

EFFECTIVENESS OF THE 5-TODAY PROGRAM AT INCREASING FRUIT AND
VEGETABLE CONSUMPTION IN GRADE FIVE AND SIX CHILDREN

By

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B.Sc. (Nutrition and Food Sciences) University of Alberta, 2003

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

Master of Science

In

THE FACULTY OF GRADUATE STUDIES
(Human Nutrition)

THE UNIVERSITY OF BRITISH COLUMBIA

April 2005

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Abstract

Adequate fruit and vegetable (FV) intake may help prevent chronic disease, yet most Canadians do not consume the recommended minimum five servings per day. The 5-TODAY project targeted children to promote FV intake. The purpose of this study was to evaluate the effectiveness of the 5-TODAY program in grade five and six students. Specific objectives were to measure changes in FV intake and knowledge, attitudes and perceptions regarding FVs, and to identify ways in which the 5-TODAY program could be improved.

Evaluation the 5-TODAY program, involved 10 Vancouver area schools, divided into three intervention levels: liaison, champion and usual practice. Grade five and six class teachers in intervention schools taught students about FVs, using provided 5-TODAY lesson plans. Quantitative assessment of the 5-TODAY program included 24-hour food recalls, FV food frequency questionnaires (FFQ), and a FV Knowledge, Attitudes & Perceptions (KAP) survey. The students completed these three forms before, during, and after 5-TODAY implementation. Qualitative evaluation involved the use of focus groups with the teachers who implemented the program.

Repeated measures ANOVA results of the 24-hour food recall and FFQ showed that total FV intake did not increase significantly during the duration of the 5-TODAY program. The KAP survey revealed that the students' attitudes towards FVs did not change as a result of the 5-TODAY program. Teachers thought the 5-TODAY program increased awareness of the importance of FV in students, teachers and schools. Some teachers felt that their students did not change their eating behaviour during 5-TODAY implementation, while other teachers did

observe changes, although some only temporary. Suggestions to improve the program included increased time and intensity, as well as targeting a younger age group.

Results show that the average FV intake of the sample (3.49 servings/day) did not meet the recommended minimum amount of five FVs per day at any measurement period. Also, 75% of students consumed less than five FV daily. This provides evidence that further FV promotion interventions are required in Canadian elementary schools. To achieve success, it is recommended that these programs include multiple dimensions, such as classroom, environmental, community and parental components.

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List of Abbreviations

ANOVA: Analysis of Variance

AS! BC: Action Schools! BC

BC: British Columbia

CATCH: Child and Adolescent Trial for Cardiovascular Health

CFGHE: Canada's Food Guide to Healthy Eating

CPMA: Canadian Produce Marketing Agency

CVD: Cardiovascular Disease

DC: Dietitians of Canada

FFQ: Food Frequency Questionnaire

FV: Fruit and vegetables

HEAL: Healthy Eating Active Living

KAP: Knowledge Attitudes & Perceptions

NCI: National Cancer Institute

NIN: National Institute of Nutrition

UNB: University of New Brunswick

US: United States

WHO: World Health Organization

Acknowledgments

Thank you to my supervisor, Dr. Ryna Levy Milne, who always welcomed questions and provided me with positive encouragement throughout this process.

Thank you to my committee member, Dr. Susan Barr, who provided me with invaluable guidance throughout my research, particularly in analyzing my results and writing my thesis.

Thank you to my committee member, Dr. Kadriye Ercikan, who helped in the design of my study and writing the results.

Thank you to Dr. Jim Frankish, for reviewing my thesis and serving on my examination committee.

Thank you to the Action Schools! BC team, especially Heather MacDonald, who answered many questions and provided me with resources about the project.

Thank you to my husband Jeff, who provided computer help and plenty of emotional support.

Chapter 1: Introduction to the Study

Purpose and Objectives

The literature has established an association between FVs and prevention of chronic disease, yet Canadian children are likely not consuming enough of this food group. Health Canada, Dietitians of Canada (DC), teachers and parents all agree that there is a need for nutrition programs in Canadian elementary schools, particularly promoting FVs. The 5-TODAY program was developed to meet this need, based on some best practices seen in successful school-based nutrition programs. Research suggests that a multi-mode method of assessing the effectiveness of nutrition programs is necessary. It is for this reason that a 24-hour recall, FFQ and a Knowledge, Attitudes and Perceptions (KAP) survey were all used to evaluate the effectiveness of the 5-TODAY program.

The purpose of the 5-TODAY pilot project was to promote FV consumption in school-aged children. The purpose of my proposed research was to evaluate the effectiveness of the 5-TODAY program in grade five and six students. Specific objectives included:

1. To determine the students' FV intake and measure changes in intake during the duration of the 5-TODAY program.
2. To measure changes in the students' knowledge, attitudes and perceptions regarding FVs during the duration of the 5-TODAY program.
3. To identify ways in which teachers who implemented the 5-TODAY program believe it can be improved.

Relevance

Fruit and Vegetables and Health

The burden of chronic disease is rapidly increasing worldwide. Of the 56.5 million reported deaths in 2001, approximately 59% were the result of chronic disease (FAO/WHO, 2003). Yet up to 70% of premature deaths and two-thirds of chronic disability are preventable (U.S. Department of Health and Human Services, 1990). The benefits of preventing chronic disease include national health care savings of billions of dollars per year, improved quality of life, and avoidance of premature deaths.

The World Health Organization (WHO) reports that up to 2.7 million lives could be saved annually with adequate FV consumption (WHO, 2003). An abundance of research has been conducted to justify that adequate FV intake will be beneficial to a person's health and may even prevent chronic disease. For example, it has been determined that a rise in plasma ascorbic acid concentration equivalent to about one serving of FV per day, was associated with a 20% reduction in risk of all-cause mortality in a population consuming approximately 4.5 servings of FV per day (Khaw, Bingham, Welch, Luben, Wareham, Oakes, et al., 2001). This was independent of age, systolic blood pressure, blood cholesterol, cigarette smoking, diabetes, and supplement use (Khaw et al., 2001).

More specifically, FVs have been shown to play a role in protecting against cancer (Glade, 1999; Steinmetz & Potter, 1996), cardiovascular disease (Joshi-pura, Ascherio, Manson, Stampfer, Rimm, Speizer, et al., 1999; Joshi-pura, Hu, Manson, Stampfer, Rimm, Speizer, et al., 2001), hypertension (Appel, Moore, Obarzanek, Vollmer, Svetkey, Sacks, et al., 1997; Beitz, Mensink & Fischer, 2003), diabetes (Ford, Mokdad, Giles, & Brown, 2003), diverticulosis (Aldoori, Giovannucci, Rockett, Sampson, Rimm & Willet, 1998), cataracts

(Hankinson, Stampfer, Seddon, Colditz, Rosner, Speizer, et al., 1992; Jacques & Chylack, 1991), and to improve lung function (Antova, Pattenden, Nikiforov, Leonardi, Boeva, & Fletcher, 2003; Butland, Fehily, & Elwood, 2000; Cook, Carey, Whincup, Papacosta, Chirico, Bruckdofer, et al., 1997; Gilliland, Berhane, Gauderman, McConnel, & Peters, 2003). Inconclusive data also suggests that FVs may play a role in protecting against arthritis, Alzheimer's disease, gallstones, inflammatory bowel disease, multiple sclerosis, osteoporosis, Parkinson's disease and ulcers (Dufresne & Levy Milne, 2001; Hyson, 2002). This leads to the conclusion that there are likely many long-term health benefits to consuming adequate amounts of FVs.

There are various theories to explain why FVs may prevent chronic diseases. Depending on the disease, most evidence points to antioxidant vitamins, minerals, phytochemicals, fibre, or plant protein (Hu, 2003). For example, antioxidants may help prevent cataracts, and the oxidation of cholesterol in the arteries. Potassium from FVs may prevent and control hypertension and reduce the risk of a subsequent heart attack or stroke as well as assisting in bone health (Hyson, 2002). One finding is that health benefits come from eating the whole FV, versus taking a supplement (Produce for Better Health Foundation, 2001). Recent studies even suggest that high levels of vitamin supplements may even have a detrimental effect on health, as opposed to the benefits of the vitamins from real FVs (Miller, Pastor-Barriuso, Dalal, Riemersma, Appel, & Guallar, 2005; Lee, Folsom, Harnack, Halliwell, & Jacobs, 2004).

The Need for School-Based Nutrition Education

Health Canada, through Canada's Food Guide to Healthy Eating (CFGHE), recommends Canadians consume five to 10 servings of FVs per day (Health Canada, 1997). This is consistent with WHO recommendations of at least 400g FVs per day (WHO, 2003). Yet the BC Nutrition Survey found that 64.6% of British Columbians do not meet the recommended daily minimum five servings of FVs (B.C. Ministry of Health Services, 2004). Although this statistic is based on adult consumption, children's intakes appear to be similar. A study conducted in the United States (US) looking at data from the US Department of Agriculture Continuing Survey of Food Intakes by Individuals found an average daily FV intake of 3.6 servings among children, with only one in five children meeting the recommended five or more servings of FVs per day (Krebs-Smith, Cook, Subar, Cleveland, Friday, & Kahle, 1996).

The sample for the 5-TODAY pilot project consisted of elementary school children. Low FV intake in childhood is an indicator of low FV intake later in life (Krebs-Smith, Heimendinger, Patterson, Subar, Kessler, & Pivonka, 1995). The BC government document "An Ounce of Prevention," (Kendall, PRW, 2003) also recognizes that to improve long-term health, emphasis must be placed on sensitive periods in life, including the school years. Another reason to target this age group is that early antecedents of many chronic diseases begin years before the disease presents itself. For example, it was proven decades ago that the presence of fatty streaks in the aorta can develop in the first decade of life and in the coronary arteries in the second decade, likely leading to CVD later in life (Holman, McGill, Strong & Geer, 1958; Strong & McGill, 1962). In addition, chemopreventive agents like FVs

provided before the initiation steps of carcinogenesis have beneficial effects in cancer prevention (Turini & DuBois, 2002). Maynard et al. (2003) have even shown that fruit consumption in childhood may have a protective effect on cancer risk as an adult (Maynard, Gunnell, Emmett, Frankel, & Smith, 2003).

In 2004, the Dietitians of Canada (DC) conducted a national survey of parents and teachers of school children, to determine nutrition concerns for children. The main response regarding desired changes in the dietary habits of school children was for them to eat more vegetables (DC & Dairy Farmers of Canada, 2004). The second most common response was for children to try new foods, and the third most desired change was for them to eat more fruit (DC & Dairy Farmers of Canada, 2004). Enhancing nutrition education curriculum and programming was seen as the initiative most likely to establish and maintain lifelong healthy eating patterns among survey respondents (DC & Dairy Farmers of Canada, 2004). This research shows that Canadian parents and teachers realize that lack of FV intake among children is a concern, and that school programs may help to establish healthy eating patterns.

