

Original Research Article

## **An interactive after-school nutrition and culinary education program for primary school students: The evaluation and efficacy of changing food-related knowledge, attitudes and behaviour**

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### **Abstract**

**Objective:** To evaluate the efficacy of a 10-week afterschool nutrition and culinary education program in changing the culinary and nutritional behaviour, attitudes and knowledge of its 9-11-year-old participants, as assessed by parents and children.

**Methods:** Retrospective matched-pairs analysis of secondary pre-post survey data collected by Boîte à Lunch (BàL). Children (n=165-197; grades 4 and 5) and parents (n=53-57) who signed-up for the BàL workshops. The program was comprised of ten-week (2 hours/week) bilingual (French and English) themed sessions led by trained educators with focus on culinary skill development, nutrition education and hands-on cooking. Secondary objectives include: teamwork, kitchen hygiene, compost, understanding of food systems. Workshops were held in community centres and schools in Montreal, Canada. Changes were analyzed using the expanded exact McNemar-Bowker test with a Bonferroni-adjusted significance level of 0.001631.

**Results:** Culinary skill and knowledge improved based on all 23 measures (all  $p < 0.001631$ ). Of the six measures assessed for change in attitude, three were significantly improved. Of the two items used to assess a change of behaviour, one was significantly improved. 2 stand-alone post-workshop questions suggest a positive trend for improvements in each.

**Conclusion:** Knowledge and culinary skill of youth can be improved through nutrition education and hands-on cooking. Culinary and nutritional attitudes and behaviours may be improved; further research is needed.

**Keywords:** Nutrition education, culinary education, culinary attitudes

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## Introduction

Globally, the average individual is cooking at home less frequently and is less skilled in the kitchen; concurrently, obesity rates are rising<sup>1-6</sup>. Children are especially vulnerable to these changes, as they lack the autonomy to choose, purchase, and prepare their own meals<sup>7</sup>. Consequently, children are frequently not taught basic nutrition or culinary skills in the home and increasingly rely on take-away foods for sustenance<sup>1,4-6</sup>. This is of concern for numerous reasons, including the finding that culinary skill and nutrition knowledge have both been shown to impact diet quality, and that children who are involved in meal preparation consume healthier diets<sup>1,2,7</sup>. Nutritional knowledge and culinary skill increase the variety of foods available to individuals for cooking and consumption, and enables individuals to prepare meals that contain less salt, sugar, and fat than common take-away meals<sup>8</sup>. Additionally, nutrition and food-related behaviours created in childhood are often maintained throughout life and may predict diet quality and health outcomes in adults<sup>1-3,9</sup>.

Nutrition and culinary education programs (NCEPs) are used globally to address deficient culinary skills and nutrition knowledge<sup>3,7,8</sup>. Programs designed for children show mostly positive results relating to children's culinary self-efficacy, diet quality, and nutrition knowledge<sup>4,8,10-12</sup>. However, many of these programs lack rigorous and validated evaluations of efficacy due to budgetary constraints, difficulties in assessing outcomes in children and not including parental feedback and/or the lack of long-term follow-up<sup>7,13</sup>. Evaluation is an integral component of well-designed programs, yet there is currently no gold standard for the evaluation of NCEPs in children<sup>2</sup>.

Boîte à Lunch (BàL) is an NCEP that has been running for 30 semesters in Montréal, Canada. Throughout these semesters, over 1500 children in grades 4 and 5 from food-insecure homes have participated in the free 10-week program. Each BàL workshop is led by at least 2 trained educators and additional volunteers who engage up to 18 children in weekly lessons which include food preparation, nutrition education, and tasting opportunities. Children participate in nutrition-themed games and hands-on cooking activities where they prepare two healthy recipes to bring home for dinner or for lunch the next school day. Sessions also include lessons on composting, gardening and/or kitchen hygiene. Parents are invited to participate in the program through regular volunteering, participation in the year-end party, consumption of weekly newsletters, and by continuing to promote the program's lessons by preparing BàL recipes at home with their child. This program is unique to others in the literature due to the bilingual nature of the program, the variety of topics taught (i.e. nutrition, culinary skill, food familiarization, composting, gardening, hygiene), and the involvement of parents in the programming.

