

Garden to Table Evaluation

Report to Healthy Futures Charitable Trust

Introduction

The Garden to Table project is a New Zealand organisation affiliated to the Australian Kitchen Garden programme run by chef Stephanie Alexander. The organisation is dedicated to the introduction of vegetable gardening in primary schools, and then using the produce to cook with in a home style kitchen at school. The philosophy is to encourage children to learn to grow, harvest and cook their own fresh, seasonal vegetables, thus encouraging higher vegetable consumption. The program is aimed at 7-10 year old children and relies on a coordinator at each school. The programme must be regular, preferably weekly gardening and cooking sessions and be integrated into the school (i.e. done in school time for all children in the class, not as an option or lunch time activity).

The philosophy of Garden to Table (GTT) is to encourage children to learn to grow, harvest and cook their own fresh, seasonal vegetables, thus encouraging higher vegetable consumption. This project aims to evaluate the programme in three low decile Wellington schools to ascertain whether it improves the nutritional quality of children's diets, nutrition knowledge and willingness to try new foods.

Garden to Table considers the benefits of the programme to be:

- Children learn where food comes from, how to grow, prepare and cook home-grown produce
- Proven that children involved in the programme grow and cook food at home
- Children understand seasonality of food
- Children make better food choices, with positive and sustainable impact on health and wellbeing
- Children experience the social aspect of sitting around a table enjoying food
- Evidence of increased numeracy and literacy through curriculum integration
- Beneficial for children who do not thrive in traditional classroom environment
- Improved behaviour through engaged learning
- Immediate take home for kids which flows on into family life
- Volunteering allows community to share their skills back into the community and vice
- Non-discriminatory. It's for all children within the community - socially inclusive

Healthy Futures is a Charitable Trust dedicated to ensuring access to healthy food and exercise in Wellington. Healthy Futures brought Garden to Table to Wellington schools and they have provided seed funding to low decile schools to take up the programme. As Garden to Table was a new initiative in Wellington, Healthy Futures commissioned an evaluation of the first schools that took up the programme.

This project aims to evaluate the programme in low decile Wellington schools to ascertain whether it improves the nutritional quality of children's diets, nutrition knowledge and willingness to try new foods.

"Research says kids need to try new foods anywhere from 7 to 15 times before they acquire a taste for them. Farm to school activities serve as the "training wheels" that introduce children to new food options, setting them up for a lifelong ride of healthy eating."(US Farm to School Programme)

Key Findings

- Children enjoy the Garden to Table programme
- Teachers and Support staff find the programme has positive effects on children and can be integrated into the school curriculum
- Children were able to name vegetables they could not previously and had tried vegetables they had not previously
- Children were more willing to try new foods
- Children increased their consumption of fruit and vegetables as both self-reported and by a parent/guardian

Evaluation Research Team

The evaluation was conducted by the Centre for Endocrine, Diabetes and Obesity Research at Capital & Coast District Health Board.

The team consisted of:

Amber Parry Strong, Research Fellow

Mark Weatherall, Statistician

Cecilia Ross, Research Manager

Margaret Ward, Research Nurse

Emily Walsh, Research Nurse

Pip Cresswell, Research Nurse

Helena Faherty, Research Assistant

Jeremy Krebs, Endocrinologist

Acknowledgements

Many thanks must go to the schools and their teachers who enabled this evaluation to occur. Thank you to the volunteers who assisted with organising the evaluation days in larger schools. Thank you to the Garden to Table Wellington Coordinator who assisted us to recruit schools into the evaluation. Thanks to the children and parents who participated. Lastly thanks to Tess Clarke of Healthy Futures for liaising with schools and providing invaluable support to the evaluation.

We would like to acknowledge the funding provided by Pub Charity Wellington and individual supporters for this project.

Literature review

The 2016/17 New Zealand Health Survey indicated that with 12% of children obese and 21% overweight, New Zealand has a significant health problem in childhood obesity.¹ However New Zealand has demonstrated the success of school based interventions for the prevention of childhood obesity through the APPLE project in Otago, and Project Energise in the Waikato region^{2,3}. Both interventions successfully used a combined nutrition and physical activity approach to reduce weight gain in intervention schools. BMI z-score held steady in the intervention arms, while it continued to increase in the control arm.

The success of nutrition-only interventions is less clear. While nutrition education for children can achieve the aims of increasing knowledge around fruit and vegetable intake, as children are not purchasers or preparers of food in the home this knowledge may not necessarily translate into changed behaviour. Certainly intervention studies in this area have found both behaviour change⁴ and no behaviour change⁵ in regards to vegetable consumption. Gardening interventions are thought to increase positive nutrition behaviours by creating a personal connection between children and the food they have grown, thus increasing willingness to try vegetables. As taste preference can often take 10-15 exposures to develop, predictors of vegetable intake include anything that will increase exposure and thus promote vegetable acceptance. Other predictors include asking for fruit and vegetables, food preparation skills and self-efficacy.^{6,7}

A review of a 12 week gardening programme in primary age children at a YMCA camp in the USA demonstrated a high level of enjoyment of gardening (95%), and a correspondingly higher vegetable intake while on camp.⁸ Parmer et al noted similar,

that children had a higher nutrition knowledge and were more likely to eat vegetables in the lunch cafeteria while at school.⁹

A study of three school gardening programmes in older children found that students who participated in a garden based nutrition education program increased their fruit and vegetable intake more than those who participated in a classroom based nutrition education intervention.¹⁰ The garden group also had increased intakes of vitamin A, C and fibre. An Australian study of two schools with vegetable gardens found that gardening increased children's willingness to try new vegetables and ability to identify vegetables.¹¹ No impact was observed on vegetable intake however.

A New Zealand health survey among secondary school students assessed the impact of a school garden on health indicators.¹² The survey was completed by 8500 students in Auckland and measured nutrition behaviours, physical activity and BMI. Approximately half of the schools had a vegetable garden, identified by the question "Does your school have a garden (vegetable and/or fruit) that students participate in?" but the student themselves did not identify whether they participated or not. School gardens were associated with lower student BMI and lower takeaway consumption but not increased fruit and vegetable consumption.

References:

1. Annual Update of Key Results 2016/17: New Zealand Health Survey. In: Health Mo, editor. Wellington New Zealand: Ministry of Health 2017.
2. Rush E, McLennan S, Obolonkin V, Vandal AC, Hamlin M, Simmons D, Graham D. Project Energize: whole-region primary school nutrition and physical activity programme; evaluation of body size and fitness 5 years after the randomised controlled trial. *Br J Nutr.* 2014;111(2):363-71. Epub 2013/07/23.
3. Taylor RW, McAuley KA, Barbezat W, Strong A, Williams SM, Mann JI. APPLE Project: 2-y findings of a community-based obesity prevention program in primary school age children. *Am J Clin Nutr.* 2007;86(3):735-42. Epub 2007/09/08.
4. Magarey AM, Pettman TL, Wilson A. Changes in Primary School Children's Behaviour, Knowledge, Attitudes, and Environments Related to Nutrition and Physical Activity. 2013;2013:752081.
5. Prelip M, Kinsler J, Thai CL, Erasquin JT, Slusser W. Evaluation of a school-based multicomponent nutrition education program to improve young children's fruit and vegetable consumption. *J Nutr Educ Behav.* 2012;44(4):310-8. Epub 2012/05/15.
6. Resnicow K, Davis-Hearn M, Smith M, Baranowski T, Lin LS, Baranowski J, Doyle C, Wang DT. Social-cognitive predictors of fruit and vegetable intake in children. *Health Psychol.* 1997;16(3):272-6. Epub 1997/05/01.
7. Reynolds KD, Hinton AW, Shewchuk RM, Hickey CA. Social Cognitive Model of Fruit and Vegetable Consumption in Elementary School Children. *Journal of Nutrition Education.* 31(1):23-30.