Health Canada conducted 32 focus groups in 1995 with children and their parents, to discuss child nutrition (National Institute of Nutrition (NIN), 1995). Overall 144 middle to low-income families in four urban centres participated. Separate focus groups were held with children six to nine years old, children 10 to 12 years old, and parents of these children. All groups considered FVs to be an important component of healthy eating (NIN, 1995). Eating more of this food group and less "junk" food were potential dietary improvements mentioned by all groups (NIN, 1995). The children perceived their parents as the most important influence on their eating patterns, with school rating second (NIN, 1995). Children appeared to have a strong influence on what foods were purchased and eaten at home, particularly for

breakfast and snack foods (NIN, 1995). Considering that children do make some food decisions and that school has an influence on their eating patterns, these results suggest that educating children at school may impact their FV intake.

The BC Provincial Health Officer states: "Schools, because of their access to children and youth, their central role in child and youth development and their responsibility to teach, must figure prominently as partners in local community, provincial and national health promotion efforts" (Kendall, 2003, pg 20). According to a collaboration between the Canadian Association of Principals, the Canadian Association for School Health and Health Canada, schools are an ideal setting for nutrition education for several reasons: including

- Most children as well as their parents can be reached;
- Most students eat at least one meal at school;
- Eating is a socially learned behaviour, influenced by education, social support and school services;
- School-based instruction can improve the eating behaviours of children;
- Role models (i.e. teachers) have a powerful effect on children through setting examples (Health Canada, 2002).

Taking into account that FV are important for health and British Columbians do not consume enough of this food group, we decided to target FV promotion as the nutrition focus for the 5-TODAY program. Since childhood eating patterns may persist into adulthood, and because schools are an excellent setting for nutrition education, elementary schools were the chosen setting for the research.

Literature Review

The purpose of this literature review is to take a more in depth look at school nutrition education initiatives in Canada, as well as the characteristics of successful nutrition interventions. School-based FV promotion studies from the US are reviewed to determine the types of interventions used and their level of success. Types of tools that can be used to evaluate nutrition interventions, and the role of health behaviour theories in nutrition interventions for children are also discussed.

School Nutrition Programs in Canada

While it is established that the school is an ideal setting for reaching children with nutrition education, it appears little formal nutrition education is being offered in Canadian schools. This may be due to a lack of school nutrition policies, nutrition curricula or nutrition training for teachers. To help combat this problem, "Nutrition for Health: An Agenda for Action" is the result of a Canada-wide, multi-sectoral plan to create motivation for healthy nutrition (Joint Steering Committee Responsible for Development of a National Nutrition Plan for Canada, 1996). Some of the strategies recommended in this document involve school nutrition, including: reinforcing healthy eating by providing nutrition education, emphasizing practical skill development, training service providers and working with media to promote nutrition. Another goal of this plan is to enhance the availability of foods that support healthy eating through food policies that influence food choices available at the school cafeteria, vending machines, special events and fundraisers and by working with the food service sector

(Joint Steering Committee Responsible for Development of a National Nutrition Plan for Canada, 1996).

Researchers from the Canadian Research Institute for Social Policy at the University of New Brunswick (UNB) have developed a project called "Facilitating Capacity – Building Within the School Community to Improve Healthy Eating and Physical Activity". They have recently surveyed school districts, provinces, and stakeholders to reveal healthy eating programs that are presently functioning in Canadian schools (UNB, 2004). Sixty school districts from seven provinces responded to the survey. Half of the school districts reported they have a healthy eating curriculum in place and 11 districts have nutrition policies. Twenty-three of the 60 districts that responded have nutrition programs running, but only four have been formally evaluated. Half of the respondents indicated that their school district has a breakfast program in elementary schools and 21 have a lunch program (UNB, 2004). In response to a question regarding barriers to improve healthy eating, responses included: too many groups working in the area with no coordination, lack of funding and communication within government departments, lack of healthy eating opportunities in a school day, and income (UNB, 2004).

Various schools and school districts throughout Canada and BC are taking leadership roles by administering nutrition programs. In BC, an elementary school in North Vancouver has a nutrition policy, and a "FAB 5 Committee" that promotes fluids, activity, breakfast and eating five FVs per day (UNB, 2004). Healthy Eating and Active Living (HEAL) in Northern BC is a project funded by Health Canada and sponsored by the Northern Health Authority. The objectives were to develop nutrition policies, to teach students at least three food preparation/selection skills, for students to eat more nutritious foods at school and develop

preferences for healthy foods, and for school staff to have access to nutrition support (HEAL, 2003). Four elementary schools in the district took part in the program by creating, implementing and evaluating school nutrition policies. Along similar lines, the BC Interior Health Authority has also been organizing a School Food and Nutrition Policy Project, involving 20 schools. Part of these policies mandate that schools must participate in three nutrition education workshops per year and teachers must add three food selection/preparation skills to class the curriculum (Directorate of Agencies for School Health, 2004).

Some national FV promotion programs are also available in Canada. A social marketing campaign titled "5 to 10 A Day: Are You Getting Enough!" began in 1998. The Canadian Produce Marketing Agency (CPMA), Canadian Cancer Society and the Heart and Stroke Foundation fund the campaign. A variety of media are used to deliver messages, which are targeted at women aged 24-45, as they are responsible for the majority of grocery shopping and cooking in most households (CPMA, 1999). For children aged six to 12 the "5 to 10 A Day" campaign includes Freggie's Youth Program. Freggie is the official Canadian FV mascot and attends various health celebrations (CPMA, 1999). "Freggie Tales" is a publication available through health units, schools and libraries featuring educational stories, games, recipes and contests to make FVs appealing to children (CPMA, 1999). Freggie also has a website that offers on-line interactions with Freggie for children, and lesson plans for school teachers (CPMA, 1999).

Kellogg's Canada and DC have developed a program called "Mission Nutrition" directed at teachers, parents and children. Mission Nutrition consists of lesson plans to promote positive self esteem, healthy eating and physical activity for grades kindergarten to

one, two to three, four to five and six to eight. The website also contains information and links for parents as well as interactive games for children (DC & Kellogg's, 2000).

Evaluation conducted by phone calls to 223 elementary teachers found 22% awareness of the program. Those who had used the program were planning on using it again and thought the lesson plans were well-researched and useful for students (Ricciuto, Haresign, & Steele, 2003). Many provincial dairy boards also offer nutrition education programs for schools. For example, the BC Dairy Foundation offers lesson plans targeted to elementary and middle schools that fit in with curricular outcomes set by the BC Ministry of Education (UNB, 2004).

Characteristics of Successful School Nutrition Programs

Dufresne and Levy-Milne (2001) summarized 15 school-based nutrition interventions and devised a list of best practices. The 5-TODAY lesson plans, which were developed for use in the present study, incorporated many of these points, including:

- Clear, strongly worded, simple messages focused on changing a specific behaviour versus focused on a broad nutrition message: The 5-TODAY program targeted increased FV intake versus the broad message of healthy eating.
- Use of a combination of approaches: The 5-TODAY program lesson plans included discussion as well as interactive lessons. The program also contained ideas to promote FVs through family and community, school spirit, school environment and extracurricular events.
- Reduce the amount of time needed to prepare for teaching the program: Teachers

involved in implementing the 5-TODAY program were provided with detailed lesson plans and resources.

- Personalized methods to disseminate interventions to the teachers: Teachers were welcome to request an in-service on the 5-TODAY program.
- Easily accessible materials: Teachers were supplied with resources required to teach lesson plans and websites to aid in implementing optional activities (i.e. tuck shops or school nutrition policy).
- A curriculum that maximizes skill building through fun and interactive activities: Lesson plans included interactive activities such as field trips to a farm/orchard/supermarket, science experiment, taste testing and recipe preparation.

Further research suggests that the most effective school-based nutrition programs:

- Contain formal evaluation (Perez-Rodrigo & Aranceta, 2003).
- Offer teachers training opportunities (Perez-Rodrigo & Aranceta, 2003), as this increases teacher knowledge and classroom instruction time (Weis & Kein, 1987).
- Are culturally relevant and developmentally appropriate (Perez-Rodrigo, 2003).
- Focus on behaviour change (Perez-Rodrigo & Aranceta, 2003).
- Have theory-driven strategies (Perez-Rodrigo & Aranceta, 2003).
- Involve adequate time and intensity (Perez-Rodrigo & Aranceta, 2003).
- Involve the parents (Perez-Rodrigo & Aranceta, 2003; Weis & Kein, 1987).
- Consider the needs of students, teachers and school (Perez-Rodrigo & Aranceta, 2003).
- Directly involve the students in the learning process (Weis & Kein, 1987).

- Integrate nutrition education with other academic subjects (i.e. math lessons that analyze nutrient intake or reading lessons containing texts on nutrition) (Weis & Kein, 1987).
- Offer administrative support (Weis & Kein, 1987).

Health Behaviour Theories

In the past, healthy eating education generally targeted increasing knowledge and awareness. Now more attention is given to the role of environmental influences to change behaviour, such as availability, price, promotion, social norms and role models (Reynolds, Baranowski, Bishop, Gregson, & Nicklas, 2001). Most nutrition interventions and evaluation methods are now based on the Social Cognitive Theory (Bandura, 1986) or Transtheoretical Model (Prochaska & DiClemente, 1992). Health belief models such as these are based on the idea that behaviours are influenced by social, cultural and physical environments (Sallis & Owen, 1997).

Variables used in psychosocial theories of behaviour change have increasingly been measured in studies with children (Contento, Randell, & Basch, 2002). For example, subjective norms (Theory of Planned Behavior) were measured in several studies, with questions such as: “My friends will make fun of me if I eat fruits and vegetables (agree/disagree)”. Outcome expectancies (Social Cognitive Theory) were also measured in many studies. For example, to measure positive outcome expectations participants responded to statements such as: “If I eat fruit and vegetables everyday, I will have more energy” (Contento et al., 2002).

The ability of behaviour theories to predict food intake is on average < 30% and even lower in children, with no one theory out predicting others (Baranowski, Cullen, & Baranowski, 1999). A recent study found that overall 34% of variance in childrens' FV intake was predicted by psychosocial factors including accessibility, skills, preferences and intention (Bere & Klepp, 2004). It was determined that preferences and accessibility are the strongest correlates of FV consumption in 10 to 12 year olds (Bere & Klepp, 2004.) In accordance with other studies (Domel, Thompson, Davis, Baranowski, Leonard, & Baranowski, 1996; Reynolds, Hinton, Shewchuk, & Hickey, 1999) Vereecken et al. (2005) determined that preferences for FV were significantly correlated with children's FV intake (Vereecken, Van Damme, & Maes, 2005). They also found that perceived parental and peer behaviour were associated with FV intake in their population of 11 and 12 year old children (Vereecken, et al., 2005).

Social cognitive theory appears to be the model that is used most often in assessing reasons for children's FV intake. The theory includes components such as environment (i.e. availability of FV at home and school), outcome expectancies (i.e. perceived taste of FV), self-efficacy (i.e. feeling competent at preparing/consuming FV), reinforcement (i.e. rewards for eating FV), and self-regulation (i.e. setting personal goals to eat FV) (Baranowski, Perry, & Parcel, 2002b). These factors can also be targeted when planning a school FV promotion intervention. For example, 'Gimme 5', implemented by Baranowski et al. (2000) targeted outcome expectancies by delivering the message that eating FVs will improve the students' school performance without decreasing peer acceptance. Self-efficacy was increased by targeting students' confidence to ask for FV at home through role playing (Baranowski, Davis, Resnicow, Baranowski, Doyle, Lin, et al., 2000). Self-regulation components included

setting goals to eat more FV at targeted meals/snacks and reinforcement was offered through prizes for completing homework and congratulations for reaching dietary change goals (Baranowski, et al., 2000).

