Scoping paper:
The impact of children's cooking classes on dietary behaviours from an obesity prevention perspective

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Abstract

Introduction

Cooking programs are designed to be an educational tool that aims to encourage healthy eating behaviours. In Australia 1 in 4 children are overweight or obese. This study aimed to review the literature to investigate the effectiveness of cooking programs in school--aged children in relation to the impact on weight status, fruit and vegetable consumption and food preferences, attitudes and beliefs. The study addressed the question 'what is the impact of cooking classes targeting school--aged children on food related preferences, attitudes, behaviours and weight?

Methods

A systematic review of the literature through was conducted through EBSCOhost database to identify articles where school aged children, between 3 and 17, are involved in hands--on cooking experiences. Papers were grouped into primary and secondary school aged children and the search was limited to papers published in English between 2000 and 2015.

Results

Twenty papers met the selection criteria for this review. Programs were held in schools, camps, community groups and afterschool clubs. Ten primary and 10 secondary school programs were identified, in which exposure ranged from 3 sessions to weekly sessions over a year. Primary school interventions demonstrated higher quality studies (7/10 were of moderate quality) compared to secondary school interventions where majority (8/10) were weak quality. All papers reported an aspect of positive change in the measurable outcomes of attitudes, preferences, beliefs and cooking skills, however not all results were significant in the short term in improving diet quality and weight.

Conclusions

Findings suggest that cooking programs have the ability to have a positive impact on young people's food preferences, attitudes and beliefs. However, program design varied across all of the studies. This made it difficult to draw conclusions on the essential elements of a cooking program that will result in long-term positive impacts on consumption of fruit and vegetables and weight. Further research is needed using higher quality study designs in the secondary school setting and within an Australian context.

1. Background

a. Strategies to address childhood obesity

The effort to combat obesity among adults and children by all levels of government is a complex issue and no one policy or program will work alone to reduce this global epidemic. Potential obesity prevention measures include reducing the marketing of unhealthy food and drinks to children, standardising nutrition labelling, taxes on foods and nutrition education campaigns (World Health Organization 2012). Many authors believe that cooking education provides children with a sense of control over the food they prepare and consume, this equips them with the knowledge to apply their skills to make healthier food choices (Condrasky & Hegler 2010; Nelson, Corbin & Nickols--Richardson 2013). Accordingly, there is potential for cooking education to play a role in childhood obesity prevention.

b. Role of cooking education in obesity prevention - adults

There have been a number of studies addressing the effectiveness of adult cooking classes, including three recent literature reviews. Reicks et al. (2014) reviewed 28 studies to determine the impact of adult's cooking classes on dietary outcomes and food choices. The results presented a positive behaviour change in preparing and consuming healthier meals (Reicks et al. 2014). Four studies were also successful in implementing programs to target specific health concerns of adults, and demonstrated a significant positive effect on dietary intake as well as positively affecting rheumatoid arthritis measurements, blood pressure, serum cholesterol and quality of life for men with prostate cancer (Reicks et al. 2014). Reicks et al. (2014) also discusses the impact cooking classes could have on children and the importance of these skills persisting into adulthood.

Another systematic review of the literature of adult cooking classes among the UK population by Rees et al. (2012) assessed elements of best practice and cost effectiveness in cooking classes for adults in the UK. A total of 13 articles related to teaching cooking skills to low income populations with aims to promote and improve diet and health were included (Rees et al. 2012). The study findings were inconclusive due to the lack of high quality evaluations (Rees et al. 2012). A systematic review by Iacovou et al. (2013) examined the social health and nutritional impacts on community kitchens among a low--income adult population. The review addressed 10 studies and found that community kitchens have a positive impact on enhancing cooking skills and social interactions including the nutritional intake of study participants (Iacovou et al. 2013). Participants increased their diversity of choices when purchasing fruit and vegetables, developed cooking skills and improved social health outcomes, due to the increased opportunity to socialise with peers (Iacovou et al. 2013). Iacovou et al. (2013) concluded that there was a lack of good quality data that, therefore, reduce the ability to interrupt these findings into policy and practice within health promotion, and the need for rigorous research methods to be applied in future. In an Australian context, a study evaluating Victorian community cooking programs by Lee et al. (2010) with respect to 17 local community kitchens, found that community kitchens were successfully able to enhance participants food knowledge and cooking skills and enhance social skills and support networks. However, nutritional intake was not measured (Lee et al. 2010). These community kitchens proved valuable in reaching vulnerable population groups such as Indigenous people, newly arrived migrants and refugees, people with disability and low socioeconomic backgrounds who suffer many health inequalities and are most vulnerable to food insecurity (Lee et al. 2010).