8. Heim S, Stang J, Ireland M. A Garden Pilot Project Enhances Fruit and Vegetable Consumption among Children. *Journal of the American Dietetic Association*. 2009;109(7):1220-6.
9. Parmer SM, Salisbury-Glennon J, Shannon D, Struempfer B. School Gardens: An Experiential Learning Approach for a Nutrition Education Program to Increase Fruit and Vegetable Knowledge, Preference, and Consumption among Second-grade Students. *Journal of Nutrition Education and Behavior*. 2009;41(3):212-7.
10. McAleese JD, Rankin LL. Garden-Based Nutrition Education Affects Fruit and Vegetable Consumption in Sixth-Grade Adolescents. *Journal of the American Dietetic Association*. 2007;107(4):662-5.
11. Morgan PJ, Warren JM, Lubans DR, Saunders KL, Quick GI, Collins CE. The impact of nutrition education with and without a school garden on knowledge, vegetable intake and preferences and quality of school life among primary-school students. *Public Health Nutrition*. 2010;13(11):1931-40.
12. Utter J, Denny S, Dyson B. School gardens and adolescent nutrition and BMI: Results from a national, multilevel study. *Preventive Medicine*. 2016;83:1-4.

Methods

All schools that enrolled in Garden to Table in Wellington during 2014 and 2015 were invited to participate in the evaluation. Five schools were eligible and approached, with four schools agreeing to take part. Considerable negotiation was undertaken to find a control school who would be willing to delay their participation in Garden to Table for one year to allow a control cohort of measurements. We were unsuccessful in this endeavour as all schools wished to begin straight away. All the schools taking part in Garden to Table at this time were low decile (5 or below).

This evaluation was approved by the New Zealand Health and Disability Ethics Committee, approval number 14/CEN/180/AM04.

An information sheet, consent form for guardians and assent form for students was sent home with all students in participating Garden to Table classes. The evaluation team also attended parent teacher interviews to answer questions people may have had about the evaluation. Baseline visits were conducted before the Garden to Table classes started for the year and end of year visits were set for the second to last week of Garden to Table for each year. The evaluation ran for three years.

At each visit students with valid consent and assent forms had anthropometric measurements taken and participated in a focus group. Height was measured twice using a portable stadiometer (Seca). Weight and body composition were measured using Tanita scales (Tanita TBF-300). Waist circumference was measured twice using a standard tape measure.

In the focus group students were asked to identify 5 common (tomato, lettuce, potato, carrot and peas) and 5 less common (beetroot, zucchini, silverbeet, capsicum and beans) vegetables and to state whether they had tried them or not. Other questions asked included what their favourite fruit and vegetables were and whether they liked to try new foods. At the end of each year a process evaluation of

the Garden to Table programme was added asking questions about their experiences, both positive and negative, that year.

The children's dietary questionnaire (CDQ, Flinder's University) was sent home to the parent/caregiver to fill in. This questionnaire gathers data on fruit and vegetables, sugary drinks and non-core food consumption. In two of the schools this questionnaire was also administered to the students on the evaluation day. A \$50 grocery voucher was offered as a prize draw each timepoint for returning the CDQ. The students got a certificate each for participating in the evaluation.

Statistical methods

Simple data summaries are shown by Visit and Exposure years to gardening. Joined line plots of individual response variables are shown against Exposure years to gardening with a Locally Weighted Scatter Plot Smoother (LOESS) line and 90% confidence limits to informally examine for any trend in these response variables with time. The LOESS smoother in this instance may be influenced by the few participants that had three years of gardening exposure. The evidence for a linear change in response variables with Exposure years to gardening used a mixed linear model with random intercept and slope terms by participants and an unstructured covariance matrix for these to take account the repeated measurements on the same participants. SAS version 9.4 was used.

Results

Of the four schools that participated in the evaluation, one school took part for one year and then ceased to offer the Garden to Table programme. Two schools took part for two years and one school for the three year duration. As ethnicity was not asked of the children, the ethnic make up for each school is reproduced below.

School 1: Decile 1

<i>Māori</i>	16%
<i>Samoan</i>	37%
<i>Cook Island Māori</i>	21%
<i>Tokelauan</i>	9%
<i>Other Pacific groups</i>	12%
<i>Other ethnic groups</i>	5%

School 2: Decile 3

Māori 61%
Pākehā 22%
Pacific 17%

School 3: Decile 4

Samoan 43%
African 13%
Indian 10%
Filipino 10%
Māori 9%
Tongan 4%
Middle Eastern 4%
Other South East Asian 4%
Other ethnic groups 3%

School 4: Decile 5

Māori 12%
Samoan 20%
Pākehā 18%
Middle Eastern 17%
Indian 12%
Other Pacific 7%
Other European 4%
Asian 7%
African 3%

The cohort represented a large range of ethnic groups, and reflected the ethnic make-up of lower decile Wellington Schools.

Baseline measures:

Baseline Demographics Garden to Table Evaluation

Combined Schools N = 124	Mean (Std Dev)
Age	9.4 (1.4)
Gender	F = 67 M = 57
Weight	42.9 (15.3)
Height	142.1 (11.6)
BMI	20.7 (4.8)
WC	70.2 (11.3)
WHt Ratio	0.49 (0.06)
BMI z-score	1.59 (6.1)
z-score Percentile	77.3 (25.5)
% Body Fat	25.2 (9.7)

Anthropometric and Dietary Questionnaire Results

All the variables are presented in both by visit and by exposure to gardening (years) (*Tables 2 and 3*). Variables reported from the children’s dietary questionnaire are the summary variables – Fruit and Vegetable intake, full fat dairy product intake and noncore foods (takeaways and junk food).

