Action Schools! BC – Healthy Eating
Effects of a Whole-school Model to Modifying Eating Behaviours of Elementary School Children
Meghan E. Day, RD, MA1,2
Karen S. Strange, PhD2
Heather A. McKay, PhD3,5
Patti-Jean Naylor, PhD1

ABSTRACT

Objectives: The rate of obesity and associated risk factors in Canadian youth is increasing at an alarming rate. Nutrition plays an important role in weight maintenance. This study reports the effectiveness of Action Schools! BC – Healthy Eating, a school-based fruit and vegetable (FV) intervention, in effecting change in: 1) students’ intake of FV, 2) students’ knowledge, attitudes and perceptions regarding FV, and 3) students’ willingness to try new FV.

Methods: Five schools that represented geographic, socio-economic and size variation were recruited as Action Schools! BC – Healthy Eating intervention schools. A second set of five schools were selected as matched healthy eating usual practice schools. Student outcomes were measured at baseline and at 12-week follow-up using self-report questionnaires. Classroom logs and progress reports were used to assess implementation dose and fidelity. The intervention included school-wide activities based on individualized Action Plans addressing goals across six Action Zones.

Results: Significant differences were found between conditions over time while controlling for baseline levels. Fruit servings, FV servings, FV variety, and percent of FV tried from a fixed list increased in intervention schools. Teachers implemented a mean of 64% of requested classroom dose, and school Action Teams implemented activities across 80% of the whole-school model.

Discussion: A whole-school framework can impact FV intake, but results were modest due to implementation issues. Further implementation and evaluation are necessary to fully understand the effectiveness of this initiative.

Key words: Schools; health promotion; eating; initiative

The rate of obesity and associated risk factors in Canadian youth is increasing at an alarming rate.1 Nutrition plays an important role in weight maintenance. Recent data show that youth aged 2 to 17 years who eat fruit and vegetables (FV) five or more times a day are less likely to be overweight or obese compared to those whose FV consumption is less frequent;1 however, 59% of Canadian youth consume FV less than five times a day.1

Schools may be an ideal vehicle for healthy eating interventions and addressing childhood obesity.2-4 Action Schools! BC – Healthy Eating (AS! BC – HE) is a whole-school intervention that integrates classroom learning, environmental change strategies, and a family/community component to promote the consumption of FV. This research will determine if a whole-school intervention with active participation of the school community is effective in: 1) increasing the consumption of FV, 2) enhancing knowledge, attitudes and perceptions regarding FV, and 3) increasing willingness to try new FV.

METHODS

Recruitment
Participants were part of the Action Schools! BC (AS! BC) provincial dissemination trial, in which 30 schools throughout the province were matched by region and randomly assigned to one of two conditions: intervention or usual practice (UP). Five AS! BC usual practice schools were recruited to participate as AS! BC – HE intervention schools. Five AS! BC intervention schools were matched (by size and region) to act as AS! BC – HE usual practice schools. Informed consent was provided by parents of 527 grades 4 and 5 children, and 444 children remained at follow-up (246 intervention and 198 UP). Participation rates for eligible students did not differ between UP (66%) and intervention (64%) schools.

Ethics approval was obtained from the University of Victoria Human Research Ethics Board.

Intervention
Implementation of AS! BC – HE was from March through May 2006 (12 weeks). Classroom efforts to increase FV intake were combined with strategies to promote healthy food choices within the school. Schools
received resources (a menu of classroom activities and materials for implementation), training (1.5 hours) and support. School committees identified needs and set goals (two per Action Zone) across six Action Zones: School Environment, Physical Education, Classroom Action, Family & Community, Extra-Curricular, School Spirit. We asked teachers to implement two weekly classroom activities and one monthly tasting activity during the 12 weeks. We provided each teacher with $12.50 per month to purchase FV for the tasting activities.

Measurement
Trained researchers measured student-level outcomes at baseline (November 2005 – February 2006) and follow-up (May 2006).