c. Role of cooking education in obesity prevention - children

There are fewer studies that have examined the impact of community cooking education among children. However two literature reviews have looked closely at childhood outcomes across the

world (Brooks & Begley 2014; Hersch et al. 2014). Brooks and Begley (2014) analysed 23 papers on food literacy programs in adolescents (13 to 17 years) around the world, where interventions focused on practical cooking or food preparation skills. The review found that many programs target early adolescence and a lack of programs targeting older adolescents, culturally and linguistically diverse groups and gender specific groups (Brooks & Begley 2014). The programs lacked a focus on dietary behaviour change and suggest more research in this area is needed (Brooks & Begley 2014). However 19 of the 23 studies reported positive outcomes on food and nutritional knowledge, self-efficiency for cooking, preparing foods in a new way and making recipes at home (Brooks & Begley 2014). Another child based literature review by Hersch et al. (2014) addressed the impact of cooking classes on food related preferences, and behaviour of school aged children between the ages of 5 and 12. Only randomised control trials or quasi--experimental studies with a minimum sample size of 10 participants were included in the review (Hersch et al. 2014). The review found that cooking programs are a promising tool for their short term impact in promoting changes in food related preferences, attitudes and behaviours. Although no best practice or consistent themes were found, the review concluded that there is a need for more evidence and quality evaluation to determine if food choices are occurring because of the intervention, and can they be sustained long term throughout adolescence (Hersch et al. 2014).

2. Results

a. Overview of studies

A total of 20 papers were identified that met the search criteria for selection in this literature review. Of those, 10 were primary school focused (table 3) with children 3-10 years, however two had repeated interventions with differing outcomes (Cunningham-Sabo & Lohse 2013, 2014; Davis et al. 2011; Gatto et al. 2012a). The other 10 were secondary school focused papers (table 4) with children aged 11 to 17 years, however Revill (2004) was a doctoral theses that was sourced from Hyland et al. (2006) reference list, these two papers had the same intervention with different outcomes measures.

b. Interventions targeted at primary school aged children (Children 3-10 years)

Study selection

Of the 10 papers included for the review within the primary school aged setting, 9 were studies conducted in the United States of America (USA) and 1 study was conducted in Australia (see table 3 for full description of articles included).

Study design and sample size

All studies included in the review were a pre and post intervention evaluation in which outcomes were measured either by a questionnaire or a focus group discussion. Within this sample 8 of the studies had a control group and the sample size ranged from 36 (Dougherty & Silver 2007) to 539 (Cunningham--Sabo & Lohse 2014) participants, with mean participants approximately 175.

Intervention type and study outcomes

Fifty percent (5/10) (Caraher et al. 2013; Cunningham--Sabo & Lohse 2013, 2014; Gibbs et al. 2013b; Quinn, Horacek & Castle 2003) of programs were imbedded within the school curriculum, 10% (1/10) (Dougherty & Silver 2007) was a Summer camp, 30% (3/10) were afterschool cooking club/ community garden programs (Castro, Samuels & Harman 2013; Davis et al. 2011; Gatto et al. 2012b) and 10% (1/10) was within a community church setting (Fulkerson et al. 2010). Cooking related skills and food knowledge was largely the focus of the studies, where 60% (6/10) addressed

attitudes and beliefs, 70% (7/10) addressed fruit and vegetable 16 consumption and 20% (2/10) addressed BMI measurements.