Table 2: Continuous variables by Visit

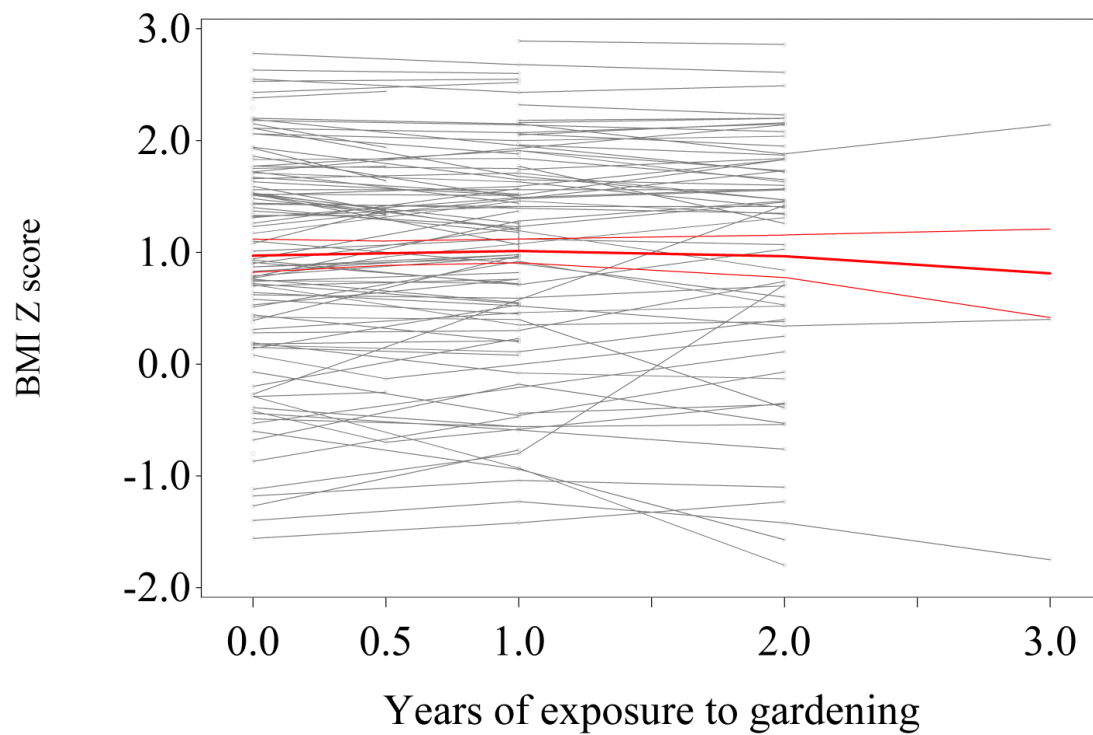
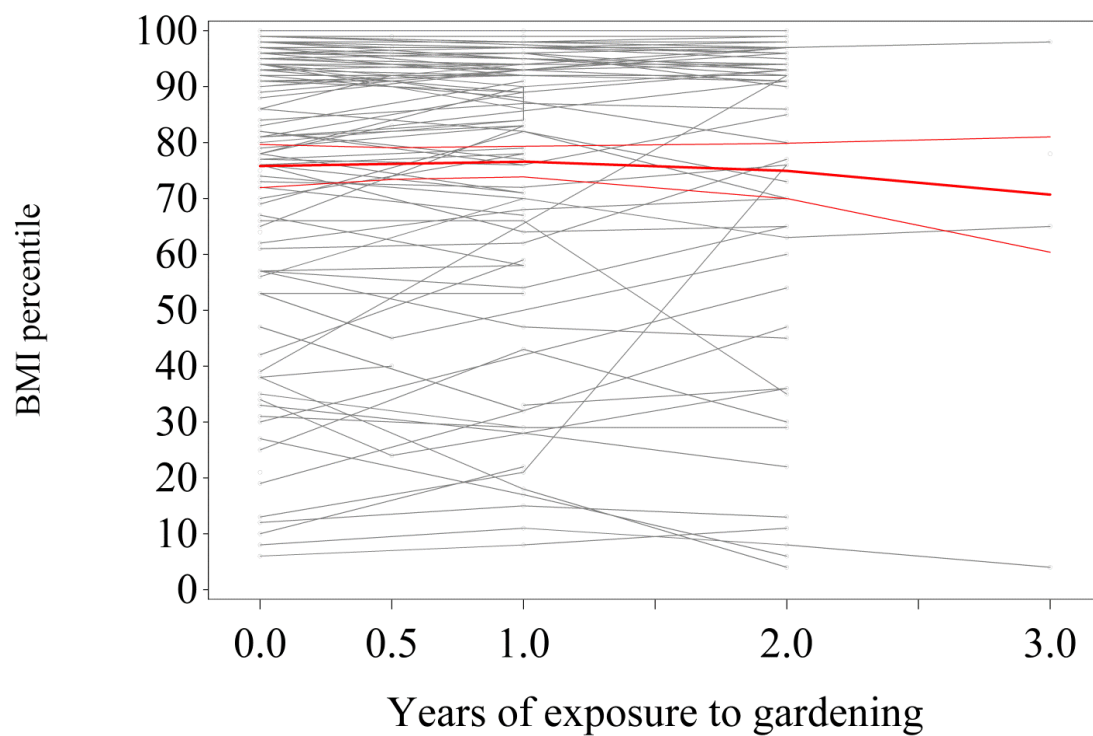
	Visit 1	Visit 2	Visit 3	Visit 4
Variable (N)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Age (years) N=124	9.4 (1.4)	10.2 (1.4)	10.2 (1.0)	10.8 (0.5)
BMI (kg/m ²) N=124	20.7 (4.8)	21.3 (5.2)	20.3 (4.2)	20.1 (6.1)
BMI Z score N=124	1.1 (1.0)	1.0 (1.0)	0.8 (1.1)	0.4 (1.6)
BMI percentile N=124	77.4 (25.5)	77.3 (25.4)	71.7 (29.9)	61.3 (40.5)
Exposure years N=124	0.1 (0.3)	1.1 (0.4)	2.0 (0.0)	3 (0)
FFM N=124	30.9 (7.8)	33.2 (8.9)	33.6 (7.7)	33.7 (4.2)
Fat mass N=124	12 (8.7)	13.7 (9.7)	10.5 (6.2)	10.5 (7.9)
Fat percentage N=124	25.2 (9.7)	26.6 (10.1)	22.2 (8.8)	21.4 (11.2)
FruitVeg Adult N=70	19.8 (8.1)	23.9 (6.9)	21.9 (6.8)	34.1 (NA)
FruitVeg Child N=75	14.4 (8.2)	20.9 (7.4)	20.3 (7.8)	26 (5.1)
Fullfatdairy Adult N=70	4.4 (3.2)	3.3 (2.4)	3.8 (3.3)	7 (NA)
Fullfatdairy Child N=75	2.5 (2.7)	2.5 (2.6)	4.2 (3.4)	4.5 (3.1)
Height (cm) N=124	142.1 (11.6)	146.4 (11.7)	146.5 (9.2)	148.7 (4.1)
Noncorefood Adult N=70	2.8 (1.4)	2.0 (1.2)	2.6 (1.9)	1.9 (.)
Noncorefood Child N=75	2.9 (2.2)	2.4 (1.5)	2.4 (1.5)	2.5 (1.4)
Sweet beverage Adult N=70	1.5 (1.5)	1.3 (1.2)	1.2 (1.1)	1 (NA)
Sweet beverage Child N=75	1.3 (1.5)	1.3 (1.2)	1.4 (1.5)	2 (1.8)
TBW N=124	22.6 (5.7)	24.4 (6.5)	24.6 (5.6)	24.6 (3.1)
WHtR N=124	0.5 (0.1)	0.5 (0.1)	0.4 (0.1)	0.4 (0.1)
Waist N=124	70.2 (11.3)	68.9 (12.3)	65 (11.1)	60.1 (11.2)
Weight N=124	42.9 (15.3)	46.9 (16.9)	44.1 (12.5)	44.1 (11.9)