Participant Descriptives
We established the socio-economic profile of the school communities, measured as the median family income, from Canadian Census information. Administrators provided school population, and parents provided children’s age and ethnic origin.

Fruit and Vegetable Consumption
FV intake was assessed using two methods: 1) hand-counting, using Canadian Nutrient File serving sizes, from a validated 24-Hour Food Recall questionnaire and 2) a Food Frequency Questionnaire (FFQ) adapted from the Eating at America’s Table Study for comparability. A conversion factor was used to convert responses from weekly frequency to daily frequency of consumption for comparability.

Fruit and Vegetable Knowledge, Attitudes and Perceptions
Knowledge of the importance of FV to disease prevention, attitudes to eating FV, and perceptions of the social environment related to FV were assessed using a Knowledge, Attitudes and Perceptions (KAP) survey adapted from a population-based survey. This survey was based on two previously validated questionnaires: the 5-A-Day for Better Health Program survey and the 1990 Behavioral Risk Factor Surveillance System survey. House (2005) modified it for use with children. Cumulative scores for health knowledge, perceptions of the social environment, and feelings about FV (affect) were generated. Students identified the FV they had tried from a fixed list to generate a score of “percent tried”.

Willingness to Try New Fruits and Vegetables
Students’ willingness to try new FV was measured using the Food Choices Scale for Children, which was drawn from the validated Food Neophobia Scale and the Food Neophobia Scale for Children, both of which focused on broad food categories. Our scale was adapted to focus specifically on FV, and scores were cumulated into a single neophobia score.

Fidelity to the Whole-School Model
School Action Plans showed if the school planned across the six Action Zones. Year-End Reports (June 2006) completed by the school committee revealed the number of zones with completed goals.

Fidelity to Classroom Dose
Teachers recorded HE activities for each day on fixed choice logs (Weekly Activity Logs), which were used to assess fidelity to implementation of classroom activities.

Feasibility of the Model
Five focus groups (45 min.) with a total of 19 teachers in June 2006 assessed feasibility of implementation of the AS! BC – HE model. Questions explored successes and challenges, and facilitators and barriers to implementation and sustainability.

Data analysis
Quantitative data were analyzed using the Statistical package for the Social Sciences 13.0 (SPSS Inc, Chicago, IL, USA). One-way analysis of variance (ANOVA) was used to determine if there were significant differences between conditions at baseline, and repeated measures ANOVA was conducted to determine if there were significant main and interaction effects on the variables between conditions over time.

Qualitative data were transcribed into a Word document verbatim, and content and thematic analysis was conducted by hand to identify critical implementation issues and themes.

RESULTS
School Descriptives
The five school districts represented wide socio-economic strata, with family incomes ranging from $50, 096 to $76,244. School populations ranged from 160 to 693 students.

Participant Descriptives
Baseline participant descriptives are described in Table I. The mean age of students was significantly different (p=0.0001) between conditions, whereas gender was evenly distributed. There were ethnic differences across geographic regions at baseline.

Baseline Outcome Measures
Significant differences were found between conditions at baseline for the following variables: age; ethnicity; fruit servings; FV servings; FV variety; and percent FV tried.

24-Hour Food Recall
Significant effects were found for fruit servings, FV variety, and total FV servings (Table II). Servings of FV decreased (-.79 serving) at UP schools while there was a small increase (+.18 serving) at intervention schools. No effects were found for servings of vegetables (Table II).

Food Frequency Questionnaire
No effects were found for typical daily frequency of FV consumption.

Knowledge, Attitudes and Perceptions
Knowledge of the importance of FV to disease prevention, attitudes to eating FV, and perceptions of the social environment related to FV did not change over time. Significant effects were found for percentage of FV tried (Table III), which increased from 78% to 83% in intervention schools.

Willingness to Try New Fruits and Vegetables
No effects were found for willingness to try new FV.

Fidelity
Intervention teachers delivered 64% of the requested dose of two HE activities per week (mean ± standard deviation of 1.27 ± 1.08). Although there was no requested duration of classroom activities, it is noteworthy that mean duration was 42.03 minutes/week. All intervention schools planned activities across the six Zones. Year-End Reports (June 2006) showed that 80% of planned activities were implemented across a mean of 4.8 Zones.