This research aims to answer three primary questions regarding the skills and knowledge acquired by the children, and to determine if a change in attitudes and behaviours results from program participation. Specifically: Does participation in BàL lead to changes in:

1. The cooking-skillset of the child (change in culinary skill and knowledge)?

2. Fruit and vegetable consumption/willingness to try new foods (change in attitude)?
3. The level of home involvement in food preparation (change in behaviour)?

Based on published evaluations of similar programs, it was hypothesized that BÀL workshops would produce positive results for all aforementioned objectives<sup>5,6,8,10-12,14</sup>. Due to differences in program structure between BÀL and other programs in the literature (i.e. duration of program, methods of assessment, bilingual lessons etc.), the results of this study are novel addition to the literature. Additionally, the collection of both child and parental feedback corroborates perceived changes due to the program; this is a strength of the study as it is not often included in NCEP evaluations.

## Methods

This pre-post, no control, evaluation-design study was conducted using secondary parent and child questionnaire data provided by BÀL. Children voluntarily signed-up for the NCEP with recruitment taking place via advertisements placed in municipal recreation centres, grocery stores, and online. The workshops were held in schools or municipal centres in Montreal. Each semester, there were between 6 and 8 classes running in parallel, each with a maximum of 18 students. Each child came to one predetermined 2-hour workshop afterschool, each week, for 10 weeks (1 semester). Workshops were run by at least 2 trained nutrition educators, dietitians, animators, and volunteers. Sessions began with a spotlight on a specific food (e.g.: bok choy), then the recipes were read by the children in both French and English, the recipes were prepared, followed by an additional lesson (e.g.: nutrition, body systems, composting, kitchen hygiene etc.), tasting, and cleaning. The research team was not involved in the production of the workshops. All parents and children signed consent/assent to answering both pre- and post-workshop questionnaires as a part of regular programming. Parent and child questionnaires were completed as either a hard copy or online, at or before the beginning of the first workshop, and within 2-3 weeks of the last. Data were collected and entered into Excel by members of the BÀL team immediately after collection; analysis occurred during the study period, up to 1 year following the completion of the semester. No control group was used in this study.

Questionnaires were designed by the BÀL team (nutrition educators, community chefs, trained animators, and nutrition coordinators). The researchers' only role was in data analysis. The questionnaires were initially developed by the BÀL team to determine if the program was meeting the objectives set forth by stakeholders and members; item formulation was the sole product of informal discussion between involved parties. The questionnaires evolved over time in response to informal feedback and the addition of new program objectives; data analyzed in this study was collected between Winter 2017 and Winter 2018 (Three 10-week semesters). Complete questionnaire responses were removed from analysis if either the pre-workshop or post-workshop questionnaire was missing. If a response was missing on an otherwise complete questionnaire, the remaining survey responses were included while the response paired to the missing data was not. Missing data resulted in variable number of responses per item: between 156 and 198 child responses, and between 56-57 blinded parent pre-post responses.

To determine if a change in child knowledge, attitudes, and behaviour occurred due to participation in the workshop, a matched-pairs analysis was used wherein children and parents acted as their own controls. Each individual's pre-workshop responses were compared with their own post-workshop responses. For analysis, the three semesters were pooled. Institutional review board approval was provided by BLINDED Research Ethics Board.

## Questionnaires

Unique pre-workshop and post-workshop questionnaires were administered to parents and participants. Questionnaires were designed over time by the BâL team to address questions asked by program stakeholders. Questions were the unique work of the BâL team and were not scientifically piloted, though informal feedback allowed for the evolution and improvement of the questionnaires. Questions were edited to optimize comprehension and added or removed to ensure assessment of all pertinent objectives. The questionnaires addressed many different topics: nutrition habits, food-related attitudes and behaviours, culinary knowledge, and parental engagement.