School-Based Fruit and Vegetable Promotion Studies

The American School Health Association reviewed the major school-based nutrition education studies conducted in the US during the 1980s. They found that most studies involved 10 to 15 hours of instruction time, over a three to 15 week period. These studies resulted in a positive effect on nutrition knowledge, diet-related skills, behavioral expectations and self-efficacy. The effect of the studies on changing attitudes was inconsistent, but generally positive. The impact of general nutrition education programs on behaviour change was minimal, yet the impact of more specific nutrition programs was slightly more positive (America School Health Association, 1997).

The 5-A-Day program began in California and became a national American program in 2001, sponsored by the National Cancer Institute (NCI) and Produce for Better Health Foundation. The program goal is to increase FV consumption to five or more servings per day, through implementation of four major components: retail, community, media and research (Reynolds, et al., 2001).

I conducted database searches of PubMed and Web of Science for school-based FV interventions in grades four to six students, which revealed five multi-component programs (Foerster, Gregson, Beall, Hudes, Magnuson, Licingston, et al., 1998; Perry, Bishop, Taylor, Murray, Mays, Dudovitz, et al., 1998a; Gortmaker, Cheung, Peterson, Chomitz, Cradle, Dart,

et al., 1999; Baranowski et al., 2000; Reynolds, Franklin, Binkely, Raczynski, Harrington, Kirk, et al., 2000). These programs, which will be described below, were all conducted in the US, funded as a part of the 5-A-Day program. Most of these multi-component interventions included classroom education curriculum, environmental/cafeteria interventions, parent outreach and two studies also included a community component. The parent and community components have yet to be well developed and evaluated (Foerster et al., 1998; Perry et al., 1998a; Gortmaker et al., 1999; Baranowski et al., 2000; Reynolds et al., 2000).

The 'High-5 Project' was a two-year intervention implemented by Reynolds et al. (2000) in Alabama. It involved 28 elementary schools and 1700 students in grades four and five. Schools were randomized into intervention or control categories. The intervention included training of food service staff to serve and promote FVs, classroom curriculum and parent/child home activities. The classroom curriculum lesson included plans that were taught by trained researchers, consisting of two lesson plans per week for seven weeks. The lessons used modeling, self-monitoring, problem-solving, reinforcing and taste-testing activities to promote FV. Student psychosocial questionnaires, 24-hour recalls and observed lunch intakes were used to measure FV consumption. The lunch observation effects were not significant. The 24-hour recalls showed that the project significantly increased fruit intake by 0.56 servings/day, vegetable intake by 0.35 servings/day and total FV intake by 0.9 servings/day at the end of years one and two. The intervention was equally effective in males and females as well as different ethnicities (Reynolds et al., 2000). The High-5 Project produced very strong results, likely due to the implementation of the program by trained research staff (French & Stables, 2003).

The '5-A-Day Power Plus Program' was conducted by Perry et al. (1998a) in Minnesota. The intervention lasted one year and involved grades four and five students in 20 schools, randomized into an intervention group or a control group. The intervention included classroom education (16, 45-minute sessions taught twice per week for eight weeks, implemented by trained teachers), parent/child home activities (five activity packs), and food service intervention (signage, increasing availability and attractiveness of lunch FV). FV intake was measured with a 24-hour recall and FV lunch observation. Results showed that the intervention significantly increased total FV servings by 0.62 servings/day. Girls were more responsive than boys, as their vegetable servings increased by 0.26 servings compared to a non-significant change in boys (Perry et al., 1998a).

'Gimme 5: Fruits and Vegetables for Fun and Health' in Georgia was conducted by Baranowski et al. (2000). In this program 16 elementary schools and 1900 students were randomized into a two-year multi-component intervention. Grade four and five students received a classroom curricula implemented by trained teachers (12, 45 to 55-minute lessons in each school year), a parental component (newsletters, home activities and videos) and grocery store activities (point of purchase education). This intervention did not include a food service component. Seven-day food records, a student psychosocial questionnaire (including preferences, outcome expectancies, social norms and self-efficacy) and parent phone surveys were used as evaluation tools. The psychosocial questionnaire determined reasons why children were not eating FVs, including environmental, personal and behavioural factors (i.e. availability at home, preferences, and ability to prepare FV recipes). The seven-day food

records showed significant intervention effects for total FV intake and vegetables, although there was no increase in intake. The significant effects were due to a decline in consumption among the control group. These results are weaker than the previous studies, perhaps because of low curriculum implementation by teachers. Only 47% of the planned lessons were implemented in the classroom (French & Stables, 2003). Another possible reason for weaker results is that this program did not include a food service intervention component.

'5-A-Day Power Play' in California was conducted by Foerster et al. (1998). This program used social marketing to promote FVs in a study with 2600 grade four and five students in lower income communities. Three different levels of interventions were formed and implemented for eight weeks:

1. Teachers conducted classroom activities to promote FV in regular subject-matter classes;
2. Teachers conducted classroom activities to promote FV in regular subject-matter classes plus a community component (media, grocery stores, farmers markets);
3. Control.

The classroom curricula consisted of 14 activities, implemented by teachers that were paid a \$100 stipend. Psychosocial attitude surveys and 24-hour recalls were used for evaluation. The 24-hour recalls showed significant increases in FV intake among students in the two intervention groups (intervention one = 0.2 servings/day increase; intervention two = 0.4 servings/day increase) compared to the control group (-0.3 servings/day). There were no gender or ethnicity interactions (Foerster et al., 1998). This study shows that teacher-implemented classroom interventions alone can increase FV intake. The activities were a part

of usual classroom curriculum, and changes occurred without altering the school food environment.

The above study designs did not allow the researchers to identify which sub-component (i.e. classroom, community or food service environment) was most effective at increasing FV intake. Another study conducted by Perry et al. (2004) consisted of an environmental-only randomized trial, which can be compared to Perry's multi-component study (Perry et al., 1998a). First and third grade students in 26 elementary schools participated in a two-year cafeteria-based intervention. FVs were increased in availability at school lunches and promoted through taste tests and contests. Luncheon observations found significant increases from 0.14 to 0.17 servings per day in FV intake. This environmental-only study increased FV intake to a smaller degree than the multi-component intervention (increase of 0.62 servings per day) (Perry, Bishop, Taylor, Davis, Story, Gray, et al., 2004). Yet these results show that less intensive, environmental-only interventions (i.e. cafeteria changes) can successfully increase FV intake. This may be a more realistic option for many schools, as one of the major challenges with school nutrition education is that the teachers have very little time to add nutrition education into their curriculum.

Several elementary school based multi-behavioural interventions, including FVs as only one target, have been conducted. Perry et al. (1998b) ran a three-year intervention program called the 'Child and Adolescent Trial for Cardiovascular Health' (CATCH). The program was designed to decrease CVD risk factors by targeting dietary fat and sodium intake and physical activity. School food service increased the use of FV and classroom and

home activity packages included FV as a part of several intervention messages. No significant changes in total FV intakes were found using 24-hour recalls as a measurement tool. The CATCH program was not successful in increasing FV intake, compared to studies such as the '5-A-Day Power Plus Program' (Perry et al., 1998a) that have a specific message targeted solely at FV intake. Therefore, the authors concluded that specific food-related messages (i.e. eat five FV per day) are more effective in changing eating behaviours than more general nutrition messages (Perry, Lytle, Feldman, Nicklas, Stone, Zive, et al., 1998b).

Gortmaker et al. (1999) compared FV intake in eight control schools to six intervention schools in grades four and five students. Over two years, the intervention school-teachers targeted decreasing high fat foods, increasing FV consumption to five a day, reducing time spent watching TV, and increasing physical activity. Thirteen lesson plans were integrated into the classroom curriculum and five lessons were integrated into physical education class. Twenty-four-hour recalls found increases of approximately 0.73 FV servings/day in the intervention groups compared to control groups (Gortmaker et al., 1999). However these results are difficult to interpret, as the researchers used different measures of FV intake at baseline (food and activity survey) and follow-up (24-hour recall) (French & Stables, 2003).

Liquori et al's (1998) 'Cookshop Program' was run in two elementary schools and targeted kindergarten to grade six students. The desired behaviour changes included increased intake of whole grains and vegetables. Over five months, the classrooms were randomly assigned to:

1. Cafeteria environment only
2. Cafeteria environment + classroom education

3. Cafeteria environment + cooking experiences
4. Cafeteria environment + classroom education + cooking experiences.

The classroom education consisted of 10, 45-minute sessions designed to increase knowledge. The cooking program consisted of 10, 60 to 90-minute cookshops in which students cooked and tasted different whole grains and vegetables. Evaluation looked at the percentage of targeted food (whole grains and vegetables) consumed at lunch, as estimated by plate waste. The results showed significant effects of the program on target food consumption among younger grades (kindergarten to third grade), but not for grades four through six. The cafeteria environment only intervention group had a 5% increase in target food intake. The cafeteria environment + classroom education produced no changes. The cafeteria environment + cooking led to changes of 19%, but only among younger grades. Cafeteria environment + classroom + cooking produced an increase of 24% in intake of targeted foods (Liquori, Koch, Contento, & Castle, 1998).

Overall, the school interventions have been effective in changing fruit intake (0.2 – 0.6 servings/day increase) and vegetable intake (0 - 0.3 servings/day). Total FV changes ranged from none to an increase of 0.9 servings per day. These results concur well with a review article summarizing published studies targeting increased FV consumption in a school based setting, which found that the majority of studies showed no effect or an increase of 0.2 to 0.75 servings per day (National Public Health Department, 2000). Most programs included classroom education targeting behaviour change, food service changes and parent home activities.

Evaluation measures

There are no universal criteria that can be applied when selecting data-collection methods suitable for studies of children and adolescents. Research on children's recall of food intake shows that considerable error can occur, including over and under-reporting and incorrect identification of foods. This is due to children having little knowledge of foods and food preparation methods (Livingstone & Robson, 2000). Some errors may have less to do with memory than they are to do with inattention. It is unlikely that children pay attention to the details of the food they may be eating, such as portion sizes (Livingstone & Robson, 2000).

Evaluation of nutrition education often uses some form of dietary recall. Estimating the amount of food consumed is a difficult task, requiring the participant to describe food quantities in terms of proportions or units. The participant must be able to think abstractly about food while viewing models of different volumes and dimensions. They must have a developed concept of time to describe food intake in terms of averages, for some dietary recalls (Livingstone & Robson, 2000). Some children will not have the required cognitive and/or technical skills to accurately complete dietary recall evaluation tools (Livingstone & Robson, 2000). Certain methods of delivering dietary recalls have been shown to obtain a more accurate recall from children. The most usual retrieval mechanisms used to remember by children are visual imagery (appearance of food), usual practice, behavior chaining (association of foods to other food items or activities during the meal or day), and preference (Domel, Baranowski, Davis, Leonard, Riley, & Baranowski, 1994). Therefore, when delivering a food recall, prompts should be included to aid in accurate memory retrieval. Food recall errors are less likely to occur if children are encouraged to reconstruct the context

in which the food is eaten, and the information is used to cue what was eaten (Livingstone & Robson, 2000). A review of the literature suggests that children over eight years can reliably recall foods eaten in the recent past if the time period did not contain irregular events or eating patterns (Livingstone & Robson, 2000).