Program duration

Program duration varied depending on the setting. Within the school setting program length was diverse, with the shortest intervention being 3 sessions over a year (Caraher, Baker & Burns 2004) to the longest being weekly sessions over 2 years (Gibbs et al. 2013b) and all school based sessions ran for 1--3 hours in length. The summer camp program ran for 5 days with 2 hours cooking each day (Dougherty & Silver 2007), whereas the afterschool community kitchen garden programs ran from 7 weeks (cooking component) (Castro, Samuels & Harman 2013) to 12 weeks (Davis et al. 2011; Gatto et al. 2012a). However in Castro, Samuels and Harman (2013) the garden component ran for 7 months.

c. Interventions targeted at secondary school aged children (Children 11-17)

Study Selection

Of the 10 papers selected for this review, 70% (7/10) were studies within the USA and 30% (3/10) were from the United Kingdom (UK). Refer to table 4 for details of the papers included.

Study design and sample size

Of the studies included in the review, 90% (9/10) were a single intervention with a pretest and posttest evaluation using either focus group discussion or questionnaire. Only two programs had a control group (Bukhari, Fredericks & Wylie--Rosett 2011; Revill 2004). One study (Thonney & Bisogni 2006) completed a post intervention evaluation only. Details of questionnaires were not provided in the journal papers, with the exception of Revill (2004) which was outlined in her doctoral thesis. Sample size ranged from 20 (Beets et al. 2007) to 229 (Brown & Hermann 2005) participants, with the mean at 83. Intervention type and study outcomes. Most interventions (9/10) focused on food related attitudes and knowledge in a varying amount of detail. Fruit and vegetable consumption was evaluated in 30% (3/10) of the studies and 20% (2/10) of papers looked at weight related measures. In using a school aged child cohort there was a strong focus on a child's environment. Twenty percent (2/10) were designed as a Summer Camp (Beets et al. 2007; Condrasky et al. 2010), 20% (2/10) of interventions were incorporated into the curriculum (Bukhari, Fredericks & Wylie--Rosett 2011; Winham et al. 2014), 50% (5/10) of interventions were designed as an afterschool food/cooking club (Gatenby, Donnelly & Connell 2011; Hyland et al. 2006; Isoldi, Calderon & Dolar 2014; Revill 2004; Thonney & Bisogni 2006) and 10% (1/10) were set within a community setting, where facilitators decided within their groups, such as a community centre or church (Brown & Hermann 2005).

Program duration

The program duration was dependent on the intervention setting. Summer camp interventions (2/10) ran for 5--8 days and ranged from 4 to 7 hours a day in the kitchen. The school--based intervention (2/10) in which the intervention was incorporated into 20 the curriculum ran for 3 weeks to 19 weeks, which were predominantly 1 to 2 hours in length and ranged from daily sessions to twice a week. Eighty percent (4/10) of after school cooking clubs were run for either 10 or 20 weeks and averaged between 1 to 2 hours a week. One of the interventions, Thonney and Bisogni (2006), demonstrated a flexible delivery mode in which the program can be implemented over 4 to 6 sessions at 90minutes each, where time frame was dependent on the individual implementing the program.