The questionnaire administered to the children, titled *Skills Checklist (SC)* addressed the three main objectives using a 3-point Likert scale: 1 = no/disagree, 2 = a little/neutral, 3 = yes/agree. A higher score was more positive in each question. The *Parental Survey (PS)* included questions relating to perceived effects of the workshops, potential behavioural or attitude changes in the child, and home cooking frequency and involvement. A 5-point Likert scale was used ("no, not at all" to "yes, very much") that was merged to a 3-point Likert scale due to low statistical counts. The three objectives were assessed using these questionnaires responses.

The responses to these questionnaires were given to the researchers by the BâL team deidentified. Neither workshop locations nor names of parents/children were given to the researchers.

## Domains

### *Culinary Knowledge*

Measures assessing culinary skills included 21 items on the *SC*, and 2 items on the *PS* (see Table 1 in results for list of items). Children ranked their culinary skills for a variety of techniques, such as reading recipes and measuring ingredients. Parents ranked child culinary efficacy and mastery of basic culinary skills, such as using measuring tools, cutting with a knife, and using a food processor.

### *Attitude*

The overall attitudes measure used responses from six questions; 3 from the *SC*, and 3 from the *PS* (Table 2). Children ranked their willingness to try new foods and perceived frequency of

fruits and vegetable consumption, while parents answered similar questions about the child's consumption habits. One post-workshop-only question was included in the parental questionnaire: "Has your child tried new foods at home since the beginning of the B&L workshops?". This question was a yes or no question that was included in the analysis as the percentage of answers indicating "yes".

### *Behaviour*

A change in behaviour was represented in the questionnaires as a change in child involvement in food preparation at home (Table 3). This measure used two similar items on the child and parent questionnaires asking about perceived frequency of cooking together at home. Additionally, one post-workshop-only question on the *PS* asked: "Since the beginning of B&L, my child and I cook more together". This question, using the collapsed 3-point Likert scale, was analyzed as the percent who described themselves in each category.

### Statistical analysis

Data were analyzed using SPSS version 24. Cross tabulations were computed to determine the direction of possible changes for each question in the pre- and post-questionnaires. The expanded exact McNemar-Bowker test was used for each item to compare pre-post responses. Statistical significance was set at  $\alpha = 0.05$ ; because multiple tests were conducted on the same dataset, the Bonferroni correction was used to reduce the probability that the results were due to chance<sup>15</sup>. For the three objectives, a total of 31 metrics were used therefore the Bonferroni adjusted significance level becomes  $\alpha = 0.05/31 = 0.001613$ . This method allows for direct comparisons of the individual changes experienced, as opposed to comparisons of group level responses. Comparing frequency of participants who agreed or disagreed with questions would not reflect the individual changes and therefore was not used.

The impact of the workshop on the three overall research questions was determined by summation of the number of questions included in each objective that yielded a significant change, compared to the total number of measures that constitute each objective, similar to as was done in a study by Cunningham-Sabo and Lohse<sup>11</sup>. If more than half of the questions demonstrated a statistically significant change, that objective was said to have undergone a statistically significant change.

## **Results**

For all questions, the direction of score change between pre-post questionnaire indicates a positive change, with the exception of "My child is open to trying new foods" (*PS*) which was not statistically significant. Results below are split based on overall outcome.

**Table 1.** Quantitative results for objective one (change in knowledge from pre-workshop to post-workshop). All 23 measures showing statistically significant improvement in culinary knowledge and skill over the course of the workshops.