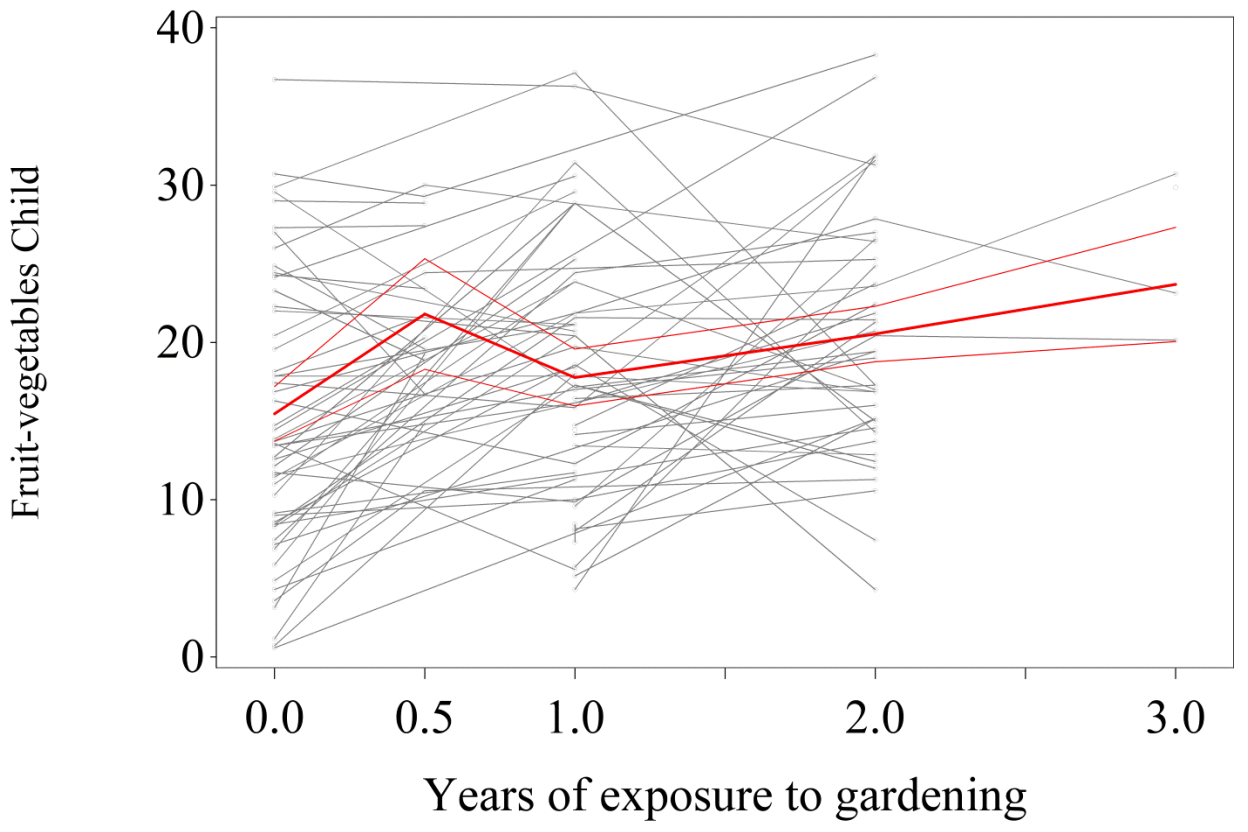
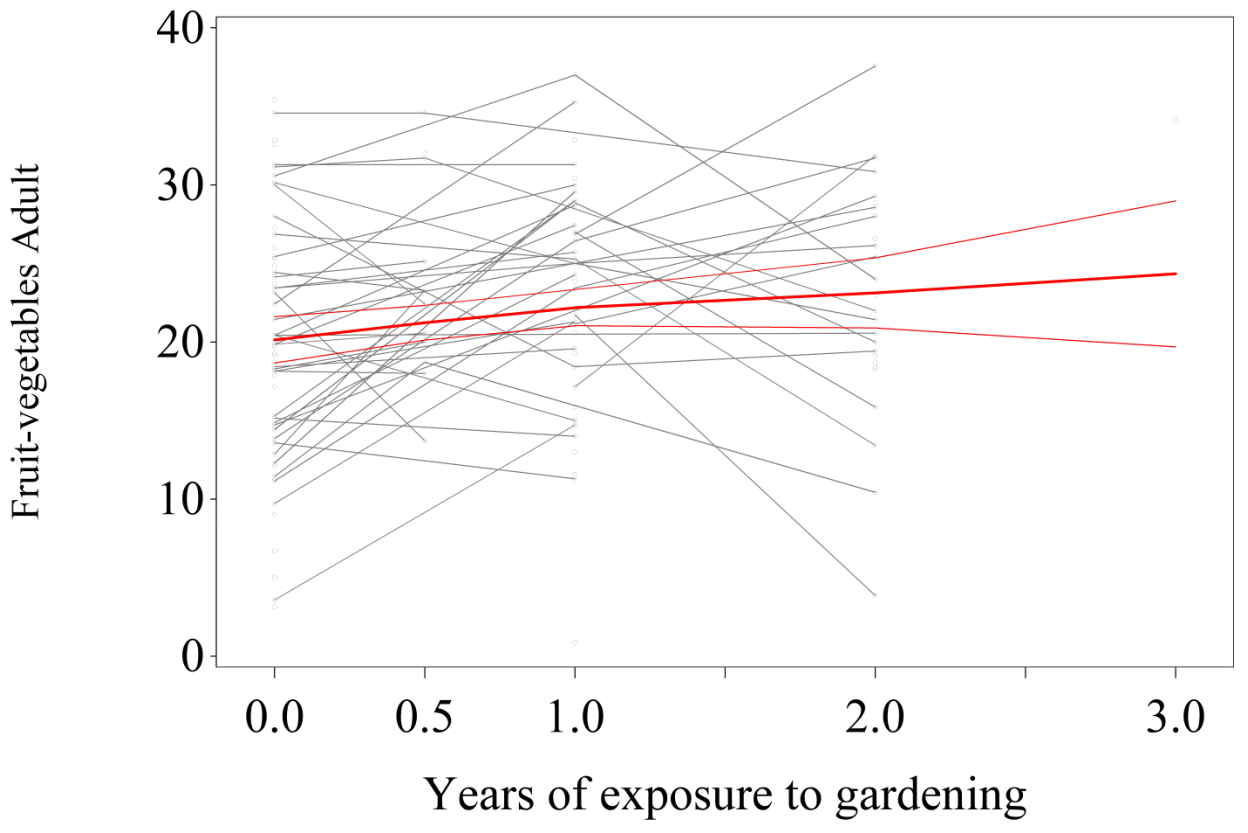
Table 2: Continuous variables by Exposure years