A comprehensive review by Contento et al. (2002) examined the effectiveness of various nutrition education evaluation measures used in different populations (Contento, et al., 2002). The review suggests that where interventions are longer, more comprehensive and a large number of participants are involved (such as those directed at school children), 24-hour recalls are the best tool to assess food intake (Contento et al., 2002). Compared to school lunch observation in fourth-graders, Baranowski (2002a) found that the 24-hour food recalls produced a 59% match (food reported was actually consumed), with 17% intrusion (food reported that was not consumed) and 24% omission (food that was consumed was not reported) (Baranowski, Islam, Baranowski, Cullen, Myres, Marsh, et al., 2002a). While 24-hour food recalls are not very dependent on long-term memory and subjective judgment, large variability in day-to-day food intake can limit their ability to capture usual food intake (Patterson, Kristal, Tinker, Carter, Bolton, & Agurs-Collins, 1999; Buzzard, Faucett, Jeffery, McBane, McGovern, Baxter, et al., 1996). This problem can be overcome by food frequency questionnaires (FFQ). FFQ have become especially desirable to use in evaluation, because they can be self-administered and processed rapidly at a low cost.

Research on the validity and reliability of FFQ in children is limited. Kaskouen et al. (1994) found that FFQ application in children aged four to seven resulted in a 53% overestimation of energy intake (Kaskouen, Johnson, & Goran, 1994). Although not as accurate as 24-hour food recalls, FFQ provide a reliable estimate to compare intakes within a

study between baseline and follow up measurements (Contento et al., 2002). Domel et al. (1994) demonstrated that grades four and five students produce acceptable reliability in completing food records as well as weekly and monthly FV FFQs (Domel et al., 1994). However, the FFQs were not valid, due to significant over-reporting (Domel et al., 1994). The authors again concluded that food recalls are preferred over FFQ when attempting to measure FV intake in grades four and five students (Domel et al., 1994). Other similar studies have also found that FFQ are not valid tools to use in elementary school children, due to over-reporting (Baranowski, Smith, Baranowski, Wang, Doyle, Lin, et al., 1997; Crawford, Obarzanek, Morrison, & Sabry, 1994). Thomson et al. (2003) determined that both the FFQ and 24-hour recalls have large coefficients of variation, therefore it is best to use more than one method to assess dietary intake (Thomson, Giuliano, Rock, Ritenbaugh, Flatt, Faerber, et al., 2003).

In Contento's (2002) review, the majority of studies in school-aged children reported establishing content validity of their FFQ. Content validity determines the extent to which items in an instrument are representative of the subject being measured (i.e. if we are measuring typical dietary intake, do the items on our FFQ represent what is typical?). Face validity is an aspect of content validity and refers to having a panel of experts or potential users review an instrument after it has been developed to decide if it measures what it is intended to measure. Many studies reported establishing face validity through use of a panel of experts to review the instruments. In studies with school-aged children, about 90% specifically reported establishing content or face validity (Contento et al., 2002).

Conclusion

Taking into account the need for school nutrition programs in Canada, as defined by the Canada-wide effort "Nutrition for Health: An Agenda for Action," characteristics of successful nutrition programs were discussed in this literature review. The 5-TODAY program, which was implemented in ten Vancouver and area elementary schools, attempted to utilize some of these best practices. However, the program has not been evaluated.

While some FV promotion studies have produced no change in FV consumption, others have shown that it is possible to increase elementary school students' FV intake via nutrition education. Review of tools used to evaluate nutrition interventions in children suggest that 24-hour recalls may be the best tool to assess changes in dietary intake, yet it is important to use more than one tool. For this reason, we have used both a 24-hour food recall and FFQ to assess changes in the students' FV intake. Also, changes in variables used in health behaviour theory is another important area to measure, as changes in these variables may determine if a behaviour change is made. For this reason, we are also used a survey to measure changes in students' knowledge, attitudes and perceptions towards FVs.

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Chapter Two: Effectiveness of the 5-TODAY Program at Increasing Fruit and Vegetable Consumption in Grade Five and Six Children.

Introduction

Fruit and vegetables (FVs) can aid in preventing chronic diseases (WHO, 2003), yet 65% of adults in British Columbia (BC) do not meet the minimum recommended intake of five FVs per day (BC Ministry of Health Services, 2004), as recommended by Canada's Food Guide to Healthy Eating (CFGHE) (Health Canada, 1997). Although little data on Canadian children's intake of FVs exist, American data suggest that most children are also falling short (Krebs-Smith et al., 1996). This is problematic, as low FV intake in school-aged children can be an indicator for low FV intake later in life (Krebs-Smith et al., 1995), and early antecedents of some chronic diseases begin to develop in youth (Strong & McGill, 1962).

The 5-TODAY program ran in grade five and six classes in conjunction with the Action Schools! BC (AS! BC) provincial pilot project, which evaluated the AS! BC physical activity model to promote healthy living (Naylor, in press). Evaluation outcomes of the AS! BC pilot project included physical activity, healthy weight, healthy heart, healthy self and healthy eating. The 5-TODAY program was developed to meet the healthy eating requirement of the AS! BC pilot project.

Healthy eating has a broad scope and past studies have found that nutrition interventions are most successful when they have a single targeted message (American School Health Association, 1997; Perry et al., 1998b). Thus, one simple and positive message was chosen as the 5-TODAY target: increased FV consumption. The 5-TODAY program (Appendix A) was developed based on some best practices observed from other school nutrition interventions. These include clear, simple messages focused on changing a specific behaviour, easily accessible

materials, a curriculum that maximizes skill building through fun and interactive activities, personalized methods to disseminate interventions to the teachers, and reduced amount of time needed to prepare for teaching the program (Dufresne & Levy Milne, 2001; Perez-Rodrigo & Aranceta, 2003).

Specific objectives of the 5-TODAY pilot evaluation included:

- 1) To determine the students' FV intake and measure changes in intake during the duration of the 5-TODAY program.
- 2) To measure changes in the students' knowledge, attitudes and perceptions regarding FVs during the duration of the 5-TODAY program.
- 3) To identify ways in which teachers who implement the 5-TODAY program believe it can be improved.

Methods

Participants

Ten Vancouver and area elementary schools participated in the AS! BC evaluation. They were randomly assigned to one of three groups by the AS! BC research team. The three groups consisted of liaison, champion and control schools. Four liaison schools were provided with an AS! BC facilitator and all resources to administer the AS! BC programs. Three champion schools were provided with AS! BC resources and basic training, and a designated 'champion' from within the school organized the program implementation. Three "usual practice" schools continued with their regular program of health and physical activity, to serve as a control group.

A total of 515 students, out of approximately 1200 grade five and six students, were given parental consent to participate in the AS! BC pilot project. When the 5-TODAY pilot evaluation began in September 2003, surveys were implemented with 180 of these students (approximately 60 students in each of the liaison, champion and control levels). The sample size of 180 was determined to be the greatest number of participants that would be possible to survey using all three survey tools, given the amount of time available with the students, and the amount of staff available to conduct the surveys. My final sample size included 133 students (44 liaison, 41 champion, 48 control). Using this N, and a significance level of 0.05, the study was powered for a medium effect size of 0.25 and a power of 0.7. This effect size was used, as a smaller effect size likely would not have a great amount of physiological impact and the magnitude of effect reported in a review of school-based FV interventions was approximately 0.5 servings of FV per day (National Public Health Partnership, 2002).

The sample used to meet objective three of this study, consisted of 37 teachers from intervention schools who had implemented the 5-TODAY program in their classroom. Nineteen teachers from the liaison schools participated, and 18 teachers from the champion schools

participated in the focus groups. Seven focus groups were conducted, each made up of three to eight teachers.

Ethics approval for this project was obtained from the University of British Columbia Clinical and Behavioural Sciences Research Ethics Board, The Vancouver Hospital Ethics Board and the Richmond and Vancouver school districts.

Intervention

Teachers in intervention schools were presented with the 5-TODAY program in September 2003, which included four FV promotion lesson plans (Appendix A). Each lesson plan was designed to take approximately 45 minutes to teach. Teachers were instructed to implement at least two lessons throughout the school year. Teachers were able to use the lesson plans provided, or integrate their own ideas to promote FVs in a particular course curriculum (i.e. art or French). Once the class completed the lesson plans, they conducted the '5-TODAY Challenge', which involved students' learning about portion sizing and then recording their FV intake for one week. The 5-TODAY resources also included optional ideas to promote FV through school environment, family and community, extra-curricular activities, and school spirit. Upon request, the teachers were able to receive an in-service on the 5-TODAY program conducted by the researcher. Two schools took advantage of this instruction (a liaison school and a champion school).

Each teacher from the liaison and champion schools kept a weekly AS! BC activity log. In addition to recording physical activities performed, teachers also recorded the class time devoted to the 5-TODAY Program. Most teachers did not record which particular 5-TODAY lesson plan they used, but some teachers recorded alternative ideas that they used to promote FVs in their classroom. These included daily lunch checks for FVs and activities planned to

coincide with special holidays (i.e. discussion of healthy foods that can be made with pumpkin, while pumpkin carving for Halloween). Total number of lesson plans implemented, and which particular lesson plans were implemented by each teacher were not recorded.

Survey Tools

To evaluate the effectiveness of the 5-TODAY program on changing FV intake, a 24-hour food recall and Food Frequency Questionnaire (FFQ) (Appendix B) were used. It is common for FFQs to over-report actual intake, and for 24-hour recalls to under-report intake (Domel et al., 1994; Baranowski, et al. 2002). Research shows that since methods of determining food intake in children are not very accurate, it is best to include more than one tool to most accurately assess food intake (Thomson et al., 2003). A Knowledge, Attitudes & Perceptions (KAP) survey was also used, to measure psychosocial variables that may predict FV behaviour change, such as preferences, knowledge, and influence of others (Appendix C).

The KAP survey was adapted from the “Knowledge Attitudes Behaviour Survey,” used by the Alberta Cancer Board in 1999 to telephone survey over 2000 Albertans aged 18 to 45 (Alberta Cancer Board, 1999). The Knowledge Attitudes Behaviour Survey uses a likert scale from zero to 10 to classify responses. We modified the tool to use a likert scale of “agree,” “in the middle,” “disagree,” or “don’t know,” so that it would be easier for the students in our sample to respond. Our survey incorporates questions regarding knowledge, perception of intake of FVs, influences of others, and preferences.

The FFQ consisted of questions adapted from the US National Cancer Institute’s (NCI) “National Institutes of Health: Eating at America’s Table Study Quick Food Scan” (NCI, 2000). In completing the FFQs, participants were asked about their normal weekly intake of FV, broken into morning, afternoon and evening time periods. The original NCI FFQ asked for monthly FV

intake, and serving sizes of FVs. Our FFQ asks the students for weekly intake, and did not include serving sizes, due to lack of time available with students.