Table 1 ***Summary of Interventions within primary school aged children***

Author & Year	Country	Target group	Study type	Duration	Quality EPHPP	Sample size	Outcome measures	Setting	Intervention components
Caraher et al, 2013	USA	9-11 year olds , general population	2 group; quasi-experimental, pre and posttest assessment	3 sessions a year	Weak	86 intervention 83 control	Attitudes and skills , fruit and vegetable consumption	School	3 sessions; session 1: healthy eating, flavours and taste session 2: practical session, prepare pasta salad Session 3: visit a restaurant (where possible)
Cunningham-Sabo and Lohse, 2013	USA	4th grade, low income Hispanic populations	Quasi-experimental, randomized; 2 group	7 sessions in 10 weeks	Strong	137 intervention 69 boys; 68 girls, 120 in control	Fruit and vegetable consumption, cooking skills, self-efficiency	School	1 hour introduction session, - two hour cooking classes and 3- 1 hour fruit and vegetable tasting sessions. Experimental multicultural foods intervention.
Cunningham-Sabo and Lahse, 2014	USA	4th Grade, low income Hispanic populations	3 group, quasi-experimental, pre posttest assessment	10 sessions in 9 months	Strong	Cooking & tasting: 539 Tasting only 294 & control 397	Fruit and vegetable consumption, cooking skills, self-efficiency	School	1 hour introduction session, - two hour cooking classes and 3- 1 hour fruit and vegetable tasting sessions. Experimental multicultural foods intervention.
Quinn, Horacek and Castle, 2003	USA	5th Grade students	Nonrandom quasi experimental design	11 lessons over approx. a year	Moderate	81 Treatment and 68 Control	Fruit and vegetable consumption and attitudes	In school	11 lesson CookShop, highlighted a different fruit and vegetable each lesson that the students learn about a cook with. In class cooking with hard plastic knifes, board and bench.
Gibbs et al, 2013	Australia	8-12 years,	2 group quasi-experimental	2 years 2.5 hour weekly sessions	Moderate	Intervention: 463, control: 280	Attitudes, behaviours	School	Weekly 45 minute garden program and 90 minute cooking classes
Dougherty and Silver, 2007	USA	Youth 8-12, disadvantaged youth	Pretest-posttest Non experiment	1 week	Weak	36	Attitudes & Behaviours	Summer Camp	Five day series, 2 hours per day with disengaged youth. Children learnt about healthful cooking, grouping recipes for balanced meal, reading a recipe and basic principles of nutrition.

Davis et al, 2011	USA	4th & 5th graders, average 10years At Risk Latino Youth	Nonrandom quasi experimental	12 week, 90mins a week	Moderate	104, 70 control, 34 intervention	BMI, Blood Pressure	After school in community garden	Each week a 45 minute interactive cooking and nutrition education class in the garden and consumed family style. Then a 45 minute interactive garden program of harvesting organic fruit and vegetable
Gatto et al, 2012	USA	4th & 5th Graders, average 10 yrs At risk Latino Youth	Pretest posttest quasi-experimental with qualitative results	12 week, 90 mins a week	Weak	N=104, 70 control, 34 intervention	Attitudes, behaviours and consumption Fruit and vegetable	After school in community garden	Each week a 45 minute interactive cooking and nutrition education class in the garden and consumed family style. Then a 45 minute interactive garden program of harvesting organic fruit and vegetable
Castro, Samuels & Harman, 2013	USA	Children 2-15 Focus Hispanic families	Pretest-posttest Non experiment	7 months in Garden Cooking 7 weeks 1 year program	Weak	120 2-15 years, mean age 6	Fruit and Vegetable consumption & BMI	Community garden program	Program had a weekly gardening program from April to November for the 3 years, and a 7 week cooking and nutrition workshop for children and parents, in the 3rd year offered in Spanish
Fulkerson et al, 2010	USA	Parent and child, child 8-10yrs	Two arm nonrandom pretest posttest quasi experimental	3 months	Strong	81 Treatment (45B, 36G) & 68 Control (26B, 42G)	Fruit and Vegetable consumption, attitudes and beliefs	Community setting	Parent and child participated in five 90 minute intervention session in a multiple family group format. Included health snack, separate parent and child group time, nutrition education, group meal, homework task and take home materials.

Table 2 ***Summary of Interventions within secondary school aged children***

Author & Year	Country	Target group	Study type	Duration	Quality EPHPP	Sample size	Outcome measures	Setting	Intervention components
Beets et al. (2007)	USA	adolescents	Pretest-posttest Non experiment	8 days 4 hrs each day	Weak	20	Attitudes and knowledge	Summer Camp	Attendees cooked from 10am-2pm each day. Based on different themes each day, eg. Breakfast, Asian cookery with a safety and hygiene component day 1
Bukhari, Fredericks and Wylie-Rosett (2011)	USA	9th grade students from low income families and minority groups,	Randomised pretest posttest control group design	19 weeks 1hr class each day	Weak	98, 49 in intervention and 49 control	Fruit and vegetable consumption, attitudes and knowledge	School	Classroom teachers were trained in teaching the program. Each week there were in class activities such as classroom lecture, inquiry based problem solving activities and weekly development of garden and/or cooking skills. Based on themes such as diet influences, meet the farmer, garden fresh snacking.
Gatenby, Donnelly and Connell (2011)	UK	Pupils between 12-13years old. Culturally diverse population	Pretest-posttest Non experiment	10 sessions	Moderate	55	Attitudes and knowledge	After school Cooking club in School	Program of learning about a new multicultural food celebration dish each week, school chose how to recruit 12-15 students each in the 4 schoolsk, then in weeks 9 & 10 students would go to other schools to share and teach their