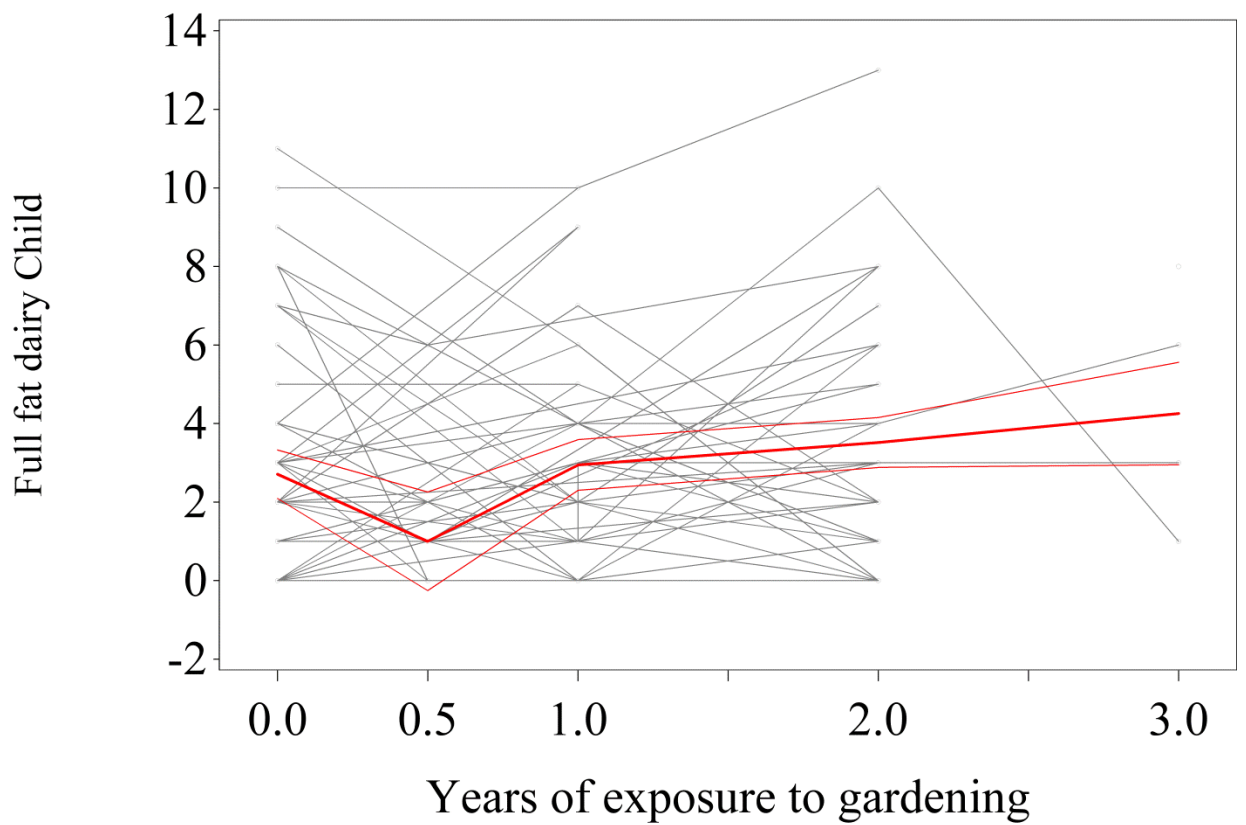
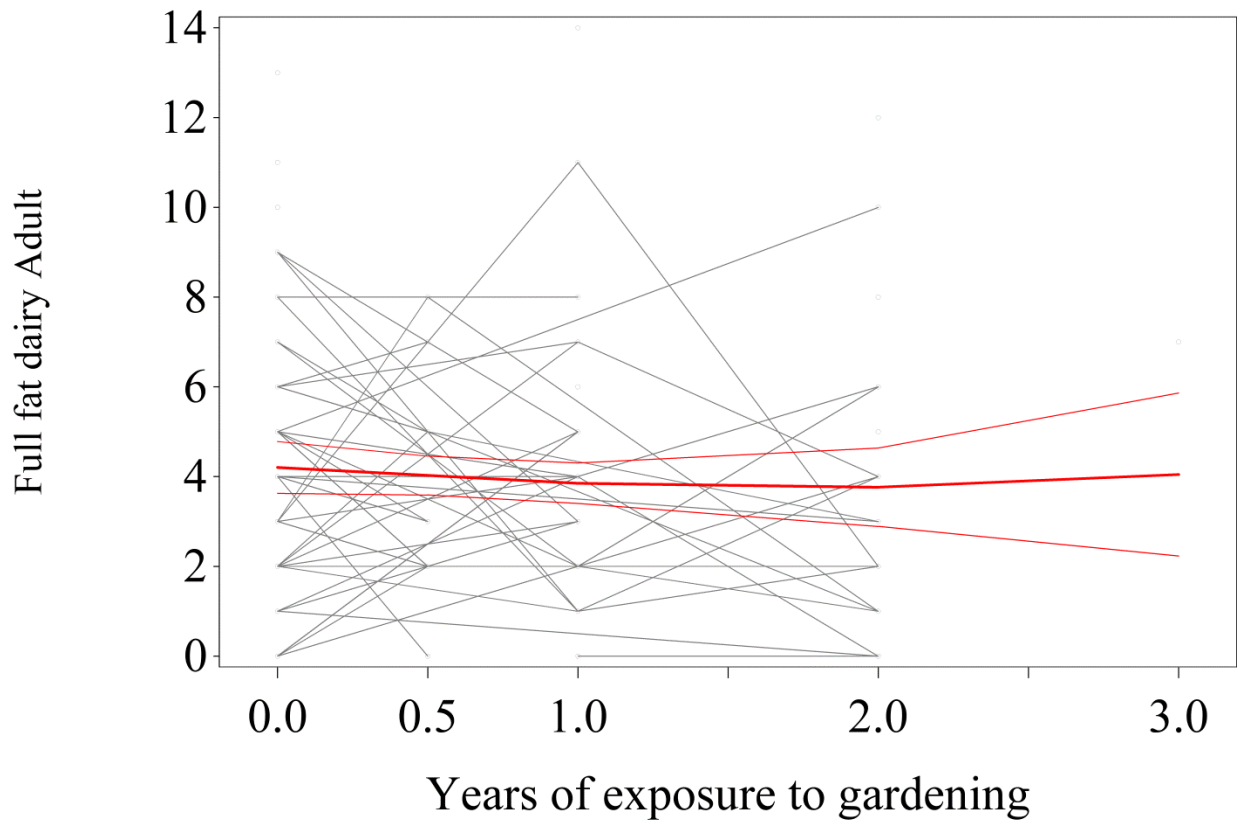
	0	0.5	1	2	3
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Age (years) N=107	9.3 (1.5)	12.3 (0.6)	9.7 (1.2)	10.3 (1)	10.8 (0.5)
BMI (kg/m ²) N=107	20.1 (4.4)	23.2 (4.5)	20.9 (5.1)	21.5 (5.3)	20.1 (6.1)
BMI Z score N=107	0.9 (1.0)	1.1 (0.9)	1.0 (1.0)	1 (1.1)	0.4 (1.6)
BMI percentile N=107	75.1 (26.1)	80.5 (24.6)	77.3 (25.3)	75.9 (28.9)	61.3 (40.5)
FFM N=107	30.1 (7.8)	44.1 (9.4)	31.3 (6.7)	34.9 (8.4)	33.7 (4.2)
Fat mass N=107	11.1 (8.1)	18.7 (8.3)	12.5 (9.3)	12.9 (8.7)	10.5 (7.9)
Fat percentage N=107	24.4 (9.5)	29.1 (7.9)	25.8 (9.9)	24.7 (10.3)	21.4 (11.2)
FruitVeg Adult N=62	19.6 (8.1)	23.6 (6.3)	23 (7.4)	22.6 (7.1)	34.1 (NA)
FruitVeg Child N=58	15.5 (8.6)	21.8 (5.8)	17.8 (8)	20.3 (7.7)	26 (5.1)
Fullfatdairy Adult N=62	4.3 (3.1)	3.7 (2.3)	3.8 (2.9)	3.6 (3.2)	7 (NA)
Fullfatdairy Child N=58	2.7 (2.9)	1 (1.6)	2.9 (2.6)	3.4 (3.3)	4.5 (3.1)
Height (cm) N=107	141.3 (11.9)	163.8 (8.6)	143.2 (9)	147.8 (9.5)	148.7 (4.1)
Noncorefood Adult N=62	2.7 (1.4)	1.7 (1)	2.5 (1.4)	2.4 (1.8)	1.9 (NA)
Noncorefood Child N=58	2.9 (2.3)	1.9 (1)	2.8 (1.6)	2.4 (1.5)	2.5 (1.4)
Sweet beverage Adult N=62	1.5 (1.5)	1.5 (0.9)	1.4 (1.5)	1.2 (1.1)	1 (NA)
Sweet beverage Child N=58	1.3 (1.6)	1.5 (1.2)	1.3 (1.2)	1.3 (1.4)	2 (1.8)
TBW N=107	22 (5.7)	32.3 (6.9)	23 (5)	25.6 (6.1)	24.6 (3.1)
WHtR N=107	0.5 (0.1)	0.5 (0.1)	0.5 (0.1)	0.5 (0.1)	0.4 (0.1)
Waist N=107	69 (10.6)	77.5 (10.6)	67.6 (12)	68.3 (13)	60.1 (11.2)
Weight N=107	41.2 (14.8)	62.8 (14.9)	43.7 (14.7)	47.8 (15.2)	44.1 (11.9)