Testing of Survey Tools.

To determine if the adapted FFQ and KAP surveys were appropriate for students in grade five and six, data regarding the clarity of questions on the survey was obtained. This data collection effort focused on determining if children of this age group understood the vocabulary and instructions, and if they interpreted the questions as the researcher intended. The sample used to measure the content validity of the FFQ and KAP survey included 17 students - approximately 10% of the students in which the surveys were implemented. These students were involved in the AS! BC program evaluation, but had not been included in the 5-TODAY program evaluation, therefore they had not seen the nutrition surveys before the content validity data collection.

Students were asked all questions orally, one-on-one with the researcher, as if completing the surveys. Participants were asked to define specific words that were judged by the researcher to be more difficult. At completion of the survey, students were asked if they understood all questions and words used in the survey, as well as the rating scales (i.e. agree, in the middle, disagree). Students' answers to questions about the surveys were recorded. Each survey was later reviewed for comments and answers indicating whether the student correctly interpreted and understood the questions.

All participating students stated that they understood all of the questions, words, and response scales used in the FFQ. They also understood the KAP survey response scales and were able to successfully define 'heart disease' and 'prevent'. However, some students had difficulty defining 'serving size'. Answers included: "How many," "Plate full," "Something you eat at one

time,” “Whole apple,” “Not sure,” “A meal,” “Helpings,” and “A certain amount of food”.

Future use of the KAP survey would require alteration of this term.

Survey Administration

The type of research design used was a repeated measures control group design. The 24-hour food recall, FFQ and KAP surveys were administered in the schools at baseline (September 2003), as well as during (January 2004) and after (June 2004) 5-TODAY implementation.

Approximately 15 children were brought into the survey room (empty classroom) at a time, and had 45 minutes in total to complete both the AS! BC, and the 5-TODAY surveys. One survey administered by the AS! BC evaluation team was called the Physical Activity Questionnaire for Children (Crocker et al, 1997). This questionnaire assesses general physical activity to obtain a score out of 5 (low activity = 1, high activity = 5) for each student. The AS! BC team also recorded each student's height and weight at this time.

All 5-TODAY surveys were administered orally to students on a one-on-one basis by the researcher (dietitian) or a survey assistant (dietetic student), and took approximately 15 - 20 minutes to complete. Each assistant was trained by the researcher in how to administer the surveys, particularly the 24-hour food recalls (Appendix E). The children were asked to recall all of the foods they had eaten on the previous day, beginning with the first thing they had to eat or drink after waking. The surveyors probed for details of the food such as the brand, cooking method, percentage fat for dairy products, etc. To estimate amounts consumed, each survey assistant was equipped with tools including measuring cups, measuring spoons, a deck of cards, ruler, some empty food containers and 1/2 cup portion food model. Although the primary focus of this research was FV intake, all foods were important to collect from the 24-hour food recall.

This is because dietary intake of various nutrients was required for other AS! BC evaluation outcome studies (i.e. calcium intake for bone health and fat intake for heart health).

Methodology for the 24-hour food recall was adapted from the "Sample Protocol for Completing the 24-hour Recall" as described in the Manual of Clinical Dietetics (American Dietetic Association & Dietitians of Canada, 2000). This method of dietary recall was chosen in part due to limited amount of time available to survey each student. The US Department of Agriculture has developed a multiple pass method of 24-hour food recall collection, which takes approximately 20 - 30 minutes to complete (Johnson, 2002). This method requires five "passes," or reviews of the food recall, which was not possible during our study due to time constraints. Depending on the individual child's memory and cooperation, the food recalls were completed in approximately 10 - 15 minutes per student, although more time was taken if the student was having difficulty remembering.

Process evaluation

Seven focus groups were conducted by the AS! BC evaluation team to determine the opinions of the teachers who had implemented AS! BC programs in their classrooms. The moderator was an employee of AS! BC, and an assistant was also present to take notes. Each focus group consisted of questions pertaining to all components of the AS! BC program, and took approximately 45 minutes. To meet objective three of this research project, questions about the 5-TODAY program were included:

- How well did the 5-TODAY Program work in your classroom?
- What did not work well?
- Do you have suggestions for changes?

Data Analysis

Fruit and vegetable intake.

To measure changes in FV intake during the duration of the 5-TODAY program, number of FV servings were determined from the 24-hour food recalls. CFGHE (Appendix E; Health Canada, 1997) and Canadian Nutrient File (Health Canada, 2001) serving sizes were used to hand-calculate the number of servings eaten for each food recall. The FFQ results were scored to convert the frequency responses into average daily number of times FVs were consumed. For each question on the FFQ the frequency response was multiplied by a conversion factor to determine the times consumed per day (Appendix F). The total number of times FV were consumed per day was calculated for each student by adding up the answer to each question. The FFQ did not ask the students about FV serving size, therefore this information could not be directly compared to 24-hour recall results, as one “time” may be more or less than one “serving” size.

Statistical package SPSS, release 11.5 (SPSS Inc, Chicago, IL, USA) was used to conduct statistical analysis. Data on number of servings (24-hour food recall) and frequency of intake (FFQ) were used to assess fruit, vegetable and total FV intake in control, champion and liaison groups. Repeated measures Analysis of Variance (ANOVA) was used to determine whether there were significant effects on intake of group or time, and/or significant group-by-time interactions in the number of FV servings consumed.

Knowledge, attitudes and perceptions.

To measure changes in children’s knowledge, attitudes and perceptions regarding FV as a result of the 5-TODAY program, each question on the KAP survey was summarized using descriptive statistics and frequency distributions. Questions on the KAP survey were given a

score and repeated measures ANOVA was used to determine if there were significant changes in responses attributed to group and/or time. Responses of "Don't Know" were not included in these statistical calculations, as this response did not fit into the ordinal response rank order of the other possible responses ("Agree", "In the middle" and "Disagree"). Chi-squared statistics were applied to the "Don't Know" data separately.

Process evaluation.

Teacher focus groups were tape recorded and transcribed verbatim by AS! BC employees. The 5-TODAY pilot evaluation researcher was given the data pertaining to the 5-TODAY program. This data was organized into common themes: knowledge/attitude changes, behaviour changes, program strengths, program weaknesses and suggestions for improvement. The main messages were summarized to help evaluate the success of the 5-TODAY program and determine its strengths and weaknesses.

Results

Descriptive Characteristics of Participants

Students who completed all three surveys at all three measurement periods were included in analyses. The sample size for September included 180 students, which decreased to a total of 133 participants by June. Sample numbers decreased due to students moving away, being absent on data collection days, being uncooperative in survey completion, or unable to remember what they had eaten the previous day. The background information gathered about these participants includes age, gender, and ethnicity (Table 2-1). For the final sample of 133 students, the average age at baseline was 10.8 years (std dev = 0.6), 43% were male and 57% were female. The majority of the sample (60%) consisted of Asian students, 30% were Caucasian and 10% were of a different ethnicity. Chi-Square revealed there was no significant difference among intervention groups when comparing gender and ethnicity, and one-way ANOVA revealed no significant differences when comparing age.

Table 2-1. Background Data for the 5-TODAY Evaluation Sample.

	Liaison ¹	Champion ¹	Control ¹
Number	44	41	48
Gender: Male n (%)	18 (41%)	15 (37%)	24 (50%)
Female n (%)	26 (59%)	26 (63%)	24 (50%)
Age (years) mean +/- (std dev)	10.8 (0.5)	10.9 (0.6)	10.8 (0.6)
Ethnicity: Asian n (%)	23 (52%)	30 (73%)	27 (56%)
Caucasian n (%)	18 (41%)	6 (15%)	16 (33%)
Other n (%)	3 (7%)	5 (12%)	5 (11%)

Note. N =133.

¹ Liaison schools received the 5-TODAY program, and assistance to implement the programs. Champion schools received the 5-TODAY program, with the assistance of a leader within the school community to implement the programs. Control schools did not receive the 5-TODAY program.

Chi-Square revealed there was no significant difference among groups when comparing gender ($X^2(2, N=133)=2.33$ $p=0.31$) or ethnicity ($X^2(4, N=133)=7.37$, $p=0.12$). ANOVA revealed there was no significant difference among groups when comparing age ($F(2, 128)=0.66$, $p=0.52$).

Descriptive data of the students who completed the 5-TODAY surveys are presented in Table 2-2, including height, weight, body mass index (BMI), and physical activity score (out of five). Repeated measures ANOVA analysis revealed no significant differences among the liaison, champion and control groups when comparing height, weight, BMI, and physical activity score.

Table 2-2. Descriptive Data for Each Group of the 5-TODAY Evaluation Sample at Each Measurement Period.

Variable	Group	September '03	January '04	June '04
Height (cm) ¹	Liaison	144.3 (7.8)	146.2 (7.9)	148.5 (8.4)
	Champion	146.8 (7.9)	149.1 (7.8)	150.7 (7.8)
	Control	145.1 (6.9)	147.4 (7.2)	149.1 (7.4)
	Average	145.4 (7.5)	147.3 (7.6)	149.1 (7.8)
Weight (kg) ²	Liaison	37.0 (6.3)	39.5 (8.0)	41.0 (8.3)
	Champion	41.2 (11.3)	42.1 (11.3)	43.1 (11.3)
	Control	41.9 (10.4)	43.5 (10.1)	45.0 (10.1)
	Average	40.6 (10.3)	42.6 (10.8)	44.0 (10.9)
Body Mass Index (BMI, kg/m ²) ³	Liaison	18.1 (2.4)	18.3 (2.6)	18.5 (2.7)
	Champion	18.5 (3.4)	18.6 (3.3)	18.7 (3.3)
	Control	19.8 (4.1)	19.9 (3.7)	20.1 (3.7)
	Average	19.1 (3.7)	19.4 (3.8)	19.6 (3.8)
Physical Activity Score (/5) ⁴	Liaison	2.6 (0.5)	2.4 (0.5)	2.5 (0.5)
	Champion	2.7 (0.4)	2.6 (0.5)	2.8 (0.4)
	Control	2.7 (0.5)	2.5 (0.5)	2.8 (0.5)
	Average	2.7 (0.5)	2.5 (0.5)	2.7 (0.5)

Note. Values are mean +/- (standard deviation). N=133; n=44 for liaison; n=41 for champion; n=48 for control.

¹ Repeated measures ANOVA for height revealed there was a significant effect of time ($F(1.60, 203.34)=6.06, p=0.01$), and no significant effect of group ($F(2, 127)=1.26, p=0.29$), or group by time interaction ($F(3.20, 203.34)=2.12, p=0.09$).

² Repeated measures ANOVA for weight revealed there was a significant effect of time ($F(1.50, 159.07)=125.68, p=0.001$), and no significant effect of group ($F(2, 106)=2.78, p=0.07$), or group by time interaction ($F(3.00, 159.07)=1.07, p=0.36$).

³ Repeated measures ANOVA for BMI revealed there was a significant effect of time ($F(1.56, 164.13)=5.85, p=0.01$), and no significant effect of group ($F(2, 105)=2.99, p=0.06$), or group by time interaction ($F(4, 164.13)=0.27, p=0.85$).