									own recipe. Students given a take home bag of ingredients to make the dish again at home
Hyland et al. (2006)	UK	Year 7 students (11- 12 yrs) Low income, less advantaged areas	Randomised pretest posttest control group design	20 weeks 2 hrs a week	Moderate	61 girls & 37 boys	Attitudes feedback	After school, food club	2 hours after school, started with eating a healthy snack at start of session, cooking 2 different recipes, then trying a new fruit/vegetable, maintaining a recipe book and food quizzes
***Revill *same study as Hyland et al(2006)**	UK	Year 7 students (11- 12 yrs) Low income, less advantaged areas	Randomised pretest posttest control group design	20 weeks 2 hrs a week	Strong	80 Intervention, 82 control	Anthropometric Measurements	After school, food club	2 hours after school, started with eating a healthy snack at start of session, cooking 2 different recipes, then trying a new fruit/vegetable, maintaining a recipe book and food quizzes
Isoldi, Calderon and Dolar (2014)	USA	Youth between 7-13 Mean: 9.8 years, Latino youth focus	Randomised pretest posttest Quasi experimental	10 weeks, 1 hour a week	Weak	56 participated, 46 evaluated 19 Female, 27 male	BMI & behaviours	Food club	10 weekly cooking and nutrition education session lasting 1 hour that provided hands on food preparation instruction. Cooked a favourite meal but altered its nutritional value
Thonney and Bisogni (2006)	USA	Youth between 9-15	Posttest Non experiment	4-6 sessions of 90mins (flexible delivery)	Weak	128	Cooking skills, knowledge and behaviour	Food Club	Cooking program introduced to informal afterschool setting, 2 adults work with small groups of 6-8 children.

									Students engaged in what they cook
Winham et al. (2014)	USA	Sophomore students80% Hispanic20% native/African American	Pretest posttest quasi-experimental with qualitative results	Six 2hr workshops, twice a week for 3 weeks	Weak	27, 21 completed the evaluation 16 female, 5 male	Qualitative fruit and vegetable consumption and attitudes and beliefs	School	Each session had a theme based on the social cognitive theory, some sessions were knowledge based, theatre games, storytelling, discussion and students designed and researched a food to cook
Condrasky et al. (2010)	USA	Adolescents between 10-14. Majority 11-12	Pretest-posttest Non experiment	5 sessions for the week from 9am-4pm	Weak	100	Knowledge and behaviour	Summer camp	Two cooking sessions each day, one in morning and one in afternoon. 1 hour break with physical exercise. Help run by peer mentors (nutrition graduates)
Brown and Hermann (2005)	USA	Youth, average age 12	Pretest-posttest Non experiment	8 classes over 2 months	Weak	229	Fruit & vegetable consumption, knowledge food skills	Community setting	Classes on a variety of fruit and vegetable preparation methods

d. Fruit and Vegetable consumption

Primary setting- children 3 - 10 years

Five studies (Caraher, Baker & Burns 2004; Castro, Samuels & Harman 2013; Cunningham-Sabo & Lohse 2013; Fulkerson et al. 2010; Quinn, Horacek & Castle 2003) out of the ten focused on improving the food behavior of study participants and measured fruit and vegetable consumption. This outcome was predominantly measured with a self-reported questionnaire or focus group discussion and details of the results are listed in Table 5. Three of the studies demonstrated a significant increase in vegetable consumption that was measured qualitatively (Caraher et al. 2013; Castro, Samuels & Harman 2013; Cunningham-Sabo & Lohse 2014). The study by Fulkerson et al. (2010) also demonstrated a trend towards higher intake of vegetables and fruits post intervention, however this was not significant. Quinn, Horacek and Castle (2003) demonstrated no difference in vegetable consumption.