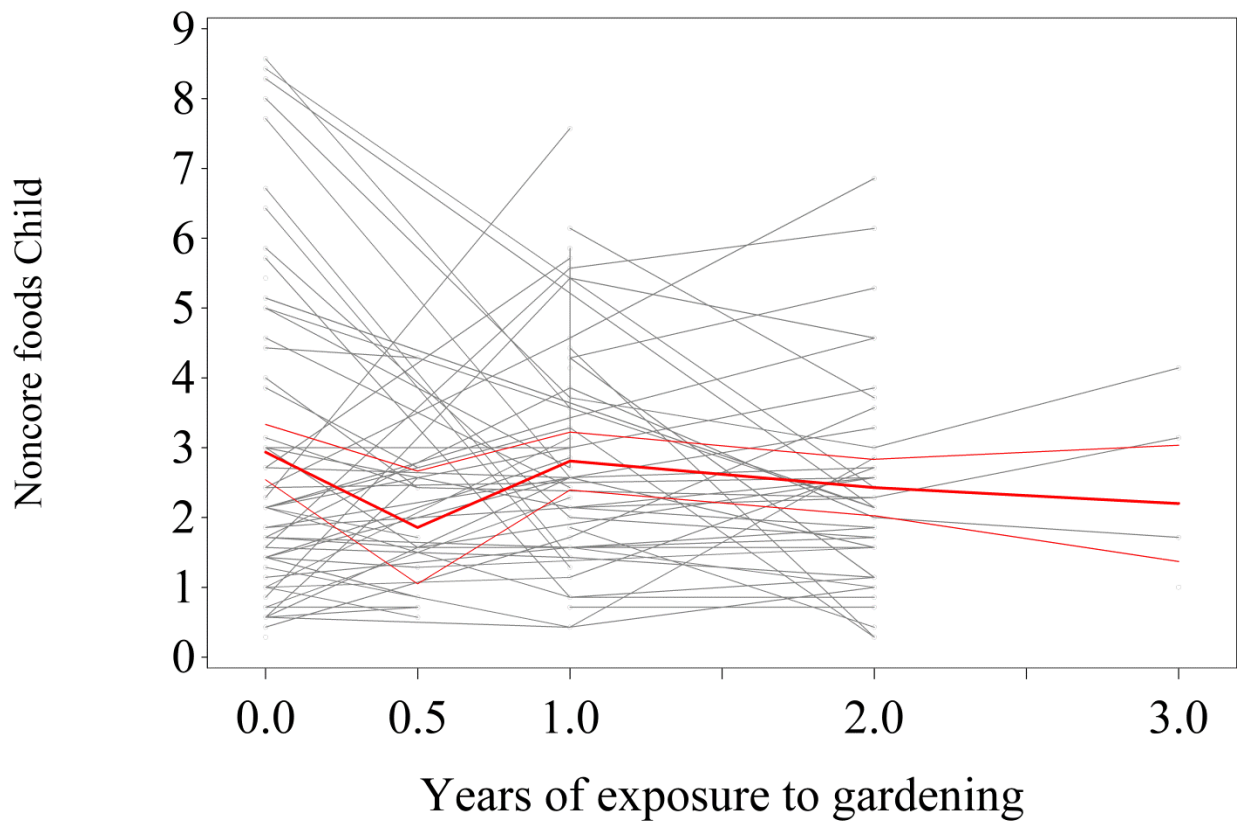
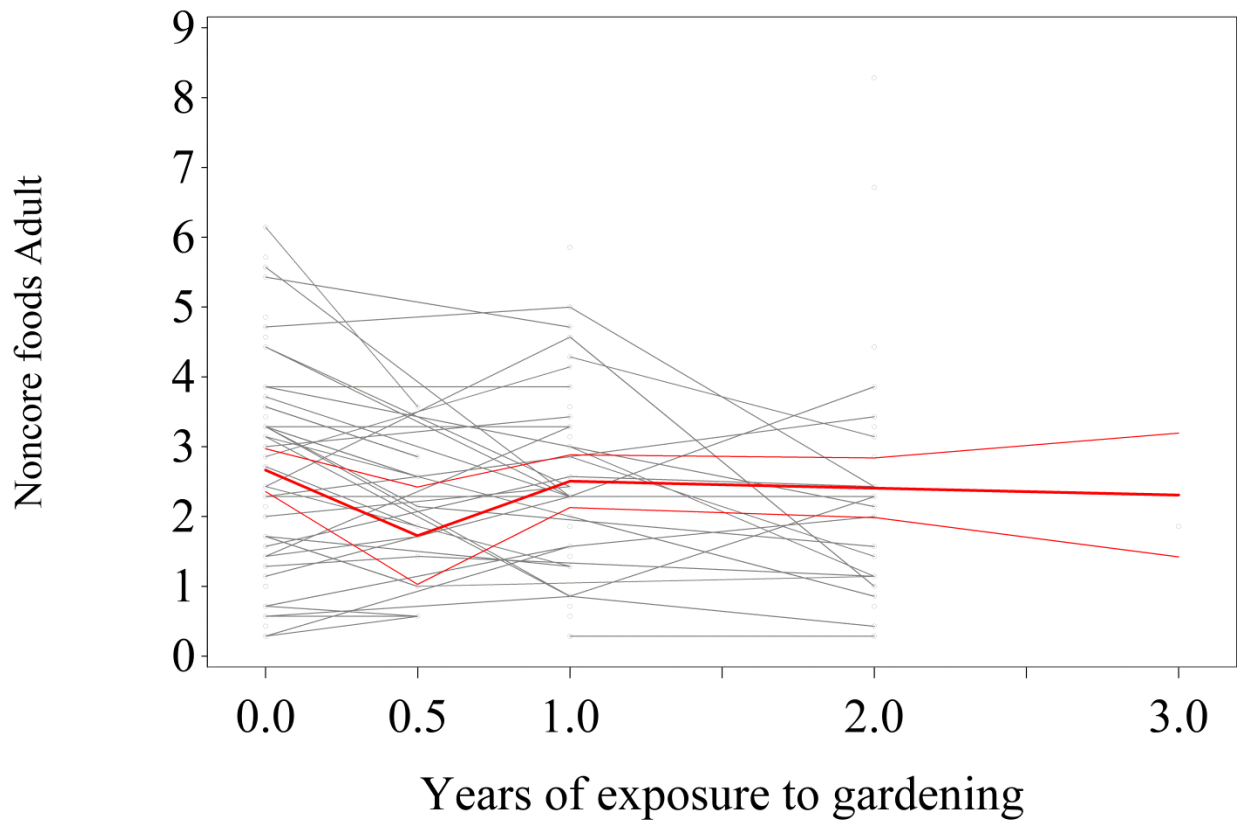
LOESS smoothed plots

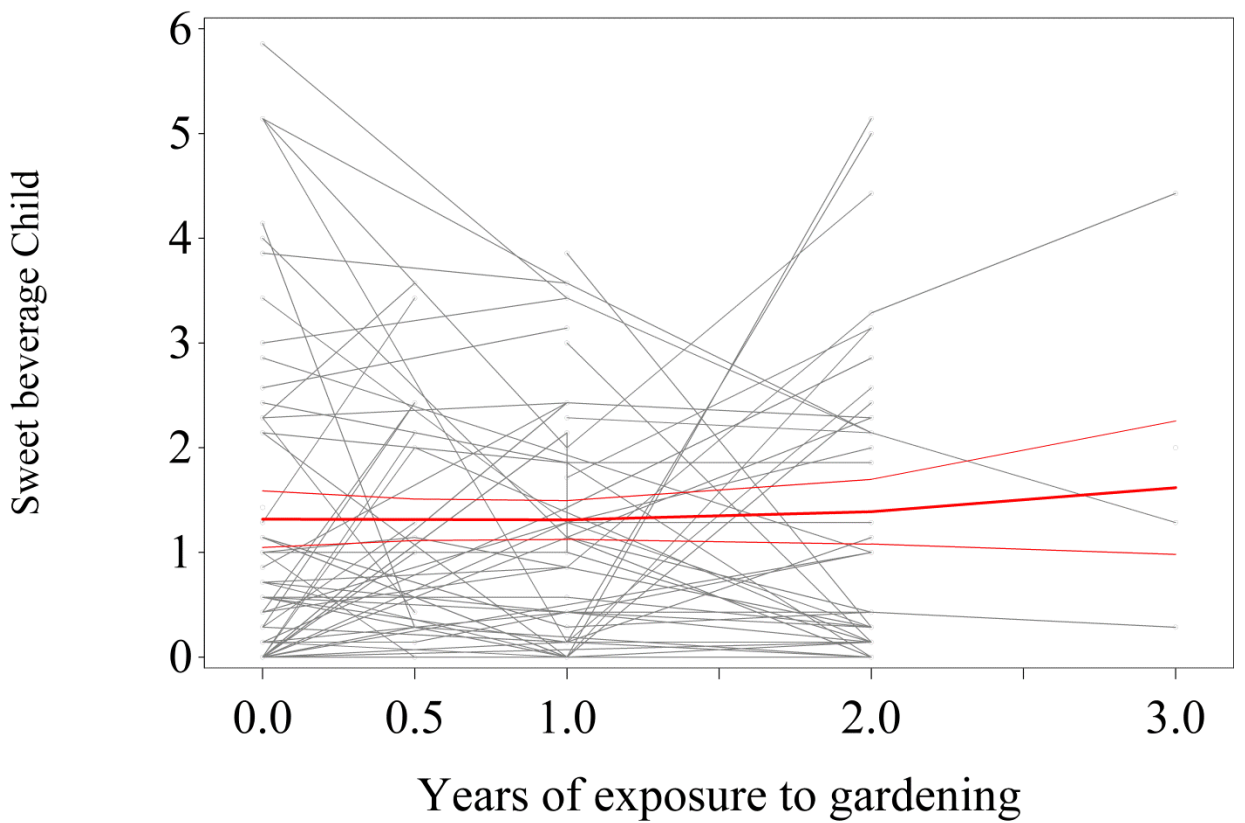
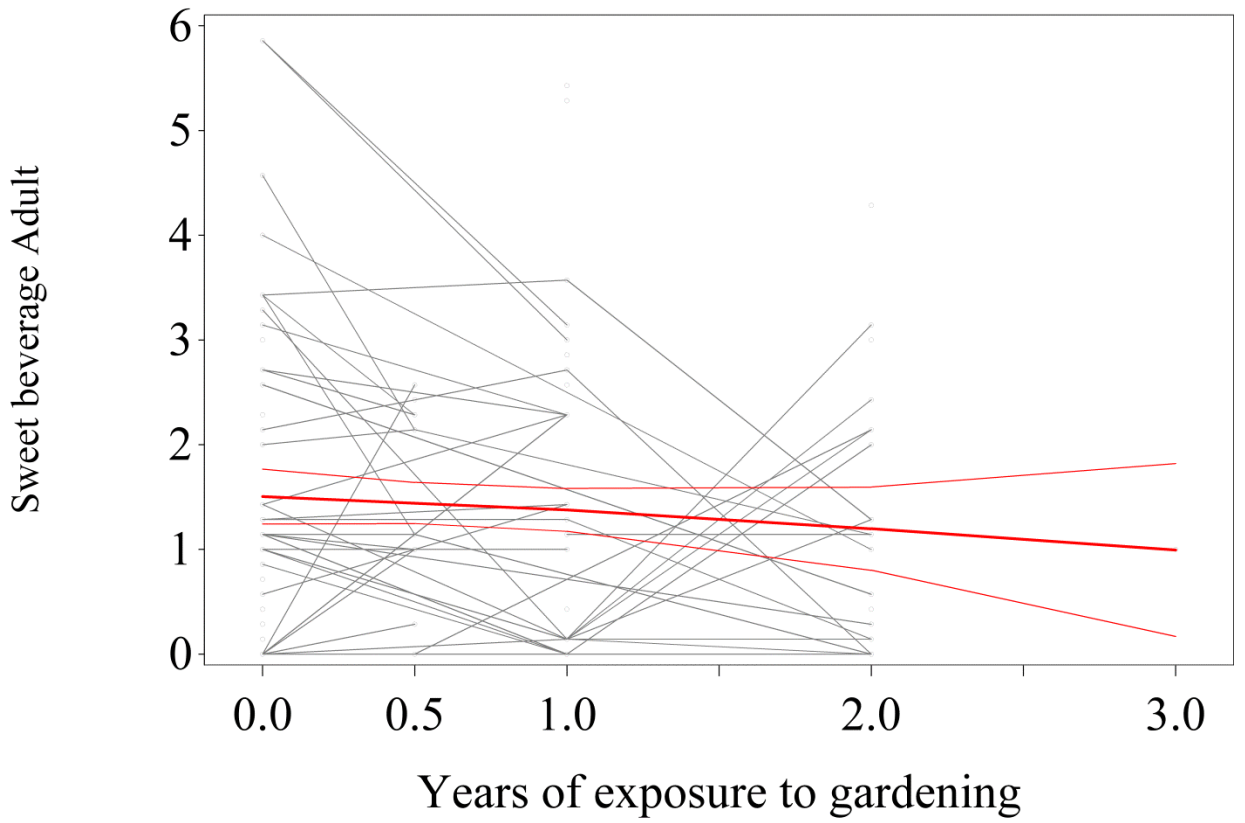
For all the plots individual participants are in grey and the fitted smoothed LOESS in dark red with 90% CI in lighter red