Metric	n (matched)	Mean Pre-Workshop Response	Mean Post-Workshop Response	p-value
I know how to read a recipe (SC)	165	2.65	2.89	P < 0.001
I know how to follow a recipe (SC)	173	2.57	2.85	P < 0.001
I know how to prepare a recipe without help (SC)	168	2.03	2.51	P < 0.001
I know how to measure with a teaspoon (SC)	171	2.24	2.75	P < 0.001
I know how to measure with a tablespoon (SC)	170	2.21	2.78	P < 0.001
I know how to measure with a cup measure (SC)	174	2.20	2.78	P < 0.001
I know how to measure with a thermometer (SC)	171	1.65	2.09	P < 0.001
I know how to use a peeler (SC)	176	2.35	2.85	P < 0.001
I know how to use a grater (SC)	176	2.65	2.95	P < 0.001
I know how to use a knife (SC)	175	2.67	2.94	P < 0.001
I know how to use a juicer (SC)	175	2.36	2.81	P < 0.001
I know how to use a whisk (SC)	175	2.70	2.88	P = 0.001
I know how to use a microwave oven (SC)	172	2.47	2.74	P < 0.001
I know how to use a food processor (SC)	176	1.97	2.55	P < 0.001
I know how to use the oven (SC)	169	2.34	2.80	P < 0.001
I know how to crack an egg (SC)	176	2.10	2.59	P < 0.001
I know how to dice (SC)	176	2.67	2.91	P < 0.001
I know how to cut in slices (SC)	196	2.41	2.89	P < 0.001
I know how to use a rolling pin (SC)	195	2.51	2.92	P < 0.001
I know how to fill a muffin tin (SC)	197	2.44	2.85	P < 0.001
I know how to cook (SC)	178	2.42	2.83	P < 0.001
My child knows how to cook (PS)	57	1.59	2.65	P < 0.001
My child has mastered basic culinary skills (PS)	53	1.57	2.81	P < 0.001

\*P < 0.001613. McNemar-Bowker Test

\*\* Mean Responses based on a 1-3 scale; 1 = disagree, 2 = so-so/neutral, 3 = agree

\*\*\*SC = Skills Checklist; PS = Parent Survey

## Change in knowledge

All 23 metrics used to determine change in knowledge/skill demonstrated a statistically significant increase (Table 1); a positive change in culinary knowledge was identified. Overall, the measures used to assess this objective demonstrated a strong increase in culinary and nutritional knowledge

## Change in attitudes

Of the six outcomes measured to assess a change in attitude, three were statistically significant (Table 2); it is therefore difficult to determine if a change in attitudes occurred though a positive trend signifying improvement was noted. Parents and children agreed that following workshop completion, the children were better equipped to make healthy choices. The parents and children disagreed regarding fruit and vegetable consumption: parents noted a statistically significant increase in the quantity of fruits and vegetables consumed by their child, whereas the children did not. Interestingly, both parents and children agreed that the child was no more willing to try new foods at the end of the workshops than the beginning. Additionally, a post-workshop-only question for parents showed that 61% of parents believed their child had tried a new food at home since the beginning of the workshop.

**Table 2.** Quantitative results for objective two (change in attitudes from pre-workshop to post-workshop). Three of six measures showing statistically significant improvement over the course of the workshops; some disagreement is noted between parents and children regarding fruit and vegetable consumption. The other two measures showing agreement between parent and child.

Metric	n (matched)	Mean Pre-Workshop Response	Mean Post-Workshop Response	p-value
I eat lots of vegetables and fruits (SC)	175	2.70	2.75	0.62
I know how to make healthy food choices (SC)	178	2.41	2.79	P < 0.001
I am open to trying new foods (SC)	183	2.68	2.73	0.46
My child eats plenty of fruits and vegetables (PS)	57	2.20	2.72	P < 0.001
My child knows how to make healthy food choices (PS)	57	2.41	2.84	P < 0.001
My child is open to trying new foods (PS)	57	2.69	2.67	0.46

\*P < 0.001613. McNemar-Bowker test.

\*\* Mean Responses based on a 1-3 scale; 1 = disagree, 2 = so-so/neutral, 3 = agree

\*\*\*SC = Skills Checklist; PS = Parent Survey

## Change in behaviour

Change in behaviour was assessed by one question administered to both parents and children asking about perceived frequency of cooking together at home (Table 3). Only the parental responses indicated a statistically significant improvement; it is therefore difficult to determine if an overall change in behaviour occurred, though there was a positive trend identified.

Interestingly, the child responses did not change appreciably while the parents indicated in the pre-post question *and* in the post-workshop-only question that they cooked often/more often with their child (63% of parents agreed/strongly agreed with the statement: “Since the beginning of BÀL, my child and I cook more together”).

**Table 3.** Quantitative results for objective three (change in behaviour from pre-workshop to post-workshop). Only the parental response showed a statistically significant improvement in culinary behaviour over the course of the workshop; while the child response was in the positive direction, this is not conclusive.