Feasibility of the Model
The main implementation barrier was identified as time constraints. Barriers to
sustainability were identified as the decrease in monetary and human support that may occur in the large-scale implementation of provincial dissemination. The main facilitators consisted of support from the AS! BC Support Team, the resources, and student enthusiasm.

**DISCUSSION**

The AS! BC – HE pilot provides evidence that a whole-school framework can affect FV intake of elementary school children. Significant differences between conditions in fruit intake were due to a decrease in same in UP schools and a moderate increase in intervention schools. The decrease in fruit intake in UP schools may represent a seasonal effect that was mitigated by the intervention.

The increase in servings of FV was small compared to previous multi-component FV school-based initiatives. Research has suggested that effective interventions are intensive (high dose), implemented over several years and consistently delivered throughout the school year. AS! BC – HE provided an average of 42 minutes of HE activities per week for 12 weeks over one year (total of 640 minutes). Although total minutes of HE activities was comparable to other successful initiatives, both the weekly intensity (minutes/week) and total duration (number of years) was lower. Teachers achieved 64% of requested dose and the intervention period was short (12 weeks).

The lack of effect on vegetable intake is consistent, however, with findings from previous research. A systematic review showed vegetable consumption increasing on average by only one third of a serving. Conversely, the lack of results for typical intake measure (FFQ) may be due to measurement issues. FFQs with detailed food lists show better agreement with validation standards than do those with broad food categories. Our research aligns with previous evidence that there is little agreement between 24-hour recall and FFQ results because they do not share a referent period. A FFQ measures food consumption over a period of months, while a 24-hour recall measures daily food consumption. Additionally, children have difficulty recalling past events accurately, as was required by our FFQ.

Increases in FV variety may be a response to classroom tasting. Research suggests that exposure to novel foods reduces food neophobia, and that children without neophobia have greater food variety than children with neophobia. However, we did not find the expected concomitant decrease in neophobia scores. Limited tasting opportunities may be responsible for this discrepancy. Research suggests that 10-15 exposures to a novel food are required to enhance preference for that food. AS! BC – HE students experienced only a single exposure to any one FV during an average of 3.12 tasting opportunities. Focus groups with teachers revealed barriers to the implementation of tasting activities such as time, money, equipment and resources. These issues raise two important questions for future research: “What is the minimum dose of tasting activities required to affect willingness to try new FV?” and “What dose of tasting activities is feasible for teachers to implement?”

A strength of this study was the inclusion of a process evaluation to measure fidelity to and feasibility of the model. Although results showed a moderate level of fidelity to and feasibility of the model, a critical recommendation that emerged from the process evaluation is that teachers require training, regular support and resources in order to achieve sustained implementation. Tasting experiences, in particular, were identified as essential strategies to elicit behaviour change, but also require support to implement. The sustainability of AS! BC – HE largely lies in the ability to provide teachers with human and monetary support.

The results should be viewed in light of the following limitations. First, the primary variables were self-report, which has previously been shown to be problematic in this age group. Second, the family and community component was minimal, including only: monthly newsletters, voluntary take-home activities, presentations to parent advisory committees, and the encouragement of parental involvement in school HE events. Neither dose received by parents nor fidelity to family activities were evaluated. Third, activities implemented outside the classroom did not focus specifically on FV, and thus the effects of this broader framework were not detected by the measurement tools. The whole-school framework addressed a broader agenda, including implementing and promoting: healthy vending policies, school meal programs, healthy fundraising policies, and

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**TABLE I**

**Participant Descriptives Measured at Baseline**

<table>
<thead>
<tr>
<th></th>
<th>Intervention</th>
<th>Usual Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>141 (49%)</td>
<td>128 (57%)</td>
</tr>
<tr>
<td>Male</td>
<td>142 (51%)</td>
<td>98 (43%)</td>
</tr>
<tr>
<td>Participation Rate</td>
<td>64%</td>
<td>65.6%</td>
</tr>
<tr>
<td>Age in Years (Mean ± SD)</td>
<td>10.1 ± .64</td>
<td>9.9 ± .57</td>
</tr>
</tbody>
</table>