Only two studies (Castro, Samuels & Harman 2013; Quinn, Horacek & Castle 2003) demonstrated a significant increase in fruit consumption.

Table 3 ***Fruit and vegetable consumption among Primary setting***

Author (year)	Quality rating	Outcomes for Fruit and Vegetable consumption
Caraher et al, 2013	Weak	Significant increase in vegetable consumption in intervention group [P=0.002]
Cunningham-Sabo and Lahse, 2014	Strong	Vegetable consumption improved in both groups [P<0.05]
Castro, Samuels & Harman (2013)	Weak	According to parental reports, there was an increase of 146% (p<0.001) in the availability of fruits and vegetables and an increase in the consumption of fruits (28%; p<0.001) and vegetables (33%; p<0.001) among children of families participating in the program.
Fulkerson et al, 2010	Strong	A trend of higher intakes of fruits and vegetables (P = 0.08) among children in the intervention condition compared to those in the control condition was also apparent. Not significant
Quinn et. Al, 2003	Moderate	The treatment students significantly improved their intake of folate, fruit (P<0.05), and milk.

Secondary setting- children 11 to 17 years

Within the secondary school setting three studies out of the ten measured fruit and vegetable consumption (Brown & Hermann 2005; Bukhari, Fredericks & Wylie-Rosett 2011; Winham et al. 2014). Of these all found an increase in vegetable consumption with Brown and Hermann (2005) identifying a significant increase from 1.4 servings pre intervention to 2.4 servings post intervention.

However, only one study out of the 3 found a significant increase in fruit consumption, where participants consumed 1.1 pieces of fruit pre intervention to 2.3 post intervention (Brown & Hermann 2005).

Table 4 ***Fruit and vegetable consumption among secondary setting***

Author (year)	Quality rating	Outcomes for fruit and vegetable consumption
Bukhari, Fredericks and	Weak	Increases in food intake based on 15 survey foods [P<0.01], increase in eating vegetables as snacks [P=0.001], increase in preparing healthy

Wylie-Rosett (2011)		snacks[P<0.01]
Winham et al. (2014)	Weak	Qualitative focus group responses were an increase in reporting of eating more vegetables, trying new foods and confidence in team building skills
Brown and Hermann (2005)	Weak	Fruit servings increased (1.1 to 2.3) and vegetables (1.4 to 2.4) significantly. [P<0.0001]. 69% youth reported eating a new fruit and vegetable.

e. Body Mass Index

Primary school setting (children 3 - 10 years)

Two studies (Davis et al. 2011; Fulkerson et al. 2010) addressed body mass index (BMI) measurements. The study by Davis et al. (2011) found that post intervention the intervention and control group BMI increased. This increase was 4% among control participants compared to 1% in intervention participants, indicating a slower rate of weight gain in intervention group. One study, Castro, Samuels and Harman (2013) was the only study to demonstrate an improvement in BMI, in which 16% (6/36) of the participants significantly improved their BMI score, 3 children moved from the obese to the overweight category and 3 moved from the overweight category to normal weight.

Table 5 ***BMI outcomes within primary setting***

Author (year)	Quality rating	Outcomes for BMI classification
Davis et al. (2011)	Moderate	BMI was measured in all participants and at post intervention. All intervention gained 1% of total body weight compared to a 4% increase in control [P=0.03]. Intervention group were slower in weight gain.
Castro, Samuels and Harman (2013)	Weak	36 participants had a BMI classification of obese or overweight at the time their family joined the program. Of these 36 children, 6 had achieved an improved BMI classification (p<0.005).

Secondary school setting (children 11 to 17 years)

Two studies (Isoldi, Calderon & Dolar 2014; Revill 2004) conducted 10 years apart, measured BMI status and both studies showed no significant change in BMI. Isoldi, Calderon and Dolar's study (2014) had 48% of participants overweight or obese pre-intervention and this decreased to 46% post-intervention, however this outcome was not significant. In contrast, the Revill study (2004)showed no significant difference in BMI status between control and intervention groups pre intervention, yet post intervention the intervention group had a significant increase in BMI, resulting in a significant change in BMI between the two groups post intervention (see Table 8 for details).