Fitted regression lines by Exposure year (number of units change in response variable per year of gardening exposure) from the mixed linear models.

Response variable	Regression coefficient (95% CI)	P
BMI Z score	0.001 (-0.05 to 0.05)	0.96
BMI percentile	0.72 (-0.7 to 2.1)	0.32
Fruit-vegetable Adult	0.9 (0.3 to 3.7)	0.024
Fruit-vegetable Child	3.2 (1.9 to 4.4)	<0.001
Full fat dairy Adult	-0.2 (-0.9 to 0.5)	0.50
Full fat dairy Child	0.4 (-0.1 to 1.0)	0.13
Noncore foods Adult	-0.2 (-0.5 to 0.04)	0.09
Noncore foods Child	-0.2 (-0.6 to 0.1)	0.20
Sweet beverage Adult	-0.2 (-0.4 to 0.1)	0.24
Sweet beverage Child	0.03 (-0.2 to 0.3)	0.82

Focus Group Results

The percentage of children knowing the name of both the common (lettuce) and uncommon (all) vegetables significantly increased over the intervention. Likewise the numbers of children having tried each vegetable increased significantly for courgette, silverbeet and capsicum. The most common comments were for the green beans – before the intervention most children thought they were “pea sacks” and after the intervention the most common guess was broad beans, reflecting what had been grown in their gardens that year.

Percentage of children knowing the name of vegetable (std dev)	Before	After
Peas	88.3 (25.7)	99.4 (3.0)
Tomato	100 (0)	98.1 (6.2)
Potato	93.5 (11.6)	93.4 (19.1)
Carrot	98.5 (4.6)	99.3 (3.2)
Lettuce	67.4 (37.0)	90.3 (17.6) *
Courgette	24.8 (30.9)	73.2 (35.2) **
Silverbeet	28.7 (28.4)	53.6 (35.4) *
Capsicum	72.8 (28.0)	94.1 (12.4) **
Beans	45.8 (32.2)	68.9 (33.3) *
Beetroot	50.0 (33.8)	83.9 (26.3) **

Percentage of children having tried the vegetable (std dev)	Before	After
Peas	92.1 (17.7)	98.9 (5.2)
Tomato	97.2 (8.7)	98.1 (6.2)
Potato	98.9 (4.6)	95.8 (16.1)
Carrot	98.3 (5.3)	100 (0)

Lettuce	88.1 (29.6)	96.0 (9.4)
Courgette	44.3 (38.6)	81.3 (27.4) **
Silverbeet	76.6 (18.4)	90.9 (19.2) *
Capsicum	77.7 (20.6)	91.7 (11.4) *
Beans	78.9 (20.2)	85.2 (22.0)
Beetroot	71.5 (29.3)	84.0 (28.3)

T-Test *P < 0.05 **P < 0.01

The number of children who liked trying new foods rose from 75.7% to 84% but this was not statistically significant. Some of the comments about trying new foods were positive and some philosophical: *"so we can say to people we've eaten it", "you don't want to be fussy all your life", "so we don't always eat the same food all the time", "you try foods and sometimes they are yum and sometimes they are yuck"*.

Process Evaluation

At the end of each year the children were asked some questions specifically about garden to table.

"What did you like most?"

The children were overwhelmingly positive about GTT, evidenced by such comments as *"everything", "it's fun" and "it's awesome"*. Children liked both the gardening and cooking modules although some children were less keen on one or the other. Some comments showed progressing acceptance over the programme *"The vegetables get yummiier over time - you get used to it"*. Many recipes were listed as favourites and included savoury items such as dumplings, soup and risotto, along with sweet options such as apple pie, rhubarb cupcakes and carrot muffins. Some schools used "Masterchef" type challenges and competitions in the programme and this was very popular, as was getting to be head chef for the session. Some students also mentioned getting to visit local restaurants or getting their photo in the paper.

"What did you like least?"

This section elicited some minor complaints such as getting wet (dishes) and muddy (gardening), dealing with insects and compost. Some jobs were clearly unpopular – washing dishes, taking out rubbish and weeding were often mentioned. This section elicited some interesting feedback about the importance of good volunteers (*"getting shouted at (by the volunteers)"*) and systems for dividing jobs. It seemed that in one school in particular the jobs were announced and asked for children to volunteer, the boys tended to be more vocal and so got the "good jobs", and the girls tended to hang back and hence were "stuck" with the "boring jobs". Once this was fed back to the school the same comments did not arise the following year. Getting cut featured a few times across schools, with the knives and grater, but was not mentioned in the final year.

"Have you done anything at home that you learnt at GTT?"

As the children were aged from 7 to 12 with schools choosing to implement GTT at different ages, this impacted on the number of children replicating GTT activities at home. Children reporting making GTT dishes at home were older, while younger children tended to report gardening at home. The New World "Little Garden" promotion of free vegetable and flowers seeds ran over two of the three years and many children reporting planting these. Some of the children reported using knife skills at home *"I taught my nana how to cut silverbeet properly"* and reported chopping vegetables for dinner preparation (*"chopping with a bear claw"*). A good number of children did report making dishes at home, ranging from simple (scrambled eggs and pizza) to more complex (dumplings, roast veges and sushi). A total of 20 different dishes were cited as having been made at home, with some mentioned more than once (scrambled eggs, feta triangles, minestrone and French toast). Some children also said they were more likely to cook now in general.