**TABLE II**

**Intervention Effects for Servings of Fruit, Vegetables, and Fruit and Vegetables**

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Condition</th>
<th>Baseline (T1) (Mean ± SD)</th>
<th>Follow-up (T2) (Mean ± SD)</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servings of F</td>
<td>Intervention</td>
<td>2.31 ± 2.75</td>
<td>2.55 ± 2.72</td>
<td>+.24*</td>
</tr>
<tr>
<td></td>
<td>Usual Practice</td>
<td>3.36 ± 3.10</td>
<td>2.68 ± 2.66</td>
<td>-.68</td>
</tr>
<tr>
<td>Servings of V</td>
<td>Intervention</td>
<td>1.94 ± 1.94</td>
<td>1.87 ± 1.90</td>
<td>-.07</td>
</tr>
<tr>
<td></td>
<td>Usual Practice</td>
<td>2.08 ± 2.11</td>
<td>1.97 ± 1.84</td>
<td>-.11</td>
</tr>
<tr>
<td>Servings of FV</td>
<td>Intervention</td>
<td>4.24 ± 3.69</td>
<td>4.42 ± 3.45</td>
<td>+.18*</td>
</tr>
<tr>
<td></td>
<td>Usual Practice</td>
<td>5.44 ± 4.26</td>
<td>4.65 ± 3.46</td>
<td>-.79</td>
</tr>
<tr>
<td>Variety of FV</td>
<td>Intervention</td>
<td>3.33 ± 2.15</td>
<td>3.80 ± 2.56</td>
<td>+.47*</td>
</tr>
<tr>
<td></td>
<td>Usual Practice</td>
<td>3.93 ± 2.34</td>
<td>3.83 ± 2.37</td>
<td>-.10</td>
</tr>
</tbody>
</table>

* Change significantly different compared to usual practice (p<0.05)

**TABLE III**

**Intervention Effects for Percentage of Fruit and Vegetables Tried from a Fixed List**

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Condition</th>
<th>Baseline (T1)</th>
<th>Follow-up (T2)</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Eaten</td>
<td>Intervention</td>
<td>.78 ± .16</td>
<td>.83 ± .14</td>
<td>+.05*</td>
</tr>
<tr>
<td></td>
<td>Usual Practice</td>
<td>.83 ± .15</td>
<td>.84 ± .16</td>
<td>+.01</td>
</tr>
</tbody>
</table>

* Change significantly different compared to usual practice (p<0.05)
HE campaigns. These activities may, however, have created a supportive school culture that enhanced classroom activities.

Implications for practice

AS! BC – HE utilized a whole-school framework to affect the FV consumption of grades 4 and 5 students, but the effects were modest, possibly due to implementation issues. Further research is necessary to explore: 1) the optimal dose and duration of classroom HE activities necessary for behaviour change, 2) the minimum dose of teaching activities required to enhance students’ willingness to try new foods, 3) the dose of both learning and teaching activities that is feasible for teachers to implement and the internal supports that are necessary to achieve this dose, and 4) strategies to enhance the active participation of families in school-based HE interventions.

REFERENCES


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RÉSUMÉ

Objectifs : Le taux d’obésité et ses facteurs augmentent à un rythme alarmant chez les jeunes Canadiens. La nutrition joue un rôle important dans le maintien du poids. Nous avons cherché à découvrir une initiative en éducation à la santé (Initiative d’Éducation au Bien-être des Écoliers) axée sur les fruits et légumes (F et L) et les effets du changement des habitudes de consommation de F et L. Nous avons accordé une attention particulière à l’impact des habitudes de consommation de F et L parmi les élèves; 2) les connaissances, les attitudes et les perceptions des élèves sur les fruits et légumes; et 3) la volonté des élèves d’essayer de nouveaux F et L.