Table 6 ***BMI outcomes within secondary setting***

Author (year)	Quality rating	Outcomes for BMI classification
Revill (2004)	Strong	Post intervention BMI's rose significantly of the intervention group than the control [P=0.027] in which the difference was not significant in pretest [P=0.093]
Isoldi, Calderon and Dolar (2014)	Weak	48% participants were overweight obese at baseline, post intervention 46% were. Slight change in weight, however not significant [P>0.05].

f. Food preferences, attitudes, beliefs and self-efficiency

Primary school setting (children 3-- 10 years)

As outlined in table 9, seven out of 10 studies, within the primary school aged children measured outcomes related to food preferences, attitudes and beliefs. Four out of the 7 studies post intervention demonstrated a higher preference for healthy foods (Fulkerson et al. 2010; Gatto et al. 2012a; Gibbs et al. 2013b; Quinn, Horacek & Castle 27 2003). While, three out of the seven studies demonstrated an improved attitude to making healthy food choices (Caraher et al. 2013; Cunningham--Sabo & Lohse 2013; Quinn, Horacek & Castle 2003). Three out of the seven studies also demonstrated increased food knowledge and self--efficiency, whereas two studies showed increased cooking skills and confidence in the kitchen.

Table 7 ***Outcomes for preferences and attitudes within primary setting***

Author (year)	Quality rating	Outcomes for food related preferences, attitudes, beliefs, knowledge and self-efficiency
Caraher et al. (2013)	Weak	Increase cooking confidence in intervention and control group [P<0.001], confidence to ask for pasta salad ingredients. [p<0.001].
Cunningham-Sabo and Lohse (2013)	Strong	Cooking attitudes significantly increased and self-efficiency [P=0.001].
Gibbs et al. (2013b)	Moderate	Children's willingness to try new foods if they have never tried it [P=0.03], cooked it [P=0.001] or grown it [P<0.001] increased among participants in the intervention group than control. Parent's responses did not show significance in regards to children 'always' willing to try new foods [P=0.09].
Dougherty and Silver (2007)	Weak	90% high level enjoyment to the program 58% learned about nutrition 97% learned a new cooking skill, no significance testing
Gatto et al. (2012a)	Moderate	Intervention had improved preferences for vegetables (intervention 1.8 increase compared to 1.3 point decrease in control [P=0.06]) but not fruit. Intervention has significantly increased preferences for pears, carrots and nopales [P=<0.05]. Intervention was 54% more likely to report that vegetables in the garden taste better than store [P=<0.05]. Intervention had greater increases in self-efficacy pre and post intervention (3.3 vs 0.4 point change)
Fulkerson et al. (2010)	Strong	Intervention group gained more knowledge in food preparation skills than control group [P<0.01] Intervention parents reported that their children helped make dinner more often than control group [P<0.01]. Trends in higher fruit and vegetable in the family home [P=0.12] and lower availability of quick, microwaved foods and processed meats [P=0.11], however not significant.
Quinn, Horacek and Castle (2003)	Moderate	Treatment group more likely to try a new vegetable than control. Parents responded (33%RR) that 35% increase in positive eating habits, 23% increase in healthier shopping habits and 55% willing to try new foods.

Secondary school setting (children 11 to 17 years)

Within the secondary school setting, eight studies looked at outcomes related food preferences, attitudes, beliefs, knowledge and self-efficiency. Of those eight, only three studies (Gatenby, Donnelly & Connell 2011; Isoldi, Calderon & Dolar 2014; Winham et al. 2014) demonstrated changes in preferences to making healthier food choices. One study, Bukhari, Fredericks and Wylie--Rosett (2011) demonstrated improved attitudes towards food. Secondary school interventions had a tendency to focus predominantly on food knowledge and cooking skills in which five studies (Beets

et al. 2007; Brown & Hermann 2005; Bukhari, Fredericks & Wylie--Rosett 2011; Gatenby, Donnelly & Connell 2011; Thonney & Bisogni 2006) addressed a positive shift in food knowledge, from how to wash food, nutritional information to understanding the multicultural differences in foods. Four studies (Beets et al. 2007; Gatenby, Donnelly & Connell 2011; Hyland et al. 2006; Thonney & Bisogni 2006) demonstrated an increase in cooking skills and abilities in the kitchen.