Metric	n (matched)	Mean Pre-Workshop Response	Mean Post-Workshop Response	p-value
I cook often with my parents/family (SC)	178	2.34	2.50	0.092
My child and I cook together at home (PS)	57	1.81	2.43	P < 0.001

\* P < 0.001613. McNemar-Bowker test.

\*\* Mean Responses based on a 1-3 scale; 1 = disagree, 2 = so-so/neutral, 3 = agree

\*\*\*SC = Skills Checklist; PS = Parent Survey

## Discussion

BÀL is an NCEP running in Montréal since 2003; in this time, no formal evaluation was undertaken to confirm that objectives were being met. The present study used models similar to ones in the literature to perform an evaluation using secondary data collected by BÀL and demonstrated the effectiveness of the program in improving the culinary skill and knowledge of the children. While only half of the questions used to assess two of the main objectives (changes in attitude and behaviour) showed statistically significant improvements, the directions of all but one change were positive. The number of questions used to address each objective was determined based on questions already included in the questionnaires; the questions were chosen based on the stated objectives and were not modified for the purposes of this research. To further elucidate possible changes in both attitudes and behaviour, future studies could include more questions that specifically address these objectives. In addition to the pre-post questions, two post-workshop-only questions suggest that an improvement in attitude and behaviour have been met i.e.: 61% of parents indicated that their child had tried a new food at home since the



beginning of the workshops, and 63% of parents felt they cooked more with their child following the program.

While these final two metrics are not necessarily indicative of a change attributable to B&L, they are interesting for other reasons. The first question (“Has your child tried a new food at home since the beginning of B&L”) is the only question posed that uses a yes/no response and is objective in nature (and 61% said yes). While there are similar questions on both questionnaires that ask about willingness to try new foods, they give no standardized way for respondents to quantify willingness. The questions used by this study to assess willingness are similar to others used in the literature, such as agreement statements (“my child is constantly sampling new and different foods”)<sup>14</sup> and questions asking about perceived willingness.<sup>14</sup> For this reason, even considering the lack of pre-post comparison, this question holds some value in the context of a program evaluation. In future questionnaires, a baseline question should be added that asks whether the child has tried new foods in the 10-weeks prior to the commencement of the workshops, which can then be compared to the number at the completion of the workshop.

The latter question asked parents about the perceived frequency of cooking with their child; the results are in agreement with the related question on the parental pre-post-test (“My child and I cook together at home”) that demonstrated a statistically significant change ( $p = 3.00 \times 10^{-6}$ ). However, the companion child question (“I cook more with my family”) did not yield a significant change between pre- and post-test. This disparity raises interesting considerations regarding data sources. When utilizing data from multiple related sources from similar tools and metrics, as seen here with parent and child data, interpreting results can be arduous<sup>16</sup>. It is made even more difficult when the sources are related yet occupy specific social roles; family members may understand and recognize different subjective realities, and there may be distinct interests of each family member (i.e. self-serving bias of parents wanting to appear as good parents)<sup>16,17</sup>. A 2018 study investigating the validity of parent and child questionnaires showed that parents often report more positive claims regarding their own parenting compared to reports from their children<sup>16</sup>. While it is beyond the scope of this study to decipher the intricacies of parent-child perspectives and perceptions, it begs further investigation as there appears a paucity of data suggesting methods for reconciliation of the two perspectives.

Overall, the results observed by the present study are in agreement with other studies in the literature that suggest an improvement in culinary skill and a trend towards improvements in attitudes and behaviours<sup>1-3,6,8,11</sup>. This study reaffirms that NCEPs are effective in increasing the culinary skillset of youth and may incite positive benefits in related areas of culinary attitudes and behaviours. Based on the results of various research studies, culinary skill is a large contributing factor to lifelong dietary habits. Interventions aimed at improving the culinary skill of participants may therefore lead to more nutritious diets throughout life. Further research is needed to fully elucidate the possible benefits of culinary and nutritional intervention programs, such as B&L, in changing the lifelong habits of participants.

