one garden, to the involvement of teachers, students, parents and volunteers. Design was sometimes integrated into classroom activities such as maths problems. As one stated: 'Part of a maths lesson where they had 48 sleepers (wooden slabs) and they had to arrange them the best way for the garden. They built models and that sort of thing'.

Factors considered in site selection and design of gardens included safety, drainage, raised beds, soil characteristics, accessibility /convenience, yearly maintenance, pathways, space for expansion, and cost effectiveness, privacy, away from the road, space available, sunlight, space and water, and an area already fenced off with water supply. The size of the gardens varied significantly (approx. 4m² to 450m²) depending on the number of students involved and money available. Additional factors included time and money, security, cover and protection for young plants, and the length of time for design, set up and growing before the end of semester.

Students and teachers were most heavily involved in site preparation. Other contributors involved were principals, janitors, parents and volunteers. Teachers took on an advisory role in most schools, while students did most of the hands-on work. Subjects reported student involvement gave students more ownership of the garden:

Students did all the site preparation.
We did the top layer first. They had to work out the area, they had to do all the measuring, and then they put all the boxing in. They did all the brickwork.

Four of the twelve schools held working bees with attendances ranging from 5-30 people. They were run annually, involving parents, teachers and students and proved an effective way of preparing the garden site.

Subjects were asked to identify the people involved in planting the vegetable garden. The most common answers were students, teachers and, in one instance, parents came in to plant the vegetable garden: There is a fair amount of unemployment around, so many parents come in and work with the kids as they don't have much else going on'.

Vegetables were most commonly planted after school holiday breaks, although some planting occurred throughout the year. The vegetables reported to have grown well, included tomatoes, lettuce, corn, herbs, beans, potatoes, capsicum and snow peas. Most schools reported more success in growing vegetables when planting seedlings instead of seeds. The vegetables that grew poorly included carrots, broccoli, cabbage and celery. The reasons for this included inadequate space between plants, planting vegetables at the wrong time of year, inadequate soil depth, rabbits and other pests, water restrictions and impatient students, as one reported: 'Someone kept
Participants were asked how they would plant differently. Many schools reported that the plantings were poorly timed. Planting a limited variety of plants to make the garden more manageable was a common suggestion.

Vegetables were used in various ways after harvest. In some schools, students would pick the vegetables to eat, or use them in cooking classes. At four schools, students sold vegetables to parents or staff and reinvested money back into the garden. Three schools reported enough produce for students to take home. One school used the vegetables to make sandwiches for the school canteen. Another school used the vegetables to make a green salad and spaghetti sauce for the school camp.

In almost half the schools, teachers, students or volunteers carried out garden maintenance over the Christmas holidays. The remaining schools scaled down activity, harvesting and clearing plants in readiness for the next year. Subjects were asked if they were allocated class time to carry out garden activities. Six schools incorporated garden activities into class time with all interested teachers allowed access to the garden. Two schools reported that a limited number of teachers were allowed to access the garden and four schools reported that time in the garden had to be outside of class time.

**Student learning**

Most subjects reported that garden activities included learning about healthy eating, plant identification, seasons, permaculture, soil characteristics and physical education. Subjects also reported using the garden in combination with more formal subjects such as science, mathematics, literacy, business studies, art and music:

> We created a bogus business, we had a board of directors, marketing department, research and development department—the kids were all shareholders.

> Lots of songs and stories that we read, there are a lot of good ones about growing things that we relate back to the garden. You know the cooking activities too—well that’s a maths and science activity.

We’ve used maths in there, like I said for measurement, science growth, drawing, naming parts of the plant and what a plant needs to grow, sunshine, water, soil just the very basic type—we have also talked about nutrition with some of the kids.

They used to write about it, some kids who hadn’t written much would write things like—all of a sudden there was a purple flower on the eggplant.

We did a whole class on the different soil levels. We would draw what was growing successfully, we would write about what didn’t work in our scrapbook, what we thought went wrong.

One school incorporated the vegetable garden into computer studies, photographing the garden at different stages and then sending pictures to other children around the world via email.

