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1 Abstract

2 **Purpose:** Few efficacious child obesity interventions have been converted into ongoing
3 community programs in the after school setting. The aim of this study was to evaluate the
4 impact of phase 2 of *Back to Basics* cooking club at a low income school with a relatively
5 high indigenous population of >10% on dietary behaviours and fruit and vegetable variety in
6 a population at risk of obesity.

7 **Methods:** Baseline and 3-month dietary intake and Social Cognitive Theory (SCT)
8 constructs were collected in children mean age 9 years, 61% female. McNemar tests were
9 used for comparison of proportions between categorical variables. Cohen's *d* was used to
10 compare effect sizes across different measures.

11 **Results:** Consumption of one or more fruit servings/day significantly increased from 41% to
12 67% ($P=0.02$, $d=0.13$) and the proportion of individuals consuming takeaway food less than
13 once per week also increased. The SCT constructs assessed within the current study improved
14 significantly ($P<0.01$), with moderate to large effect sizes ($d=0.33-0.78$).

15 **Conclusion:** This study documents that a previous efficacious healthy lifestyle program can
16 be adapted for use as an obesity prevention program addressing improvements in vegetable
17 and fruit intakes in a low income community with a relatively high indigenous population.

18

19 **Keywords:** obesity prevention, nutrition, low socioeconomic

20 Background

21 Increasing research attention is being focused on the translation of results from health
22 promotion efficacy trials into sustainable programs and current practice (1, 2). Very few
23 studies exist in this area and the time lag to implementation of findings from academic/
24 clinical settings to community settings, averages 17 years (3, 4). Effective dissemination of

25 evidence-based programs is a process that does not happen instantaneously but rather occurs
26 in stages that are dependent of issues such as strategic planning, funding, workforce
27 development, ongoing training, organisational values and policy (5).

28 Therefore, it is not surprising that few efficacious child obesity interventions have been
29 converted to ongoing community based programs in the after school setting (6). Many
30 interventions for preventing childhood obesity have been implemented in the school setting
31 (7) with modest environmental and behaviour changes (8, 9). A meta-analysis of these studies
32 found no consistent changes in body composition (10). Children spend less than 50% of their
33 awake time at school, studies are needed to address all of the daily influences on energy
34 balance and improve living environments that support healthy eating and physical activity
35 outside of school hours (11). This includes the after school setting where many children
36 spend an increased number of hours each week and are picked up by parents or carers at the
37 end of their working day.

38 To meet these needs Back to Basics (B2B) was developed as an after-school cooking
39 program which incorporated the nutrition messages from the efficacious Hunter Illawarra
40 Kids Challenge Using Parent Support (HIKCUPS) child obesity intervention program (12)
41 (Figure 1), which has demonstrated improvements in child BMI z-scores (13, 14), dietary
42 intake (15) and physical activity (16, 17) in both the short and long term (13, 14). HIKCUPS
43 was a 3 armed RCT that targeted overweight children. Participants were randomised into a 10
44 week program that was either: a parent centred dietary modification program; a child centred
45 physical activity program; or both programs simultaneously. After the HIKCUPS trial and
46 consultation using focus groups with parents from a socio-economically disadvantaged area
47 via a school community worker, the HIKCUPS program was converted to an initial pilot B2B
48 program (18) and adapted to meet the expressed needs of families whose children attended an
49 after-school program in a regional area of New South Wales (NSW), Australia. This was

50 phase one of the B2B program. Due to the difference in setting and the parental preference to
51 use the children as the agents of change as well as parents, direct translation of HIKCUPS
52 was not possible. However B2B uses knowledge translation whereby strategies from
53 HIKCUPS have been adapted to optimise uptake in a new environment (19). Key dietary
54 messages including how to choose healthier foods, improve recipes, get children to eat more
55 fruits and vegetables were retained and are detailed elsewhere (18). This population group
56 was specifically targeted given they are more likely to have inadequate intakes of fruit and
57 vegetables and higher obesity rates than children from families with medium-to-high incomes
58 (20). Pilot results (phase one) with 10 families demonstrated the program to be acceptable
59 and feasible within this community setting (18). Phase two was to evaluate the program in a
60 larger sample of children with simplified research outcome measures in an attempt to make it
61 sustainable in this setting. The aim of the current study was to evaluate the impact of Phase
62 two of the *B2B* after-school cooking club on dietary behaviours and fruit and vegetable
63 variety in a population at risk of obesity.

