Does the Royal Horticultural Society Campaign for School Gardening increase intake of fruit and vegetables in children? Results from two randomised controlled trials

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Declared competing interests of authors: Janet E Cade is a personal member of the Royal Horticultural Society. Janet E Cade and Charlotte EL Evans received funding from Kids Company to undertake some subsequent analysis of this data set (results not presented in this report).

Published August 2014
DOI: 10.3310/phr02040

Scientific summary

The Royal Horticultural Society Campaign for School Gardening
Public Health Research 2014; Vol. 2: No. 4
DOI: 10.3310/phr02040

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Background

Children's fruit and vegetable intake in the UK is low, at around 2.8 servings per day. Changing intake is challenging. There is increasing evidence to suggest that gardening might be a vehicle for facilitating fruit and vegetable intake. School gardening programmes provide an interactive environment with the potential to change children's self-efficacy and willingness to try different fruits and vegetables. These changes in attitudes towards fruit and vegetables may potentially lead to an increase in consumption.

Objectives

To undertake the first clustered randomised controlled trials (RCTs) of a gardening intervention. To evaluate the impact of a school gardening programme, the Royal Horticultural Society (RHS) Campaign for School Gardening, on children's fruit and vegetable intake.

- To adapt an existing dietary assessment tool [the Child And Diet Evaluation Tool (CADET)] to include age- and gender-specific food portions.
- To describe children's fruit and vegetable intake, broken down by meal event, lunch type (packed or school meal) and gender.
- To explore how the home food environment and parental attitudes and values affect children's fruit and vegetable intake at baseline.
- To evaluate the impact of the RHS's Campaign for School Gardening on the change in intake of fruit and vegetables in children.
- To assess changes in children's knowledge of, and attitudes towards, fruit and vegetables between baseline and follow-up.
- To identify process measures relating to the delivery of the intervention which may affect results.

Methods

Royal Horticultural Society policy is to provide support to all schools that register an interest in the campaign. As a consequence of this, two linked trials were required. All schools in the London boroughs supported by the RHS would be given access to either the regional advisor or twilight teacher training sessions. A second set of schools from adjacent boroughs were recruited by the research team into trial 2, and randomised to receive the twilight teacher training or no RHS gardening intervention. Primary schools from eight London boroughs were invited to take part in one of two related RCTs.

Twenty-six schools from four boroughs in London (Wandsworth, Tower Hamlets, Greenwich and Sutton) were recruited for trial 1. Of the 26 schools, 10 were randomly allocated to receive the RHS-led intervention and 16 to receive the teacher-led intervention. All schools were allocated at the same time. The primary aim of trial 1 was to determine whether or not children who participate in the RHS-led gardening intervention increased their fruit and vegetable consumption more than those participating in the teacher-led gardening intervention.

Thirty-two schools from four other boroughs in London (Lewisham, Lambeth, Merton and Newham) were recruited for trial 2. These boroughs are adjacent to the trial 1 boroughs. Of these schools, 16 were randomly allocated to receive the teacher-led intervention and 16 were used as comparison schools. The comparison schools received no active intervention during the trial. However, they were informed that

once the study had ended follow-up collection in February 2012, they would be able to attend the twilight sessions offered to the teacher-led schools. The primary aim of trial 2 was to determine whether or not children who participate in the low intensity, teacher-led gardening intervention increase their mean fruit and vegetable consumption more than those in the control group.

Cluster randomisation with school location and borough to identify each cluster was used to randomise the schools. The schools were randomised by geographic location of their London borough. From each primary school, one Year 3 class and one Year 4 class was asked to consent to be part of the trial. Classes were randomly selected if there was more than one class in that particular year group.

It was not possible to blind the schools to their intervention group owing to the nature of the intervention. The fieldworkers were blinded to the allocation of schools to the intervention (RHS-led or teacher-led) and comparison arms of the study.

A 24-hour food diary (CADET) collected baseline and follow-up dietary intake. Questionnaires were designed to measure children's knowledge of, and attitudes towards, fruit and vegetables and to assess intervention implementation. Data were collected from each school by fieldworkers who were blind to the original allocation of the school. The primary outcome was change in fruit and vegetable intake from baseline to postintervention follow-up.

Baseline collection of the school food diary, home food diary, child questionnaire and school gardening telephone interviews took place between April and July 2010. The baseline process measures e-mails were sent out in November 2010 with reminders sent in December 2010. Follow-up collection of the school food diary, home food diary, child questionnaire and school gardening telephone interviews took place from October 2011 to January 2012. The follow-up process measures e-mails were sent out in December 2011 and reminders were sent in January 2012.

Ethical approval was obtained through the University of Leeds Research Ethics Committee in 2009. Written informed consent was obtained first from all schools and then from all parents whose children were in the classes chosen to participate in the trial data collection. Parents were given the opportunity to opt out of the study if they did not wish their child to take part. In this case, the child was still able to take part in the growing activities in the class; however, his or her food intake and child attitude and knowledge questionnaire were not recorded.

Statistical analysis

Baseline analysis explored key nutrients, foods, fruits and vegetables by meal event and demographic characteristics. An additional variable based on the NHS '5 A DAY' guidelines was created to evaluate how many children were achieving the UK government's fruit and vegetable target. Clustered multilevel regression models were used to explore differences between boys and girls, and the home environment for nutrients and food items. These models were first conducted unadjusted, and then adjusted for ethnicity and Index of Multiple Deprivation score (IMDS).