Seven schools used the vegetable garden formally in combination with nutrition education classes. Two schools said they talked about nutrition indirectly. Of those who incorporated the school garden into nutrition education classes, topics included cooking, healthy eating, food groups, food as an energy source, obesity, diabetes, the food production system, prevention of disease and dental hygiene:

> I suppose the kids think that veggies come from the shops. They don’t know that this is the process that has to happen before we get vegetables.

> How things grow, what they look like, what’s good for you and why chips don’t grow in our garden.

**Student engagement**

Subjects reported that most (not all) students involved in the garden enjoyed the activity. They reported boys being more enthusiastic and spending more time in the garden than girls. Some students became frustrated when plants died or were destroyed by vandals.

> The boys that you want to keep physically busy loved it. I got them to measure out the mulch, they didn’t realise that they were doing measurement—they were just having fun. Some of the kids, especially the
girls, didn’t like digging or the smell of the manure. They came around the other way, through eating the vegies.

They love it, they absolutely love it. Especially those that are lonely, because they have someone to talk to and they can see something—we do have a lot of lonely kids. It’s good for me too as I don’t get stuck in my room the whole time.

Vegetable gardens were often reported to have a positive effect on the behaviour of disruptive students:

There was an ASD (special needs) student who came here last year. He was such a problem child. He would run out of the school, scream, hide under tables, he was just having a bad time settling in here. I started taking him over to the vegie patch to see if it would work, and it did.

Subjects reported teachers also receiving benefits from vegetable gardens. Factors such as improved behaviour of children, seeing the children in a different light and students seeing teachers in a different light were noted.

Safety
Safety precautions included gloves, hats, solid shoes and careful selection of students using certain tools. Adequate supervision was identified as a key to ensuring the safety of students. One school gathered together a database that listed students’ allergies and tetanus shot status. Several students at one school suffered ant bites, but this was the extent of injuries in the 12 school gardens.

Barriers
Some of the reported barriers for using the garden for nutrition education were: the garden was not ready; lack of time to involve garden; and lack of vegetables to use. One participant indicated that the school vegetable garden had prompted parents to start their own vegetable garden at home. Many participants reported that the garden encouraged students to try new foods: ‘Some of the children ate things that they would never have tried before. The parents would say “he won’t eat that”, and then I could say “well that afternoon be did”.

Recommendations from schools
When asked to make recommendations to other schools and nominate any resources relevant to running a school vegetable garden, the following suggestions were made:

When selecting plants to grow, consider what children will enjoy eating (e.g. cherry tomatoes and snow peas), and possibly avoid root vegetables.

Let the kids do as much as possible, because that was the best way they learnt from their mistakes, and they got the most rewards from it, by doing it themselves.

Planning worked well for us, the kids really planned well. They took in all aspects of what we could possibly think of, any problems they might encounter.

Find someone who knows what they are doing.... Find someone who is passionate about gardening who knows about composting, fertilizing, plant schedules, that’s really important.

I think the biggest thing is security, you have to make it secure. The kids get heartbroken when they come up and find all of their stuff broken up.

Make it so they can do it at home, it’s no good making a fancy garden where you are spending thousands of dollars. That’s one of the reasons we didn’t ask for a lot more money, because we wanted kids to be able to make a garden at home.

Discussion
Although nutrition education was not generally considered a primary motive for starting vegetable gardens, most schools reported nutrition being a useful consequence. Subsequently, some schools allocated class time to deal specifically with nutrition-related issues in conjunction with gardening. Prior studies have shown that vegetable gardening in combination with classroom-based nutrition instruction increases nutrition knowledge more effectively than classroom-based nutrition education alone (Morris, 2002).
Apart from classroom-based nutrition education activities, having a vegetable garden at school increased students’ exposure to vegetables and fruit. Students tasted, prepared, cooked and observed vegetables and fruit growing. Even in the absence of formal nutrition education, this may have beneficial effects on developing healthier food choices (Kirby et al., 1995; Cullen et al., 1997; Resnicow et al., 1998; Margarey & Daniels, 2001). The vegetable gardens were not only said to increase children’s exposure to vegetables but also were reported to introduce children to new varieties of vegetables. Increasing the number of vegetables a child is familiar with may broaden food preference (Morris, 2002), encouraging greater dietary variety and associated health benefits. Teachers reported being more aware of the potential for vegetable gardens to promote healthy eating. Several reported they were intending to develop nutrition education classes in conjunction with gardening activities.

