Health & Place 26 (2014) 110–117

Contents lists available at ScienceDirect

Health & Place

journal homepage: www.elsevier.com/locate/healthplace

Color me healthy: Food diversity in school community gardens in two rapidly urbanising Australian cities

Daniela A. Guitart [a,1], Catherine M. Pickering [b,2], Jason A. Byrne [c,*]

[a] National Climate Change Adaptation Research Facility, Griffith University, Gold Coast, QLD 4222, Australia
[b] School of Environment, Environmental Futures Centre, Building G24, Room 3.08, Griffith University, Gold Coast campus, QLD 4222, Australia
[c] School of Environment, Environmental Futures Centre, Building G31, Room 3.06, Griffith University, Gold Coast campus, QLD 4222, Australia

ARTICLE INFO

Article history:
Received 25 February 2013
Received in revised form
26 November 2013
Accepted 20 December 2013
Available online 31 December 2013

Keywords:
Urban agriculture
Nutrition
School gardens
Community
Health

ABSTRACT

Community garden research has focused on social aspects of gardens, neglecting systematic analysis of what food is grown. Yet agrodiversity within community gardens may provide health benefits. Diverse fruit and vegetables provide nutritional benefits, including vitamins, minerals and phytochemicals. This paper reports research that investigated the agro-biodiversity of school-based community gardens in Brisbane and Gold Coast cities, Australia. Common motivations for establishing these gardens were education, health and environmental sustainability. The 23 gardens assessed contained 234 food plants, ranging from 7 to 132 plant types per garden. This included 142 fruits and vegetables. The nutritional diversity of fruits and vegetable plants was examined through a color classification system. All gardens grew fruits and vegetables from at least four food color groups, and 75% of the gardens grew plants from all seven color groups. As places with high agrodiversity, and related nutritional diversity, some school community gardens can provide children with exposure to a healthy range of fruit and vegetables, with potential flow-on health benefits.

1. Introduction

Researchers have found a close association between rapid urbanization, green-space loss, and declining citizen health (Broadway and Broadway, 2011; Domene and Sauri, 2007; Groenewegen et al., 2006; Pauleit et al., 2005; Turner et al., 2011). Rapidly increasing urbanization is a major issue confronting many countries including Australia. Rapid urbanization typically results in the loss of viable agricultural land and in increasing separation of urban residents from food production (Eigenbrod et al., 2011; Wu et al., 2011). Urban residents are less likely to produce food or even see food being grown (Campbell, 2004; Clement, 2010; Zaradic et al., 2009). Weekly shopping trips to sanitized supermarkets with abundant, colorfully packaged foods are the closest that many city-people get to food production (Kameshiwari and Kaufman, 1999). One factor contributing to these problems has been changing food-production practices (Pothukuchi and Kaufman, 1999) and flow-on dietary and nutrition impacts.

Major changes in people's experience of growing food have been described by some as a 'nutrition transition' (Popkin, 1999). Such changes are associated with decreased general health in many urban populations, including dramatic increases in obesity – especially among children (Blair, 2009; Cameron et al., 2003; Somerset et al., 2005). Many urban dwellers, particularly children in the developed world, consume less fresh fruit and vegetables, eat more processed food, and are more sedentary than rural counterparts (Somerset et al., 2005). In some countries, children's intake of fast food has increased by 300% in two decades (Sanigorski et al., 2007). Australia is no exception; many Australians now eat fewer fruits and vegetables than is recommended for good health and have less contact with the natural world than did previous generations (Magarey et al., 2001; Timperio et al., 2008).

Statistics indicate that poor food choices are also contributing to obesity in Australia, with 60% of adults and 25% of children either overweight or obese (Australian Bureau of Statistics (ABS), 2009). Most Australians eat fewer fruits and vegetables than is recommended for good health. For example, 78% of Australian children aged 4–8 years old and 86% aged 9–13 do not eat the daily-recommended amount of vegetables (Department of Health and Ageing, 2007). Obstacles preventing children from adopting healthy diets include taste preferences, knowledge, availability, convenience, peer pressure and parental or school support (O'Dea, 2003).

Community gardens are seen as one way to counter some of these trends (Block et al., 2012). Research on community gardens has demonstrated clear linkages between gardening, improved levels of physical activity, and better nutrition

* Corresponding author. Tel.: +61 7 5552 7723; fax: +61 7 5552 8244.
E-mail addresses: d.guitart@griffith.edu.au (D.A. Guitart), c.pickering@griffith.edu.au (C.M. Pickering), jason.byrne@griffith.edu.au (J.A. Byrne).
[1] Tel.: +61 7 5552 7547; fax: +61 7 5552 7333.
[2] Tel.: +61 7 5552 8059; Fax: +61 7 5552 8067.

1353-8292/$ - see front matter © 2014 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.healthplace.2013.12.014

(Armstrong, 2000; Harris, 2009; Kingsley et al., 2009; Teig et al., 2009; Wakefield et al., 2007). School-based community gardens are an example. School-based community gardens (hereafter referred to as school gardens) are a subset of the broader community gardening movement (Graham et al., 2005; Henryks, 2011; Ozer, 2007; Somerset et al., 2005). Located on land used for the full spectrum of schools (K-12), they are a distinctive type of community garden (Birky and Strom, 2013). Such gardens can act as place-based health interventions, helping to transform students' eating habits and knowledge about food production (Lineberger and Zajicek, 2000; Ratcliffe et al., 2011). Such gardens can be considered to be a type of community garden because they are community assets; benefit the wider community through knowledge acquisition and transmission and; have the potential to change people's access to safe and nutritious food at the neighborhood level (Chomitz et al., 2010). For example, researchers have reported that school children may educate their parents and siblings about lessons they have learned in the gardens and can sometimes take produce from the gardens back home to share with their families, thus altering wider eating habits (Heim et al., 2009; see also Heim et al., 2011).