The main analyses used a random effects model, based on intention to treat, with change in total fruit and vegetable intake as the primary outcome; results were reported both unadjusted and adjusted for baseline intake. A random effects model was used to determine any differences between schools.

Results

Baseline analysis of the 2389 children who had completed the dietary assessment checklist found that children consumed on average 293 g [95% confidence interval (CI) 287 to 303 g] of fruit and vegetables per day. Children of families who reported 'always' eating a family meal together at a table consumed 125 g (95% CI 92 to 157 g) more fruit and vegetables per day than those from families who never ate a

meal together. Daily consumption of fruit and vegetables by parents was associated with higher fruit and vegetable intake in children; these children consumed 87 g (95% CI 37 to 138 g) more fruit and vegetables per day than those whose parents rarely or never consumed fruit and vegetables. Cutting up fruit and vegetables for children was also associated with higher consumption. The children of families who reported always cutting up fruit and vegetables for their children had 44 g (95% CI 18 to 71 g) more fruit and vegetables per day than those from families who reported never cutting up fruit and vegetables.

In trial 1, 1138 children were randomised to receive either the RHS-led ($n = 529$) or teacher-led ($n = 609$) intervention. Of these, 312 children from the RHS-led and 329 from the teacher-led arm provided data for the primary analysis. In trial 2, 1391 children were randomised to receive either the teacher-led ($n = 698$) or comparison ($n = 693$) intervention. Of these, 488 children from the teacher-led and 428 from the comparison arm provided data for the primary analysis. Sample size calculations had estimated that to have 90% power to detect a one-portion difference in fruit intake (one portion = 80 g), a final sample of 482 per group was required, i.e. about 10 schools. The achieved sample size has reduced the power to detect a difference of one portion of fruit and vegetables from 90% to 83%.

Results from the RCTs found that in trial 1, for combined fruit and vegetable intake, the teacher-led group had a higher mean change of 8 g (95% CI –19 to 36 g) compared with the RHS-led group change of –32 g (95% CI –60 to –3 g). However, after adjusting for possible confounders this difference was not significant (intervention effect –43 g, 95% CI –88 to 1 g; $p = 0.06$). In trial 2, the teacher-led group consumed on average 15 g (95% CI –36 to 148 g) more fruit and vegetables than the comparison group; this difference was also not statistically significant. However, exploration of the process measures revealed that all schools had increased their gardening activity between baseline and follow-up, with no statistically significant difference between groups. Schools which had improved their RHS gardening score by three levels between baseline and follow-up found that, on average, children increased their intake of fruit and vegetables by 81 g (95% CI 0 to 163 g; $p = 0.05$) compared with children attending schools that had no change in gardening score, after adjusting for confounders.

Over 90% of the children at both baseline and follow-up agreed that they enjoyed eating fruit, whereas 60–70% agreed that they enjoyed vegetables, and only 50–60% agreed that they liked trying new vegetables. No change was found in children's knowledge and attitudes between baseline and follow-up. In trial 1, the RHS-led gardening group showed an increase in the total number of different vegetables recognised; this difference was not significant after adjustment for baseline measurement and confounders.

At baseline, the response rate was 92%, with 46% speaking English as an additional language (EAL) and 59% having a member of the family educated to at least degree level. This compares to a total of 55% of primary school children in London speaking EAL in 2012 and 38% having a family member with a degree, suggesting that the responding sample may be more advantaged than the general London population. This could be reflected in the results obtained, with high levels of child knowledge of fruits and vegetables and higher intakes of fruit and vegetables than were observed in the National Diet and Nutrition Survey (NDNS).

Conclusions

Results from these trials provide little evidence that school gardening alone can improve children's fruit and vegetable intake. In both trials, gardening levels increased across all groups from baseline to follow-up, with no statistically significant difference between groups in terms of improvement in gardening level. This lack of differentiation between groups is likely to have influenced the primary outcome. However, when the gardening intervention was implemented at the highest intensities there was a suggestion that it could improve children's fruit and vegetable intake by a portion per day. Analysis of the cross-sectional baseline data showed that family support for fruit and vegetable intakes through eating together, preparation of

fruit and vegetables and parental consumption was associated with higher intakes of fruit and vegetables in children. This study highlights the need for more sophisticated and accurate tools to evaluate diet in children. Future intervention designs should include a greater level of parental involvement in school interventions, along with related components, such as cooking, to substantially improve children's fruit and vegetable intake. In addition, the home environment has been demonstrated to be an important focus for intervention.

Trial registration

This trial is registered as ISRCTN11396528.

Funding

Funding for this study was provided by the Public Health Research programme of the National Institute for Health Research.

Public Health Research

ISSN 2050-4381 (Print)

ISSN 2050-439X (Online)

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This report

The research reported in this issue of the journal was funded by the PHR programme as project number 09/3001/19. The contractual start date was in November 2009. The final report began editorial review in May 2013 and was accepted for publication December 2013. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The PHR editors and production house have tried to ensure the accuracy of the authors' report and would like to thank the reviewers for their constructive comments on the final report document. However, they do not accept liability for damages or losses arising from material published in this report.

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