64

65 **Methods**

66 Primary school aged children (5-12 years) attending a low income school with a relatively
67 high indigenous population of >10% and their parents/guardians were recruited as a
68 convenience sample across successive school terms (i.e. includes groups recruited across
69 multiple school terms; four terms per calendar year) from a single disadvantaged low socio-
70 economic status (SES) school in the Hunter Region, NSW, Australia.

71 The school's location, based on post-code, gave a Socio-Economic Indexes For Areas
72 (SEIFA) rank of four out of a possible maximum of 10, with one being the lowest and 10
73 being the highest income status. The SEIFA index is a generalised measure of socioeconomic

74 status derived from national population census data and allows for comparison across
75 geographic areas in Australia. It includes a broad definition of relative socio-economic
76 disadvantage in terms of people's access to material and social resources.

77 The school was previously identified as a NSW Priority School, which is a school that
78 services a low SES community; as defined by the NSW Department of Education. The
79 priority action school program provides enhanced resources and funding to close the gap and
80 maximise education outcomes.

81 These additional resources included a school community worker and an indigenous liaison
82 officer who assisted with participant recruitment. Baseline and 3 month follow-up data was
83 collected between school term 3 (July-September), 2010 and term 4(October-December),
84 2011. The University of Newcastle Human Research Ethics committee and the school
85 principal approved the study. Parental consent and child assent was obtained prior to
86 participating in the study.

87 *Dietary intake Data*

88 Child dietary intake was assessed by a sub set of questions from a larger validated FFQ
89 known as the Australian Child and Adolescent Eating Survey (ACAES). Specifically the tool
90 was validated for use with primary school aged children (21-23). The ACAES assessed 11
91 specific eating behaviours including breakfast eating habits; fruit consumption, vegetables
92 consumed with evening meal, takeaway foods, sweetened beverages; and type of milk. Each
93 question included a range of frequency responses ranging from never to daily/
94 weekly/monthly consumption. Due to the focus of the intervention on child fruit and
95 vegetable intakes, questions specifically relating to these variables were collapsed into binary
96 variables as meeting or not meeting a predefined program recommendation. For example for
97 fruit: consuming at least one piece of fruit per day or more and for vegetables consuming

98 vegetables with main meal at least 5 times per week. Variety of fruit and vegetables was
99 assessed individually using sub-scales scores of the Australian Recommended Food Score
100 (ARFS) for children (24) where one point was awarded for each type of vegetable or fruit
101 consumed at least weekly, with a maximum vegetables score of 20 and 12 for fruit. The
102 information was self-reported by the children greater than 8 years on the day of data
103 collection, as children of this age can reliably reporter intake (22), the interviewer asked the
104 questions and recorded the child's response. For diet and other questionnaires, older children
105 >7years completed the questionnaire independently but were allowed to ask for help if they
106 wanted it. For children <7 years the information was collected by an interviewer from the
107 children using the same tool.

108 **Social Cognitive Theory (SCT) Constructs**

109 SCT constructs were incorporated into each program session and have been previously
110 mapped in detail (18). The sessions were grounded in 10 key constructs of SCT:
111 environment; situation; behavioural capabilities, outcomes expectations and expectancies,
112 self-control; observational learning; reinforcement, self-efficacy; emotional coping responses
113 and reciprocal determinism. SCT constructs were assessed using a researcher developed
114 questionnaire which comprised of 51 questions and took approximately 20 minutes to
115 complete. SCT constructs of: knowledge (4 items), expectancy (9 items), self-efficacy fruit (6
116 items), self-efficacy vegetable (6 items), environment (7 items), self-control (9 items) and
117 situation (6 items) were assessed. This survey was modelled on a previous questionnaire to
118 assess self-efficacy of fruit and vegetable intake (25). A Likert scale using smiley face
119 responses were provided for each question and labelled either 'Strongly Disagree' through to
120 'Strongly Agree' or 'Never', 'Rarely', 'Sometimes', 'Often' and 'Always' depending on the
121 question for all children. Cronbach alpha statistics were used to verify internal consistency of

122 items in the questionnaire with results shown in Table 2b. Values of 0.70 or above are
123 considered as demonstrating acceptable reliability (26).