⁴ Repeated measures ANOVA for physical activity score revealed there was a significant effect of time ($F(2, 254)=10.20, p=0.001$) with a quadratic shape. Group by time interaction also produced a significant effect ($F(4, 254)=2.87, p=0.02$). There was no significant effect of group ($F(2, 127)=2.70, p=0.07$).

Fruit and Vegetable Intake

Fruit and vegetable intake did not differ by gender or ethnicity, nor were there associations detected between FV intake and age ($r=0.06$, $p=0.48$), BMI ($r=0.10$, $p=0.27$) or physical activity score ($r=0.13$, $p=0.12$).

Table 2-3. Average Fruit and Vegetable Intake in Different Gender and Ethnicities as reported from the 24-hour Food Recall.

	Number	Mean (std dev)
Gender		
Male	57	3.25 (1.82)
Female	76	3.66 (1.80)
Ethnicity		
Asian	80	3.49 (1.85)
Caucasian	40	3.39 (1.85))
Other	13	3.72 (1.60)

Note. $N=133$. T statistics revealed no significant difference in fruit and vegetable intake between sexes ($t(131)=1.30$, $p=0.20$) or among different ethnicities ($F(2, 130)=0.16$, $p=0.85$)

Table 2-4 shows average fruit, vegetable and combined FV intake in liaison, champion and control groups at all three measurement periods. None of the groups were successful in meeting the minimum recommendation of five servings of FV per day at any measurement period (mean September = 3.55, January = 3.39, June = 3.52). Average fruit intake was significantly higher than vegetable intake ($t(132)=18.40$, $p=0.001$).

When looking at fruit intake and combined FV intake, repeated measures ANOVA revealed no significant effects of time, group, or time by group interaction. For average vegetable intake, repeated measures ANOVA revealed a significant effect for group ($p<.05$), but no significant effects for time or group by time interaction. Post hoc Tukey HSD tests show that the liaison group had significantly higher vegetable intake than the champion group (mean difference = 0.57, $p=0.02$).

Table 2-4. Daily Fruit and Vegetable Intake as Assessed by 24-hour Recalls and Based on Canada's Food Guide to Healthy Eating Serving Sizes.

Group	September	January	June	TOTAL ¹
Liaison				
Fruit	2.23 (2.01)	1.60 (1.62)	1.98 (1.72)	1.94 (1.78)
Vegetable	2.08 (1.63)	1.85 (1.69)	1.58 (1.30)	1.84 (1.54) ^a
Fruit & Vegetable	4.31 (2.73)	3.46 (2.20)	3.56 (2.00)	3.78 (2.31)
Champion				
Fruit	1.67 (1.73)	2.12 (1.99)	1.92 (1.61)	1.90 (1.78)
Vegetable	1.66 (1.70)	1.00 (0.97)	1.16 (1.48)	1.27 (1.38) ^b
Fruit & Vegetable	3.33 (2.20)	3.12 (2.24)	3.07 (2.13)	3.17 (2.19)
Control				
Fruit	1.51 (1.57)	2.04 (3.03)	2.10 (2.51)	1.89 (2.37)
Vegetable	1.53 (1.24)	1.51 (1.49)	1.77 (1.58)	1.60 (1.44) ^{ab}
Fruit & Vegetable	3.04 (2.20)	3.55 (3.56)	3.88 (3.09)	3.49 (2.95)
ALL				
Fruit ²	1.80 (1.79)	1.92 (2.32)	2.00 (2.00)	1.91 (1.44)
Vegetable ³	1.75 (1.53)	1.47 (1.46)	1.52 (1.47)	1.57 (0.96)
Fruit & Vegetable ⁴	3.55 (2.49)	3.39 (2.84)	3.52 (2.49)	3.49 (1.82)

Note. Values are mean +/- (standard deviation). N=133; n=44 for liaison; n=41 for champion; n=48 for control.

¹ Means in the same column with different superscripts differ significantly at $p < 0.05$

² For fruit intake, ANOVA revealed no significant effect of time ($F(2, 256)=0.38, p=0.68$), group ($F(2, 128)=0.01, p=0.99$), and no significant group by time interaction ($F(4, 256)=1.55, p=0.19$).

³ For vegetable intake, ANOVA revealed a significant effect of group ($F(2, 128)=3.67, p=0.03$), no significant effect of time ($F(2, 256)=1.90, p=0.15$), and no significant group by time interaction ($F(4, 256)=1.32, p=0.26$).

⁴ For combined fruit and vegetable intake, ANOVA revealed no significant effect of group ($F(2, 128)=1.16, p=0.32$), time ($F(2, 256)=0.23, p=0.80$), and no significant group by time interaction ($F(4, 256)=1.52, p=0.20$).

Figure 2-1 displays the number and percentage of participants who were below, corresponding to, or above CFGHE recommendations for FV intake, averaged over all three data

collection points. An average of the three months shows that in total, 75% of students did not meet the minimum recommended intake of five to 10 servings of FVs per day.

Figure 2-1. Number of Participants Below (<5), Meeting (5-10) and Above (>10) Canada's Food Guide to Healthy Eating Recommendations for Fruit and Vegetable Intake.

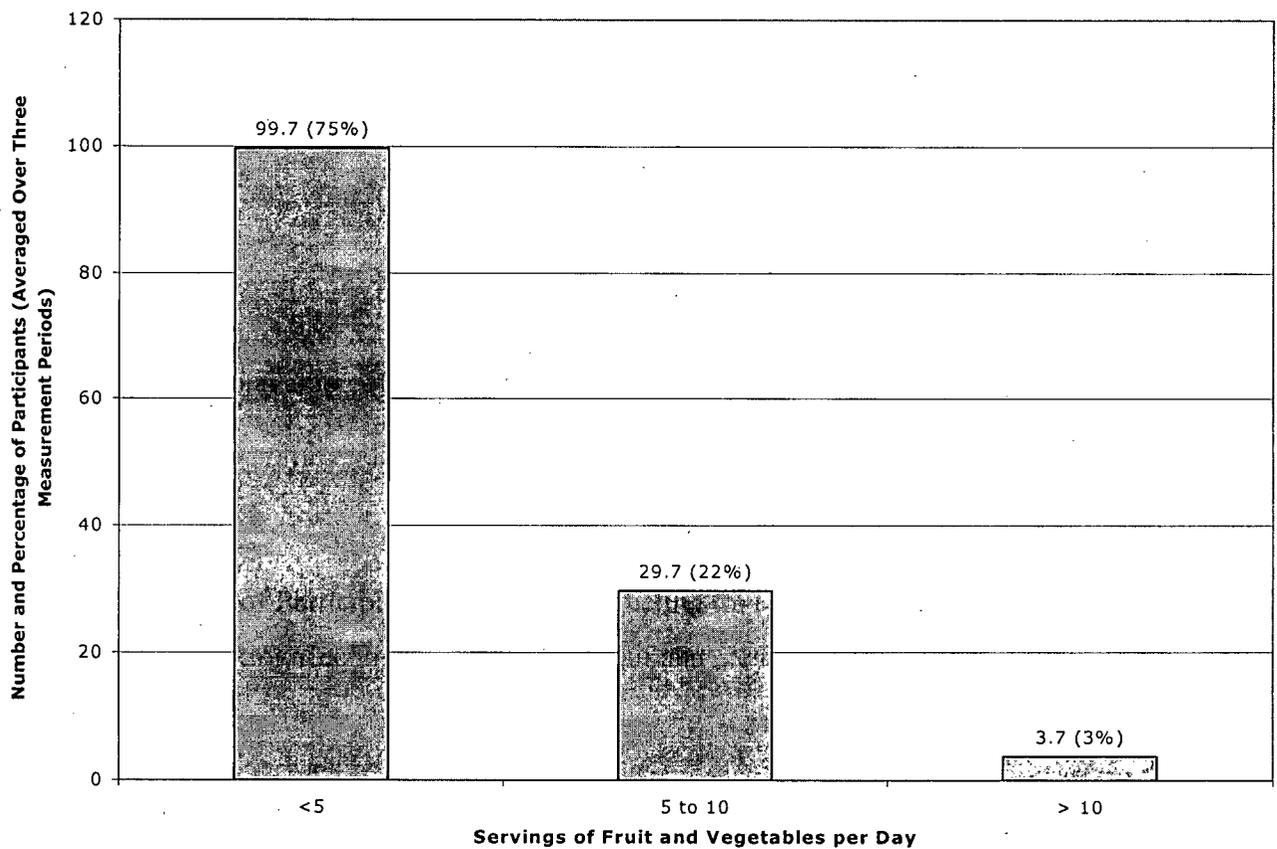


Table 2-5 displays the average number of times FV were consumed per day in each group, as calculated from the FFQs. Repeated measures ANOVA revealed no significant differences during the measurement period. Pearson correlations show that the FFQ and 24-hour recall FV intake were significantly correlated ($r(131) = 0.59, p=0.001$).

Table 2-5. Number of Times Fruit and Vegetables are Consumed per Day as Assessed by Food Frequency Questionnaires.

	September	January	June	TOTAL
Liaison	3.20 (1.15)	3.63 (1.61)	3.31 (1.31)	3.38 (0.99)
Champion	3.16 (1.32)	2.99 (1.18)	2.98 (1.32)	3.04 (0.90)
Control	3.32 (1.34)	3.53 (1.51)	3.10 (1.35)	3.31 (1.06)
ALL	3.23 (1.27)	3.38 (1.43)	3.12 (1.32)	3.18 (0.99)

Note. Values are mean +/- standard deviation. N=133; n=44 for liaison; n=41 for champion; n=48 for control.

Repeated measures ANOVA revealed no significant effect of time ($F(2, 256)=1.91, p=0.15$), group ($F(2, 128)=1.33, p=0.27$), and no significant group by time interaction ($F(4, 256)=1.04, p=0.39$).

Knowledge, Attitudes and Perceptions

The first question on the KAP survey reads: "How many servings of FV do you think you should eat every day to stay healthy?". Table 2-6 displays the average answer to this question for each group at each of the three measurement periods. Repeated measures ANOVA revealed that time, group, and time by group interaction were not significant factors in changing the students' responses. Table 2-6 also displays the percentage of students whose answer to question one fit into the five to 10 servings of FVs recommended by CFGHE. Time significantly increased the number of students whose responses fell within five to 10 servings FV ($p<0.01$). Group by time also produced a significant interaction ($p<0.05$), yet there was no significant effect of group ($p>0.05$).

Table 2-6. Average Answer to Attitudes Survey Question 1¹ and Percentage of Answers that Fell within Canada's Food Guide to Healthy Eating Recommendations.

Group and Time	Average Answer to Question 1 ^{1,2} Mean (std dev)	Percent Who Answered Between 5 and 10 ^{3,4} (%)
Liaison		
September	3.90 (2.67)	12
January	4.29 (2.24)	15
June	5.17 (2.45)	28
Group Average	4.45 (2.45)	18.3
Champion		
September	3.25 (1.63)	9
January	4.03 (1.90)	6
June	4.16 (2.18)	21
Group Average	3.81 (1.90)	12
Control		
September	3.97 (2.59)	12
January	3.62 (1.97)	14
June	3.80 (2.27)	18
Group Average	3.79 (2.28)	14.7
Total		
September	3.71 (2.57)	11.0 ^a
January	3.96 (2.04)	11.7 ^a
June	4.41 (2.38)	22.3 ^b

Note. Values are mean +/- standard deviation. N=133; n=44 for liaison; n=41 for champion; n=48 for control.