Devine and colleagues (1999) found that past positive experiences with vegetables and fruit can enhance their consumption (Devine et al., 1999). Produce from some gardens was used in cooking classes, providing potential to improve self efficacy and develop tastes for new foods, which ultimately may lead to increased vegetable intake in adults (Brug et al., 1995; Krebs-Smith et al., 1995; McPherson et al., 1995; Sandeno et al., 2000; Satia et al., 2002).

The implementation of school vegetable gardens provided motivation for parents to start vegetable gardens at home. Home gardening is linked to improved diet, as evidenced by home gardeners’ higher levels of serum retinol (an indicator of greater fruit and vegetable intake) (Morris, 2002). At a more general level, community vegetable gardens not only have the potential to improve the nutrition of participants and their immediate families but the sharing of produce to neighbours and friends suggests a wider community benefit (Armstrong, 2000).

Gardening also provided opportunities for collateral learning. Gardens were used as multi-curricular learning tools, being used to teach traditional subjects such as English, mathematics, science, art, music, nutrition and cooking. By linking nutrition to other important disciplines, some of the epistemological limitations of nutrition education (Pelletier, 1997) may be addressed.

Low literacy skills are often associated with poorer health outcomes. Gardening may provide a vehicle for educating about food and nutrition without a requirement for high literacy levels. In addition, some improvements in literacy were reported. Gardens were also reported to be useful in the management and teaching of children with learning or behaviour difficulties.

In some schools, boys showed more interest in gardening than girls. This presents a possible window of opportunity to enhance male involvement in food and nutrition from a young age. Males also have a higher prevalence of overweight and obesity than females in Australia (McLennan & Podger, 1998). Gardening may present an alternative education tool for targeting this at-risk group.

Gardens with limited funding seemed no less significant or valuable for students, implying that financial factors were not a barrier to establishing vegetable gardens. Some schools kept gardens small with few varieties of plants to sustain workload. Having a small, successful garden may be more beneficial than having a large and more demanding garden. Successful gardens all depended on the enthusiasm of teaching staff, principal and students.

Potential risks to children when establishing a school garden include injury, physical strain of manual labour, handling tools and toxic chemicals (Brown & Jameton, 2000). In addition, compost heaps may emit offensive odours and attract rodents. There were no such problems in the twelve school gardens reported in this study.

Community gardens can enhance psychological and social wellbeing (Hackman & Wagner, 1990; Malakoff, 1995; Brown & Jameton, 2000). Improvement in the self esteem and confidence of children was a common theme of response. In addition, disruptive students responded well to the different class setting and improved their disruptive behaviours, a phenomenon supported by Malakoff (1995) who reported that ‘simply looking at a plant can reduce stress, fear, and anger, lower blood pressure and muscle tension’.
School vegetable gardens provided a social focus for some children. This is an essential component of making long-lasting health changes and is a key factor in maintaining participation in a community garden program (Hackman & Wagner, 1990).

This study highlights the potential for school vegetable gardens as a vehicle for the nutrition education of primary school students. Specifically, the gardens were reported to address identified barriers to healthy eating such as enhanced availability through improved exposure, expansion of taste preferences, peer interaction and school support for healthier eating. The utility of gardens as an educative tool extended to many disciplines beyond health education, and therefore represents a means by which food and nutrition issues could be integrated into a broader range of curriculum disciplines. This study identified a range of possibilities for nutrition education, especially as a vehicle for increasing the intake of vegetables and fruit of children. Vegetable gardens represent a useful health promotion vehicle to enhance vegetable and fruit intake in school-aged children.

References


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