124 ***Intervention***

125 The phase one intervention is described in detail elsewhere (18) and was further modified in
126 phase 2 based on results of the process evaluation, as well as facilitator feedback from the
127 previous pilot study Figure 1 (18). A number of modifications were made including: (i)
128 removal of the final social BBQ to reduce the time commitment for parents and staff; (ii)
129 removal of the physical activity session due to lack of engagement from families; (iii) re-
130 orientation of the major focus to children to increase cooking efficacy; and (iv) addition of
131 nutrition information talk for parents in the final 30 minutes of the session before the child is
132 collected. The nutrition information session comprised of a range of visual nutrition displays
133 with discussion topics, weekly recipe and homework charts to complete about family food
134 habits, as outlined in Table 1. Phase 2 of the B2B program involved 5 x 90minutes cooking
135 sessions after-school (3-4:30pm), once every two weeks during one school term. Each session
136 sequence was as follows: 1) children provided with a healthy afternoon tea (e.g. fruit and/or
137 crackers with cheese and vegemite™ spread); 2) cooking session; 3) parent activity session
138 and 4) the meal/food prepared by child is shared with parents. Parents and children then sat
139 together as a group to taste and discuss the meal that the children had prepared in a relaxed
140 and comfortable environment. Families were provided with a 'vegetable of the week' and
141 recipe to encourage them to cook with vegetables at home. For example eggplant/aubergines
142 were provided to the families to cook with that fortnight. The practical cooking sessions
143 (~90mins) were designed specifically for children and were led by a trained member of the
144 research team who had training with cooking classes and most often an accredited dietitian.
145 The parents' information sessions (~15mins) were facilitated by a member of the research
146 team, with assistance from the school's community liaison officer and/or indigenous support

147 worker. The parent education sessions (~30mins) were designed to be in an informal setting,
148 usually next door to where the children were cooking, and with enough space to allow parents
149 to engage with the material at their own pace, and to allow for hands on or visual/practical
150 activities and facilitate group discussion on the topic.

151 **Statistical Analysis**

152 Data was analysed using Statistics Package for Social Sciences (SPSS) Statistical software
153 version 19 to conduct descriptive analysis with Wilcoxon signed rank tests used to assess
154 differences within groups over time. McNemar tests were used for comparison of proportions
155 between categorical variables including those consuming fruit at least once /day or not and
156 consuming vegetables with dinner at least 5 times per week. Cohen's d was used to compare
157 effect sizes across different measures (27) and allows for a more direct comparison of effects
158 on each outcome variable and for smaller samples. These were calculated using the mean
159 difference and the pooled standard deviation of the group ($d = \frac{M_1 - M_2}{\sigma_{\text{pooled}}}$). Effect sizes
160 were interpreted as small ($d > 0.20$), medium ($d > 0.50$) or large ($d > 0.80$) (27).

161 **Results**

162 A total of 51 children were recruited across the study time frame and completed the program,
163 the average attendance rate was 90% with a mean of nine participants per session. Not all
164 subjects completed the questionnaires and the actual numbers varies by items and is reported
165 in Tables 2a and 2b with an average of 37 (72%) completing the majority of measures. The
166 mean age of children was nine years (range 6-13yrs, 61% female). Five children (13.5%)
167 identified as being of Aboriginal, Torres Strait Islander (ATSI) descent. No language barriers
168 were identified in the group. Changes from baseline to 3 months follow up for dietary
169 behaviours and SCT outcomes are reported in Tables 2a and 2b.

170 *Dietary Behaviours*

171 At baseline 41% of participants reported consuming at least one piece of fruit/day; at 3 month
172 follow up this increased to 67% ($P=0.02$ McNemar test). At baseline, 32% of the children
173 reported consuming vegetables with dinner at least 5 times per week; at 3 month follow up
174 this increased to 43% , $P0.018$ (not statistically significant) . At baseline 36% of the children
175 reported consuming takeaway foods (e.g. Chinese, fish and chips, hamburger and chips/fries,
176 pizza) less than or equal to once a week; at 3 month follow up this increased to 56% (Z score
177 -1.84 , $P=0.06$). At both time points $>80\%$ of children were consuming full cream milk and
178 7% were reported consuming reduced fat or skim varieties of milk. Effect sizes for dietary
179 behaviours were calculated and while some were small the majority were classified as being
180 moderate to good (range $d = 0.02-0.45$ Tables 2a and b). While not statistically significant,
181 the variety of both fruit and vegetables reported by children increased post program. For
182 vegetables the baseline the median score was 7 out of a possible score of 20 (range 0-20) and
183 at 3 month follow-up this increased to 8. For fruit the median score was 4.5 at baseline (0-11)
184 out of a possible score of 12 and increased to 6 (0-12) at 3 month follow up.