¹ Question 1 reads: "How many servings of fruit and vegetables do you think you should eat every day to stay healthy?"

² Repeated measures ANOVA revealed no significant effect of time ($F(2, 250)=2.86, p=0.06$), group ($F(2, 125)=2.45, p=0.09$), or group by time interaction ($F(4, 250)=1.78, p=0.13$).

³ Means in the same column with different superscripts differ significantly at $p<0.05$.

⁴ Repeated Measures ANOVA revealed a significant effect of time ($F(1.53, 195.68)=40.86, p=0.001$), and group by time interaction ($F(3.06, 195.68)=4.33, p=0.01$). Group did not produce a significant effect ($F(2, 128)=1.67, p=0.19$).

Question two on the KAP survey reads: "How would you rate the amount of vegetables and fruit you eat now?" and responses were scaled from very high to very low. Percentage of students who responded "very high", "high", "in the middle", "low", and "very low" for question 2 is shown in Table 2-7. Repeated measures ANOVA revealed time produced a significant effect, with a quadratic shape. More students thought that they consumed 'high' or 'very high' amounts of FV in January than in June or September.

Table 2-7. Percentage of Participant Responses in Each Answer Category for Attitudes Survey Question 2.

	Liaison (%)			Champion (%)			Control (%)			TOTAL (%)		
	Sept	Jan	June	Sept	Jan	June	Sept	Jan	June	Sept	Jan	June
Question 2 ¹												
Very high	0.0	2.3	0.0	4.9	7.3	4.9	4.2	6.3	4.2	3.0	5.3	3.0
High	18.2	34.1	25.0	24.4	31.7	31.7	27.1	31.3	29.2	23.3	32.3	28.6
Middle	68.2	54.6	63.6	65.9	51.2	46.3	60.4	56.3	56.3	64.7	54.1	55.6
Low	11.4	4.6	4.6	4.9	7.3	12.2	6.3	6.3	10.4	7.5	6.0	9.0
Very Low	2.3	4.6	6.8	0.0	0.0	4.9	2.3	0.0	0.0	1.5	1.5	3.8

Note. N=133; n=44 for liaison; n=41 for champion; n=48 for control.

¹ Question 2 reads: "How would you rate the amount of vegetables and fruit you eat now?" Repeated Measures ANOVA revealed that time produced a significant effect ($F(2, 254)=3.33$, $p=0.04$). Group did not produce a significant effect ($F(2, 127)=1.44$, $p=0.24$), nor did group by time interaction ($F(4, 254)=0.28$, $p=0.89$).

Table 2-8 shows the percentage of students who answered “Agree”, “In the Middle”, “Disagree” or “Don’t Know” to questions 3a-g on the KAP survey. Repeated measures ANOVA was calculated for each question, excluding the “Don’t Know” responses (Table 2-8). The only significant effect detected was the effect of group for question 3g (“Eating FV makes me feel better”) ($F(2, 105)=3.46, p=0.04$). Chi-square statistics determined that there was no significant difference in the number of “Don’t Know” responses when comparing among times ($X^2(2, N=133)=2.32, p=0.31$). There were also no significant differences in the proportion of “Don’t Know” responses among the three groups in September ($X^2(2, N=133)=2.86, p=0.24$), January ($X^2(2, N=133)=3.99, p=0.14$) and June ($X^2(2, N=133)=0.29, p=0.86$).

Table 2-8. Percentage of Participants Who Responded “Agree,” “In the Middle,” “Disagree,” and “Don’t Know” to Attitudes Survey Questions 3a-g.

Question	Response	Liaison (%)			Champion (%)			Control (%)			TOTAL (%)		
		Sept	Jan	June	Sept	Jan	June	Sept	Jan	June	Sept	Jan	June
¹ 3a – Eating FV could help you prevent cancer	Agree	55.8	63.6	81.8	39.0	56.1	58.5	58.7	62.5	58.3	51.5	61.4	67.2
	Middle	16.3	6.8	11.4	22.0	22.0	19.5	21.7	18.8	20.8	20.0	15.9	16.8
	Disagree	9.3	4.5	2.3	22.0	7.3	4.9	6.5	6.3	6.3	11.5	6.1	5.4
	Don’t Know	18.6	25.0	4.5	17.1	12.2	12.2	13.0	12.5	14.6	17.0	16.7	10.7
² 3b – Eating FV could help you prevent heart disease	Agree	52.3	59.1	77.3	36.6	51.2	53.7	55.3	70.8	66.7	48.5	60.9	66.2
	Middle	15.9	15.9	13.6	31.7	22.0	19.5	25.5	18.8	20.8	24.2	18.8	18.0
	Disagree	6.8	9.1	2.3	22.0	7.3	12.2	2.1	2.1	4.2	9.8	6.0	6.0
	Don’t Know	25.0	15.9	6.8	9.8	19.5	14.6	17.0	8.3	8.3	17.4	14.3	9.8
³ 3c- I like the taste of fruit	Agree	75.0	75.0	81.8	75.6	80.5	87.8	72.9	79.2	83.3	74.4	78.2	84.2
	Middle	22.7	25.0	18.2	22.0	17.1	12.2	18.8	14.6	16.7	21.1	18.8	15.8
	Disagree	2.3	0.0	0.0	0.0	0.0	0.0	4.2	4.2	0.0	2.3	1.5	0.0
	Don’t Know	0.0	0.0	0.0	2.4	2.4	0.0	4.2	2.1	0.0	2.3	1.5	0.0
⁴ 3d – I like the taste of vegetables	Agree	45.5	27.3	38.6	36.6	19.5	24.4	33.3	31.3	35.4	38.3	26.3	33.1
	Middle	38.6	54.5	50.0	51.2	61.0	61.0	50.0	54.2	43.8	46.6	56.4	51.1
	Disagree	15.9	18.2	9.1	9.8	17.1	14.6	12.5	12.5	16.7	12.8	15.8	13.5
	Don’t Know	0.0	0.0	2.3	2.4	2.4	0.0	4.2	2.1	4.2	2.3	1.5	2.3

Question	Response	Liaison (%)			Champion (%)			Control (%)			TOTAL (%)		
		Sept	Jan	June	Sept	Jan	June	Sept	Jan	June	Sept	Jan	June
⁵ 3e – My family eats lots of FV	Agree	54.5	63.6	72.7	75.6	58.5	82.9	79.2	58.3	62.5	69.9	60.2	72.2
	Middle	45.5	29.5	22.7	24.4	41.5	12.2	18.8	41.7	33.3	29.3	37.6	23.3
	Disagree	0.0	2.3	0.0	0.0	0.0	2.4	2.1	0.0	2.1	0.8	0.8	1.5
	Don't Know	0.0	4.5	4.5	0.0	0.0	2.4	0.0	0.0	2.1	0.0	1.5	3.0
⁶ 3f – My friends eat lots of FV	Agree	11.4	13.6	27.3	17.1	19.5	22.0	18.8	8.3	18.8	15.8	13.5	22.6
	Middle	34.1	25.0	25.0	39.0	46.3	39.0	39.6	41.7	35.4	37.6	37.6	33.1
	Disagree	4.5	11.4	2.3	9.8	12.2	12.2	10.4	6.3	6.3	8.3	9.8	6.8
	Don't Know	50.0	50.0	45.5	34.1	22.0	26.8	31.3	43.8	39.6	38.3	39.1	37.6
⁷ 3g – Eating FV makes me feel better	Agree	50.0	29.5	45.5	43.9	46.3	57.5	29.2	31.3	31.1	40.6	35.3	42.9
	Middle	31.8	56.8	38.6	51.2	43.9	32.5	54.2	52.1	58.3	45.9	51.1	43.6
	Disagree	15.9	6.8	9.1	0.0	0.0	7.5	8.3	6.3	6.7	8.3	4.5	7.5
	Don't Know	2.3	6.8	0.0	4.9	9.8	2.5	8.3	10.4	0.0	5.3	9.0	6.0

Note. N=133; n=44 for liaison; n=41 for champion; n=48 for control.

¹ Repeated measures ANOVA revealed time ($F(2, 162)=2.83, p=0.06$), group ($F(2, 81)=2.13, p=0.13$) and group by time interaction ($F(4, 162)=0.96, p=0.43$) did not produce significant effects for question 3a.

² Repeated measures ANOVA revealed time ($F(2, 166)=2.68, p=0.07$), group ($F(2, 83)=2.62, p=0.08$), and group by time interaction ($F(4, 166)=1.15, p=0.34$) did not produce significant effects for question 3b.

³ Repeated measures ANOVA revealed time ($F(2, 246)=2.06, p=0.13$), group ($F(2, 123)=0.47, p=0.63$), and group by time interaction ($F(4, 246)=0.04, p=1.00$) did not produce significant effects for question 3c.

⁴ Repeated measures ANOVA revealed time ($F(2, 240)=2.74, p=0.07$), group ($F(2, 120)=0.57, p=0.57$), and group by time interaction ($F(4, 240)=1.08, p=0.37$) did not produce significant effects for question 3d.

⁵ Repeated measures ANOVA revealed time ($F(2, 246)=2.33, p=0.10$), group ($F(2, 123)=0.83, p=0.44$), and group by time interaction ($F(4, 246)=2.18, p=0.07$) did not produce significant effects for question 3e.

⁶ Repeated measures ANOVA revealed time ($F(2, 68)=0.63, p=0.54$), group ($F(2, 34)=0.12, p=0.89$), and group by time interaction ($F(4, 68)=0.55, p=0.70$) did not produce significant effects for question 3f.

⁷ Repeated measures ANOVA revealed time ($F(2, 210)=0.05, p=0.96$) and group by time interaction ($F(4, 210)=0.78, p=0.59$) did not produce significant effects for question 3g. Group ($F(2, 105)=3.46, p=0.04$) did produce a significant effect; post hoc Tukey tests show the champion group was significantly greater than the control group (mean difference = 0.23).

Process Evaluation

Teachers seemed to agree that FV promotion is an area of education that is required in the classroom *"It is really worthwhile....I think nutrition was an important part of this program [AS! BC]"*. However, few of them had the time to implement more than the minimum requirements of two lesson plans and the 5-TODAY Challenge.

Knowledge/attitude changes.

The main theme discussed was an increased awareness of the importance of FVs. The students were also made aware of how many FVs they were eating: *"Once they were able to track what they ate, they were kind of shocked to find out that they only had one or two vegetables or fruit for that day"*. The teachers and schools also became more conscious of good nutrition: *"I think it has made us aware sort of as a staff and as a school, in terms of here is what we are promoting on this end [in the classroom], so what are we promoting on this other end too [in the school environment]"*. A teacher mentioned that the students learned of many FVs that they had never heard of before.

Behaviour changes.