Table 8 ***Outcomes for preferences and attitudes within secondary setting***

Author (year)	Quality rating	Outcomes for food related preferences, attitudes, beliefs, knowledge and self-efficiency
Beets et al. (2007)	Weak	Improvement in food knowledge [P=0.03] and perceived cooking ability [P=0.04].
Bukhari, Fredericks and Wylie-Rosett (2011)	Weak	Focus group discussions found an increase sitting down with family eating meals [P<0.004] and improved nutrition knowledge and attitudes about healthy eating.
Gatenby, Donnelly and Connell (2011)	Moderate	Reported increase in cooking skills, significant responses were self-reporting on skills of simmering food, cooking a meal & cooking healthy food [P<0.05]. Focus group discussions determined there was an increase in cultural awareness of foods and foods cooked in celebration holidays, an increase frequency in cooking at home and different cultural dishes.
Hyland et al. (2006)	Moderate	Results were based on focus group discussions, which concluded the program was a qualified success; students were positive about experience, gained practical skills and enjoyed the club.
Isoldi, Calderon and Dolar (2014)	Weak	Increase in frequency of participants assisting in cooking breakfast and dinner at home, no significant changes in shopping behaviours, participants enjoyed the program and hands on cooking
Thonney and Bisogni (2006)	Weak	Successful in achieving gains in selected skills, knowledge and behaviours related to food preparation (data unpublished)
Winham et al. (2014)	Weak	Significant changes in positive shift in answers to questions about resisting unhealthy foods [P=0.034], that eating healthy does not mean boring [P=0.050], my culture is a resource for healthy behaviours [P=0.040].
Brown and Hermann (2005)	Weak	38% increased safe hygiene practices, 28% increased washing of fruits/veg.

3. Quality assessment

Quality of the papers was assessed using the EPHPP quality evaluation tool. This tool rates papers as being strong, moderate or weak based on various aspects of study methodology and implementation namely selection bias, study design, control of confounders, blinding, data collection methods and withdrawal and dropout rates (Thomas et al. 2004). Within the primary school setting, as shown in table 3, three studies were weak in quality, four were of moderate quality and three were strong quality studies. Within the secondary school setting, of the 10 studies eight were weak in quality, two were moderate quality and one was a strong quality intervention. In using the

evaluative tool for mixed method studies in the qualitative studies enabled questions to be asked of the information obtained within the paper (Long & Godfrey 2004). This tool allowed for further clarification of the study context by addressing the appropriateness of setting and how the sample population was obtained, and to determine if study groups were comparable to the general population. In the secondary school aged children many papers were lacking detail of the intervention and sample, so responses of the questions could not be obtained and they were listed as weak quality studies.

4. Conclusion

In summary, this systematic review identified that cooking classes have demonstrated a positive impact on food related preferences, attitudes and beliefs. Studies in the primary school aged children demonstrated more encouraging changes to attitude than the secondary school age group. Secondary school programs were more inclined to focus on cooking skills and attitudes to cooking than attitudes to making healthier choices. Food related behaviour was measured in the consumption patterns of fruit and vegetables and indicated a small but significant change in consumption patterns of children. In primary school aged children, only 50% of interventions measured consumption, and among these 80% found a significant increased in vegetable consumption and 50% reported a significant increase in fruit consumption. Studies in secondary school aged children had minimal focus on consumption patterns, with only 30% of studies addressing this outcome, yet all reported significant results for increased vegetable consumption and 30% increase in fruit consumption. The final outcome measure for the research question was to determine if weight had an impact 38 on cooking programs. Only two studies in primary school aged children and two studies in secondary school aged children measured BMI. However, results were inconclusive in primary school interventions, with some studies showing weight gain amongst participants, and others showing that overweight participants experienced slower weight gain or a small significant decrease in BMI. In secondary school aged children results were insignificant and no improvement in BMI score was observed.

*This scoping paper was completed by Naomi June Coates Hagenmuller for her Masters Thesis. Part of the thesis has been reproduced here with the permission of Naomi.

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