185 *SCT outcomes*

186 Table 2a shows SCT constructs assessed in this study for children in the back to B2B
187 program. All seven SCT constructs changed significantly ($P<0.01$) from baseline. Analysis
188 using Cohen's d found moderate ($d>0.50$) to large effects for six of the seven SCT constructs
189 assessed (Table 2a). In descending order these were for self-efficacy to consume fruit ($d=-$
190 0.78), situation (-0.70), self-control (-0.76), self-efficacy to cook and/or consume vegetables
191 (-0.58), expectancy (-0.55) and knowledge (-0.50) with only a small effect shown for
192 environment (-0.33).

193 **Discussion**

194 The aim of the current study was to evaluate the impact of Phase two of the *B2B* after-school
195 cooking club on dietary behaviours and fruit and vegetable variety in a population at risk of
196 obesity. The current study provides an example of adaptation and knowledge translation of
197 key dietary messages from an efficacious RCT to the after school environment, in an
198 effectiveness study. The Phase two B2B program was successful at increasing the proportion
199 of children reporting fruit consumption at least once per day, as well as increasing the weekly
200 variety of fruit and vegetables. Changes in dietary intakes included increasing weekly fruit
201 and vegetable variety and reducing takeaway foods. The program was developed and
202 implemented using the theoretical framework of SCT with favourable intervention effects for
203 six of the seven SCT constructs demonstrating moderate-to-large effect sizes.

204 While there was a reported increase in the vegetable variety, these were not statistically
205 significant this is likely due to the small sample size and lack of statistical power. It is
206 acknowledged that the effect sizes and impact on behavioural outcome measures will always
207 be smaller when research programs move from efficacy to effectiveness to public health
208 interventions.

209 Parents were engaged in the intervention and while they were not the sole agents of change,
210 as in the original HIKCUPS program, the current study fostered change in child self-efficacy
211 for fruit and vegetable preparation and consumption. . Efficacy studies are usually conducted
212 under well-resourced for ideal ‘laboratory’ or controlled condition. This means they are not
213 able to be implemented in the same way when trying to translate the results to community
214 programs. Hence, the B2B program was adapted from the original HIKCUPS trial for this
215 reason (19). In addition, the change in format between phase one and two reduced the amount
216 of time parents were involved, switching the focus from parents to both the child and the
217 parents as dual agents of change. The reduction in parent time commitment was based on
218 parental feedback from phase one. The parent education sessions focused on topics that

219 aligned with those previously identified for low income families (28) including messages on
220 role modelling and cooking and eating together. The retention in the program was high
221 (n=51) with no dropouts, however only three quarters of participants dedicated time to
222 complete the surveys which may reflect the loss of research integrity when adapting research
223 to community setting.

224 **Limitations** include that one school was used for recruitment, the sample size is small and a
225 control group was not feasible. A further limitation is that in order to accommodate the after
226 school setting and the time constraints, the questions for both diet and SCT were taken from
227 previously validated tools, but the subset used was not validated. Hence results should be
228 interpreted with caution. Complete dietary intake was not assessed as part of this study so it
229 cannot be concluded that substantial diet improvements were achieved, however overall
230 increases in diet quality in children has been associated with better growth profiles (29). In
231 addition the goal of the program was not unknown to participants so results shown for this
232 study may also be attributed to social desirability.

233 Relevance for practice: If dietary programs in Australia, Canada and internationally are to be
234 translated to sustainable environments in indigenous groups in the after school setting,
235 documentation of the process will be of value to practitioners and researchers. The BTB
236 program was about targeting minority indigenous groups who are of greater risk of obesity
237 related ill health. The current study, phase two of B2B, was very different from phase one in
238 which the program was developed based on what the population group “thought” they wanted
239 in terms of content, whereas the current study presents the revised program based on the
240 feedback and learnings from phase one. Reliability values (cronbach alphas) for SCT
241 constructs were low for the domain of knowledge. This may be a true effect size, or partly
242 attributed to the small sample size. Further research with a larger sample size is warranted. In
243 addition strategies to increase knowledge could be strengthened when the program is revised.