At one school in the first year it became apparent that the children were not given the recipes to take home. The students reported that the recipes were on a blog but none of them had access to this at home. We were able to feed this back to the school and the following year paper recipes were provided.

Some discussions occurred around whether the children ate more vegetables at home after doing GTT. Some were positive and others neutral. One child remarked that *"my parents couldn't believe I ate the vegies at school"*. Another *"maybe but depends on how they are cooked"*, *"they (GTT) find ways to make the vegetables taste nicer"*.

"What could improve GTT?"

The suggestions given here ranged from the aspirational "a fountain" "a new kitchen" and "a glass house" to the practical "aprons", "gumboots" and "clean plates". Several children suggested having chickens for eggs and many suggested specific fruit trees or vegetables they wanted to grow. A common theme was how to protect the garden better from animals and people, with better fences, nets and signs all suggested. One of the older groups said that they wanted it to be more challenging *"We could do more as we are capable of doing more - teacher does a lot for us we could be doing ourselves"*. Some children suggested they get a chance to make up their own recipes. Others wanted to try using chopsticks and having more cooking challenges.

Aprons in particular was a suggestion picked up in subsequent years by most schools with class sets provided.

Principal and Teacher feedback

The keys to success from a Principal and School point of view from the interviews were: stable funding, enough volunteers and integration into school and community life. Having strong community links was important for borrowing equipment (or getting it donated), sourcing volunteers and having help over the holidays with weeding and watering. It was also important for organising trips to visit restaurant

kitchens, getting prizes donated and sourcing extra funding. One school was able to attract the support of a chef for their programme and had a prize donated of a restaurant visit. Another was able to borrow a large plastic house for raising seedlings. In one school the volunteers themselves organised fundraisers to ensure ongoing funding of the programme.

We were able to talk to three principals, some teachers, a garden specialist and a parent helper for this evaluation. The principals were very involved and supportive.

Principal #4 – *“each week one child is designated head chef and wears a chef hat and takes charge in the kitchen. The other kids must say “yes chef” when speaking to him/her. Then I interview the head chef and I write it up for the school newsletter”.*

Principal #3 – *“we cooked recipes at GTT then invited parents to come and share, then we got the kids to cook GTT recipes at home and bring to share at school. We need more ethnic recipes from GTT headquarters e.g. Ethiopian and Filipino to match the ethnicities of the kids here. Also no expensive ingredients – one week we had to buy tahini and then we didn’t use it again.”*

Principal #2 – *“We had to build a big fence around our gardening area as things got stolen, our big water tanks got stolen but I found out from the community who had done it and I went round and got them back”.*

Integration with Curriculum

The teachers and garden specialist discussed how positive it had been for the children and about integrating other subjects with the garden. Maths was the obvious one with measuring and working out how much was saved buying seeds vs buying the vegetables at the store. The children were following systems through from the seeds to harvesting and again from raw food to cooked. Art was also incorporated and children painted murals around the gardens.

“We link the garden to the curriculum for maths and science. We bought a packet of leek seeds for \$1. We count how many seeds are in a packet and work out how many leeks we got from the packet. The leeks at the shops were \$1 each one day so we see how much we saved. We do measurement – you have to put the seed in 3 mm deep and so far apart.” “The kids have a change in vocab and knowledge and it feeds into classroom enquiry and teamwork”

Increased vegetable consumption and acceptance

The teachers had noticed children eating more vegetables at school events (camp, shared morning teas) and thought they were influencing their siblings as well. *“We just had camp and when they made their own burgers they used more vegetables lots more vegetables in their burgers.” “The positives is the attitude towards vegies has changed, they have dips from vegies and more fruit. They wouldn’t have eaten this (healthy shared morning tea) so enthusiastically before. If they get the sugar out of their lives, they don’t miss it.”*

But they noted that it needed to be supported schoolwide *“We need more whole school buy-in. The school culture for the teachers is to have junk food for*

celebrations. We need to emphasise the importance – lots of the community is affected by diabetes.”

The parent helper remarked on the love of gardening and vegetables her children had developed *“I have a taro patch at home and now my two boys love to help and get dirty because they did it here at school. They also love vegetables now. I have learnt things – I didn’t know seaweed was good for the garden.”*

Personal Growth

Teachers and volunteers also notice the children changing with the programme personally. *“They have nurtured the plants, it’s an achievement and an attitude change for them. The kids come to the teachers and say what they have done at home.” “They are more willing to try everything and that’s in any situation” “They learn problem solving. We’ve got a sick lime tree – they have to research how to look after it.”*

Challenges

The teachers and the garden specialist saw the challenges as the availability of funding, not enough time in the garden for the bigger school and help with watering over summer holidays. In the largest school the garden takes three hours to water and the school wanted an irrigation system but no funding was available. An irrigation system they felt would have meant the garden didn’t go backwards over holidays and saved time for the garden specialist to do other things. Because they had three classes doing GTT the time the children got to spend in the garden was limited – once every 6 weeks. In the smaller schools the children were in the garden every week or fortnight.

Wet days was another challenge for all schools, as was space to raise seedlings inside. *“We have to develop alternatives for wet days. The kids use the stakes as weapons so we have to do education.”*

Children’s Dietary Questionnaire

There were some limitations around this questionnaire with one data collection falling the day after students had got back from school camp, and another day falling after school had been closed after an earthquake. This would have affected their usual diets. Compliance from adults returning the questionnaire was low.

Discussion

This cohort was larger in body size than other cohorts recruited across all decile or higher decile schools. The Apple study followed 470 children across seven schools in Otago and reported the baseline BMI z-scores were 0.80 (± 0.7) and 0.61 (± 0.82) for the control and intervention groups respectively.³ Even allowing for increases in obesity over the time period since this study, our findings showed the baseline BMI z-score was double that of the Apple study.

The New Zealand Health Survey 2016/2017 reported the following BMI per age bracket compared to the BMI observed in our study.

Mean BMI per age (95% CI)

Age	NZ Health Survey	GTT Evaluation
7	17.5	17.7
8	18.8	18.9
9	18.6	20.1
10	19.9	22.1
11	20.6	22.3
12	21.1	23.9

Our cohort is larger from the age of 9 and above and reflects the body size of the lower socioeconomic areas the cohort is drawn from and the higher representation of Maori and Pacific children.

Although the LOESS fit for BMI Z score is consistent with a reduced BMI Z score with more years of exposure to gardening the regression coefficient showed no evidence of a relationship. The very small number of children completing a year three assessment has skewed the graph this way. The LOESS fit for BMI percentile had no particular pattern and the regression coefficient showed no evidence of a relationship. The determinants of obesity are complex and likely beyond the scope of one intervention to influence. There was no specific intervention around either exercise or the reduction of non-core food items so we would not expect necessarily that an effect on obesity was likely but it was still useful to have measured this anyway. Even so there was a small reduction in non-core foods with a trend towards significance and this is very positive.

The LOESS fits for Fruit and Vegetable intake are consistent with an increase with this score with exposure time with a steeper regression line when questionnaires were answered by children compared to adults. Only one school had a 0.5 year exposure due to starting halfway through the first year, this explains the steeper points at this exposure in the LOESS graphs. This provides further evidence that exposure to fruit and vegetables is a key determinant of intake and is encouraging that gardening and cooking is a valid way of increasing intake. Garden to Table also results in increased food preparation skills and self-efficacy, which have been shown to be determinants of fruit and vegetable intake.^{6,7}

The focus group data showed that with gardening exposure children were able to name more vegetables and were also more likely to have tried them. One interesting phenomena with beans and beetroot was that while children struggled to name them in their natural form, they had eaten them in other forms – for beans it was from frozen and for beetroot it was tinned.

Children overwhelmingly reported enjoying the GTT programme and teachers and principals were also very positive about the programme and its' effects.