School gardens can positively influence children's diets in various ways, including educating children about a wide variety of healthy and nutritious foods; knowledge that commentators suggest has been lost through the above mentioned changes in urban lifestyles. In school gardens, children can become more familiar with a diverse range of fruits and vegetables (Allen et al., 2008). Increasing familiarity and experiencing different foods is likely to enhance children's willingness to try new foods contributing to more nutritious diets. But we know very little about what plants are actually grown in school gardens, how diverse these gardens are, and the nutritional value of plants grown in these gardens.

This paper discusses research into school gardens in two cities within a rapidly urbanizing metropolitan region – Brisbane and Gold Coast cities, Australia. We begin by discussing the health benefits ascribed to community gardens, and then consider health benefits associated with eating a diversity of fruit and vegetables. We then examine the diversity of plants grown within all known school gardens in the study area (see Methods section for details on how these were located), and their potential nutritional value, based on a nutritional color classification analysis. We also assess the motivations of garden managers for developing these gardens, to establish the extent to which health benefits may be driving garden development. We conclude by recommending directions for future research.

2. Health benefits of community gardens

Much of the literature suggests that community gardens confer multiple health benefits upon their users (Alaimo et al., 2008; Armstrong, 2000). Many international studies have explored the link between the active lifestyles and healthier diets of community gardeners and the potential for community gardens to combat obesity, heart disease and several types of cancer (e.g. Armstrong, 2000; Wakefield et al., 2007). Community gardening has been shown to confer both physical and mental health benefits on gardeners (Kaplan, 1973; Somerset et al., 2005; Wakefield et al., 2007; Kingsley et al., 2009). Community gardeners have been found to consume more fresh fruits and vegetables and less sweet foods and drinks, compared with non-gardeners (Blair et al., 1991). Studies have also pointed to the health benefits of school gardens (see Blair et al., 1991; Somerset et al., 2005; Morris and Zidenberg-Cherr, 2002; Graham et al., 2005; McAleese and Rankin, 2007).

School gardens could be a useful education tool for improving children's dietary behavior and improving access to a diversity of healthful food (Blair et al., 1991; Corkery, 2004; Somerset et al., 2005). School gardens are a form of urban agriculture where children produce their own food while learning about where food comes from, food nutrition, and healthy cooking (Blair, 2009; Canaris, 1995; Morris and Zidenberg-Cherr, 2002; Somerset et al., 2005). In Australia such gardens are receiving widespread support, with organizations such as the Stephanie Alexander Kitchen Garden Foundation providing skills, resources and guidance to schools to assist them in establishing community gardens (Block et al., 2012). Despite research about *perceived* health and education benefits of school community gardens, very little research has evaluated the *actual* agro-biodiversity within these gardens, and potential health benefits for children. In other words, what different types of fruit and vegetables are grown, and do these plants provide a diversity of vitamins, minerals and phytochemicals that may have positive health benefits for children? This paper seeks to address that knowledge gap.

2.1. Health benefits of fruit and vegetable consumption

Increased consumption of fruits and vegetables is associated with a noticeable decrease in the risk of diseases such as cardiovascular diseases, cancer and type 2 diabetes (Heber and Bowerman, 2001; Jamison, 2003; Perrin et al., 2002; Somerset et al., 2005; Stables et al., 2002). In addition to consuming more fruit and vegetables, nutritionists have found that it is important to consume a wide diversity of these food-types, as different foods contain different vitamins, minerals and phytochemicals (Vaughan and Geissler, 2009). Phytochemicals, for example, can alter gene expression to restrain carcinogenesis via different pathways (Jamison, 2003). Researchers have suggested that because many phytochemicals have distinct colors, a color code system for classifying and analyzing the beneficial properties of fruit and vegetables could be used as an effective intervention to promote dietary diversity for optimal health (Heber and Bowerman, 2001).

Examples of phytochemicals associated with particular colors and food include the reds in tomatoes which are due to the presence of lycopene which is associated with prostate health. Strawberries, blueberries and grapes (red, blue and purple foods) contain anthocyanins and polyphenols, which are powerful antioxidants. Avocadoes and honeydew melons (light green foods) are rich in lutein and zexanthin, which are found in the retina where age-related macular degeneration occurs (Heber and Bowerman, 2001). Broccoli and kale (dark green foods) contain glucosinolates, which have been associated to reducing risk of cancer, particularly lung and gastrointestinal tract (Lund, 2003). Orange foods (carrots and mangoes) contain carotenoids which can enhance the immune system, whereas peaches and oranges (orange-yellow foods) contain cryptoxanthin and flavonoids which induce human protective enzyme systems (Yao et al., 2004). Finally, leeks, garlics and onions (white-green foods) contain allyl sulfides which have antibacterial properties and can detoxify carcinogens (Van Duyn and Pivonka, 2000). Eating at least one serving of fruit and/or vegetable from each of these color groups daily ensures that a good spectrum of phytochemicals, along with vitamins and minerals are consumed, thus improving a range of potential health outcomes (Heber and Bowerman, 2001; Jamison, 2003).

In the remainder of this paper we examine the plant types grown in community gardens within two of Australia's fastest growing cities: Brisbane and Gold Coast. This research included assessing school gardens based on their size and motivations for their establishment, as well as what was grown. Food diversity was assessed in relation to the spectrum of colors represented by the fruit and vegetables grown, to determine if these gardens