## Implications

This study demonstrates that it is possible to implement, evaluate, and adjust running NCEPs. Many NCEPs are designed to fill a need in a community or school and are not designed in the context of a scientific study; as such, by presenting the methodology used here, researchers and workshop coordinators in similar positions may find useful directions to shape their programs to reach similar goals. While it is optimal to construct evaluations and prepare for scientific inquiry during initial program planning, it is not always possible nor required. This study shows, through the demonstrated improvement in culinary skill, that adaptation of what is available and implemented elsewhere is both a practical and efficacious method of operation.

Furthermore, this study adds to the knowledge base investigating and supporting the use of NCEPs in children. Firstly, the use of both parental and child data allows for the comparison and corroboration of how the child's abilities and behaviours are perceived by the child himself/herself, and by the child's parents. The use of comprehensive and similar parental and child data has rarely been done in the literature and allows for in-depth assessments of the intricacies of perceived changes and raises further questions regarding how to interpret differences.

## Limitations and suggestions for future planning

This study contains limitations that must be addressed. First, is the lack of control group and the inability of a retrospective study to demonstrate causation. It is the belief of the researchers that the Hawthorne Effect would have been minimal, as the questionnaires were administered as part of standard practice and not in the context of research with an observer<sup>18</sup>. Nevertheless, the lack of control group prevents the formation of definitive conclusions regarding the results observed. Additionally, the present study relies heavily on data collected from children. Data collected from children regarding self-behaviours may suffer biases and may be unreliable; however, the present study requires this data and accepts any limitations inherent to it.

Additionally, no formal piloting of questionnaires occurred, and internal and external validity have not been demonstrated; this may have affected the ability of the parents and children to understand and interpret the questions. However, the unique questionnaires have been administered, in one form or another, to over 1500 children and have evolved periodically to ensure that program objectives were being met. Future evolutions of the questionnaires will be adapted to include more objective language where previous iterations used vague, subjective language (ex: "plenty", "often", "cook"). Future iterations of the questionnaires may include a condensed version of a Food Frequency Questionnaire or Dietary Recall, as seen in other studies, to decrease the subjectivity of the results<sup>4,12</sup>. To reduce the biases inherent to these tools, a three-day recall completed by parent and child could be completed. An additional question addressing the frequency of home meal preparation may also be included to assess familial routines and cooking opportunities.

Finally, the authors recommend methods for increasing the collection of viable data. In the present study, viable data was lost due to the evolution of the surveys over time, the use of group-level data in the place of individual raw data protected by unique student identifiers, and attrition in the parental cohort. A study by Bastaists et al. investigating adult non-response with child perspective data found that major indicators of whether a child completes a survey are: the topic of the survey, child demographics (lower education and ethnic minorities have been shown to respond less to surveys), and parent-child relationships (more supportive parents are more likely to participate than less supportive parents)<sup>17</sup>. Relating to the current study, parents who fill out the surveys are likely to be more engaged in their child's activities, both within and outside of the B&L workshops. Selection bias may have factored into the responses given by parents and children, especially considering that only 1/3 of the parents completed the questionnaires. As such, future directives should include measures to increase parental post-survey response rates, such as a dedicated time at the end-of-session party to fill out the forms or notes sent home with the children at the final workshop to better capture input from all parents.

### Implications for research and practice

NCEPs of sufficient frequency and duration have proven repeatedly to be effective in increasing nutrition and culinary knowledge, increasing culinary self-efficacy, and fostering healthy food relationships<sup>5,6,8,11,12,14</sup>. This study confirms the power of these programs to increase the culinary knowledge base and skillset of children. The present study was not able to demonstrate a clear improvement in attitudes or behaviours and future research is needed in these areas. Furthermore, while evaluation methods are an integral component of program planning, the present study demonstrates that evaluation tools can evolve with NCEPs and still be effective. The gold standard is not always feasible in real-world interventions; often, objectives can be met in other ways.

## Conclusion

Hands-on nutrition and culinary skills education programs, like B&L, are effective interventions to improve the culinary skillset of children. Subjective changes that result from these programs, such as changes in attitudes and behaviour, are difficult to assess; while this study found a positive trend, overall scores in these categories were not definitive and future research is needed.

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