244 As part of adapting research programs both dietetic practitioners and researchers need to
 245 allow adequate time to consult with the relevant stakeholders, conduct needs assessments and
 246 to contextualise program components to the community needs. Further this may need to be
 247 done over a number of program iterations. Key challenges in translational research include
 248 the stop and start nature of the program (i.e. lack of continuum), varying personnel being
 249 involved in the community program, across sites and subsequent school terms.

250 Future studies should ensure adequate descriptions of interventions and mapping of
 251 successful components from efficacy trials to program components as first steps in
 252 developing sustainable community based interventions.

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329

330 Table 1. Session Outline of the Back to Basics Cooking Club

Session	Children's Cooking Component	Parents Information Session Topic	Parent Engagement
Session 1 <i>Assessment 1</i>	Food Hygiene Safety in the kitchen Crunchy Crostoni's	Why food? Benefits of eating fruits and vegetables?	Health benefits of fruits and vegetables. Visual display of fresh fruit & veg.
Session 2	Fruit Salad and smoothie	Getting the balance right- How much food should my child eat?	Visual display showing a day of healthy food for a typical child.
Session 3	English muffin Pizza's	Family food habits	Reading food Labels Categorise foods according to fat/ energy
Session 4	Bush Beef Stir Fry	Goal setting/ monitoring	Setting a personal and family goal
Session 5	Apple Berry crumble	Congratulations- Evaluation and feedback	

Assessment 2		
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334 Table 2a: Changes in Social Cognitive Theory Constructs (SCT) for children participating in
335 the Back to Basics Program

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SCT Construct (n)	Mean \pm SD	Mean \pm SD	Z	P value	Effect size Cohen's d^a	Cronbach α
	Baseline	Follow up				
Knowledge (n= 33)	1.48 \pm 0.47	1.67 \pm 0.28	-2.31	0.02	-0.50	0.57
Self-efficacy (fruit (n= 36)	4.06 \pm 0.84	4.57 \pm 0.38	-3.63	<0.001	-0.78	0.80
Self-efficacy Vegetables (n= 35)	3.82 \pm 0.93	4.26 \pm 0.56	-2.61	0.009	-0.58	0.86
Environment (n= 35)	3.69 \pm 0.69	3.94 \pm 0.78	-2.01	0.045	-0.33	0.72
Self-control (n= 35)	2.91 \pm 0.82	3.51 \pm 0.75	-3.44	0.001	-0.76	0.80
Situation (n= 35)	4.24 \pm 0.54	4.59 \pm 0.45	-3.00	0.003	-0.70	0.70
Expectancy (n= 35)	4.51 \pm 0.53	4.77 \pm 0.41	-3.22	0.001	-0.55	0.79

337 Z statistic analysed with Wilcoxon signed rank test, ^a Small effect size Cohen's d

338 =0.2, moderate effect size = 0.50, large effect =0.80

339

340 Table 2b: Changes in dietary behaviours as assessed by The Australian Eating Survey for
 341 children in the Back to Basics program

Dietary behaviour	Mean \pm SD	Mean \pm SD	Z	P value	Effect size Cohen's d^a
	Baseline	Follow up			
Pieces of fruit / day (n=45)	5.47 \pm 1.63	5.69 \pm 1.65	-1.17	0.24	-0.13
Vegetables consumed with evening meal (n=45)	3.91 \pm 0.97	4.11 \pm 1.0	-1.38	0.17	-0.20
Takeaway consumption (n= 40)	2.98 \pm 1.23	2.50 \pm 0.88	-1.84	0.07	0.45
Consume evening meal in front of the TV (n=39)	3.87 \pm 1.96	3.41 \pm 1.92	-1.57	0.12	0.23
Time spent watching TV (n= 39)	1.95 \pm 0.86	1.97 \pm 0.81	-0.29	0.76	-0.02
Weekly pocket money (n= 39)	2.05 \pm 1.30	2.15 \pm 1.48	-0.005	0.96	-0.07
Consumption of snacks (n= 37)	2.51 \pm 0.84	2.81 \pm 0.94	-1.85	0.06	-0.33
Glasses of sweetened drinks (n= 37)	2.11 \pm 1.13	1.95 \pm 0.94	-1.07	0.28	0.15
Type of milk (n= 37)	3.48 \pm 1.15	3.53 \pm 1.22	-0.21	0.83	-0.04

342 Z statistic analysed with Wilcoxon signed rank test, ^a Small effect size Cohen's d

343 =0.2, moderate effect size = 0.50, large effect =0.80

344

345