Some teachers felt that while there was an increase in knowledge, no behaviour change was seen. They thought the program was not given enough time in the classroom to promote behaviour change: *"If I give a test, I am sure that they would be able to give me back the information, but when it comes to actually changing their eating habits, I think that is another step which probably takes more time"*. Other teachers noticed

temporary change: *"I noticed better snacks for a good long time, but it has kind of gone back"*.

Others noticed positive behaviour changes, and not just in the students: *"I am noticing kids bringing vegetables and fruits now for snack. When I pack my own lunch, believe it or not, I am looking at fruits and vegetables now"*. Even some parents were becoming motivated to provide their children with better nutrition: *"even the parents have been talking about trying maybe having hot lunches.... We are looking at sushi and other alternatives..."*. One teacher suggested that the program also caused behavioural changes at home for the students: *"At the PAC [parent advisory council] meeting some of these parents have kids in these classes and they said that kids are asking at the grocery store for certain fruits"*.

Program strengths.

Four teachers mentioned that they appreciated that the 5-TODAY program integrated curriculum into learning about FVs: *"It worked really well because that was the material that we used as part of our science unit"*. Other positive comments included flexible, well laid out and clear lesson plans that were easy to use.

Program weaknesses.

While all teachers seemed to agree that the content of promoting good nutrition through increased FVs was important, some thought the lesson plans could be improved. Comments included the 5-TODAY program was too repetitive, not very user friendly and

too complicated for elementary students. The 5-TODAY Challenge caused some confusion for the children recording FVs, especially related to portion sizing.

Suggestions for improvement.

Suggestions included adding more visuals and a vocabulary section, more lesson plans and longer lessons. One reoccurring suggestion was that two lesson plans throughout the year was not enough *“I don't know if the kids got a whole lot out of it because it was just two days. You know if it was even...short lessons and you did it maybe once a week for a month, I think they would get it, and then maybe a follow up”*. Another suggestion was that this should be taught at a younger age: *“I really think the younger you are, the better off it is for you. So I think grade three is a good grade to start”*.

Discussion

Fruit and Vegetable Intake

In the 5-TODAY evaluation sample, average FV intake did not increase during the program implementation period, according to the 24-hour food recall and FFQs. A review article of published studies targeting increased FV consumption in a school-based setting, found that most studies showed either no effect or an increase of 0.2 - 0.75 servings per day (National Public Health Department, 2000). These figures correspond with our findings, as there were no significant changes in FV intake during the duration of the 5-TODAY program.

One probable reason why FV intake did not increase during the duration of the 5-TODAY program is because the intervention consisted of only two mandatory lesson plans and the 5-TODAY Challenge. While other ideas to promote FV through the school environment and community were included in the 5-TODAY resources, most teachers did not have time to implement these activities, and chose to complete the minimum requirements. Foerster's (1998) 5-A-Day Power Play intervention revealed that teacher-implemented classroom interventions without other components can increase FV intake (by 0.2 servings). However, the intervention consisted of 14 lesson plans. Foerster (1998) also determined that a community intervention (media, grocery store and farmers market involvement) in addition to the classroom intervention increased FVs by 0.4 servings per day; double that of classroom intervention alone. Environmental-only interventions within the school (increased availability and promotion in the cafeteria) have also been shown to increase FV intake by 0.14 - 0.17 servings per day (Perry et al., 2004).

However, the same author conducted a multi-component intervention (classroom intervention and parent/child take home activities in addition to environmental intervention), which was more successful in increasing FV intake (0.6 servings per day) (Perry, 1998a).

With only two lessons plans and no other mandatory intervention, it is understandable why the 5-TODAY program did not increase FV intake. As supported by successful nutrition intervention literature, teachers in the focus groups suggested that more lesson plans are required to change student behaviour. Due to lack of class time available, and the 5-TODAY program being a small component of a larger healthy living intervention, it was not possible to have a larger multi-component intervention in this study.

Another possible reason why the 5-TODAY program was not successful in increasing FV intake in intervention groups is due to the difficulty in changing eating patterns of older children. Liquori's (1998) Cookshop program targeted whole grains and FV consumption, and consisted of 10 classroom lessons, 10 'cookshops' in which the students cooked and ate targeted foods, as well as environmental cafeteria alterations. At the end of the intervention FV intake increased in the age range of kindergarten to grade three, but not in grades four to six students (Liquori et al., 1998). Teacher recommendations from the AS! BC focus groups were again consistent with literature findings, as they suggested starting the 5-TODAY program at a younger age (grade three).

Both the 24-hour food recall and FFQ revealed that the students' intake of FV was below the recommended minimum intake of FV, at all measurement periods. The average

of 3.49 serving of FV per day from the 24-hour food recall shows that the students are about 1.5 servings short of meeting CFGHE recommendation of five to 10 servings. Our figures are similar to the 3.6 servings of FV American children have been found to eat daily (Krebs-Smith et al., 1996). Low FV intake may negatively affect the students' long-term risk of diseases such as cancer (Glade, 1999; Steinmetz & Potter, 1996) and cardiovascular disease (Joshi-pura et al., 1999; Joshi-pura et al., 2001), as well as impact their present nutrient status.

When averaged over the three data collection periods, 75% of the 5-TODAY evaluation sample did not meet minimum CFGHE recommendations for FV. This suggests that the percentage of children who do not eat at least five servings of FV per day in BC is greater than the 64.6% of adults in this province not meeting FV recommendations (BC Ministry and Health Services, 2004). This is a concern, as intake of FV in childhood can predict FV intake in adulthood (Krebs-Smith et al., 1995). Therefore it is important to continue to target FV promotion interventions at children, to improve their life-long eating patterns.

Knowledge, Attitudes & Perceptions

Teachers who participated in focus groups agreed that at minimum, awareness of FVs was increased in students, as well as school staff and some parents. Repeated measures ANOVA results from the KAP survey revealed that time was a significant factor in influencing the number of students who correctly responded that they should eat between five and 10 servings of FV daily. Overall, 11% of student responses to this

question fell within these CFGHE recommendations in September, compared to 22.3% in June.

For questions 3a-g, the only significant change during the duration of the 5-TODAY program was a group factor for question 3g (“Eating FV makes me feel better”). More students in the champion group agreed with this statement than the control group. Although there was a decreasing trend in the number of participants who answered “Don’t Know” to questions 3a-g, this difference was not significant. Thus from these results, the 5-TODAY program did not significantly affect the participant’s knowledge, attitudes, and perceptions towards FV. Again, this may be due to the target population age, lack of classroom time dedicated to the program, and lack of other important components to encourage FV promotion throughout the school and community.

Limitations

The 5-TODAY program took place in a real setting, and was taught by teachers in the classroom. While this makes the results more realistic, it also provided some limitations to this research project. Since the teachers determined what was taught and when, there was variability between different classrooms and schools. Another limitation of the study is that 24-hour food recalls and FFQs depend on self-reported food intake, and therefore may not always be accurate. Also, there was a fair amount of attrition in the 5-TODAY evaluation sample, resulting in decreased sample size and power.

Conclusion and Relevance

The 5-TODAY program did not significantly change FV intake, or attitudes towards FV. The 5-TODAY program has potential for use in the future, however

quantitative data and focus group results both determined that it is not intensive enough. Most successful nutrition interventions have consisted of multiple components including classroom education curriculum, environmental interventions, and community components. An increased number of classroom activities, as well as complementary environmental and community components should be added to the 5-TODAY program. The teachers who participated in implementing the intervention provided useful suggestions on how to improve the 5-TODAY program. These included increasing the number and length of lesson plans, which should include more visuals and a vocabulary section, and targeting a younger age group.

One important finding of this research is that the sample population did not consume enough FVs; therefore this is an important nutrition target area. More multi-component FV interventions are required within Canadian schools to improve the nutrition and health of children. These interventions should be evaluated to determine which components and activities are most successful at increasing FV intake in school children.

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Chapter Three: Conclusions and Recommendations

The BC Provincial Health Officer, P.R.W. Kendall (2003), stated that “Schools, because of their access to children and youth, their central role in child and youth development and their responsibility to teach, must figure prominently as partners in local community, provincial and national health promotion efforts.” While this is true, Kendall’s document “An Ounce of Prevention” also recognizes that schools operate in a broader community context, and for health promotion in schools to reach its potential, support is needed from the school environment and community (Kendall, 2003). Past nutrition interventions also support the idea that in addition to classroom education, parental and community involvement, as well as school environment changes produce the most effective outcomes (Reynolds et al, 2000; Perry et al., 1998a).

Recommendations

Given that most successful nutrition interventions consist of multiple components including classroom education curricula, environmental interventions, parent outreach and community involvement, future FV promotion studies should expand on the 5-TODAY program to include mandatory multiple components. To assist the effort of nutrition interventions, comprehensive school nutrition policies should be created to encompass all areas, including classroom education, access and promotion of nutritious meals in the school environment, and parental and community components (Briggs, Safaii, & Beall, 2003). Ongoing evaluation using multiple tools, such as a 24-hour food recall and a psychosocial behaviour survey, should be included to determine the

effectiveness of the programs. Furthermore, evaluation of individual components of nutrition programs should be conducted to determine which components are the most successful at changing nutrition behaviour in children.

Fruit intake in the 5-TODAY sample was significantly higher than vegetable intake. Past studies have also shown that fruit intake is impacted more than vegetable intake during FV interventions (Reynolds et al., 2000; Perry et al., 1998a). Nutrition interventions have shown that it is beneficial to have a single nutrition message, such as increasing FVs as opposed to general healthy eating (Perry et al., 1998b; America School Health Association, 1997). Considering this, future interventions targeting only vegetables may be needed to increase vegetable consumption in school children. This initiative would likely be well received by parents and teachers, as a DC national survey found that the number one desired change in the dietary habits of school children was for them to eat more vegetables (DC & Dairy Farmers of Canada, 2004).

Based on a review of the literature, and the results of this study, future FV promotion interventions in schools should include:

- 1) Classroom education curricula: The most successful FV intervention reviewed used trained staff to implement lesson plans, as opposed to teachers (Reynolds et al., 2000). Another study in which trained teachers implemented the lesson plans, found that only 47% of the planned lessons were actually taught, and there was no increase in FV intake (Baranowski et al., 2000). Often subject areas involving health are seen as nonessential compared to academic core subjects, contributing to the problem of school health being given less teacher support than other areas (Kendall, 2003). For these

reasons, it seems ideal for an outside educator to teach the lesson plans in the classroom. A community nutritionist could be hired for each school division in BC, or nutrition students at local post secondary schools could partner with elementary schools to teach the lesson plans. Thus, the instructor would be well educated on the topic, and the lesson plans more likely to be implemented if class time was set-aside for a guest speaker.

Another method to increase teacher cooperation includes incorporating nutrition classroom curricula with other academic subjects (i.e. math lessons that analyze nutrient intake or reading lessons containing texts on nutrition) (Weis & Kein, 1987). A benefit of using this strategy is that the lessons fit into normal curriculum, without requiring extra class time and increasing teacher burden. For example, in the AS! BC focus groups, many teachers commented that the students really enjoyed the science lesson plan. This lesson consisted of discussion of the life-cycle of FVs, nutrients in FVs, and a chemistry experiment to demonstrate how fruit may brown on exposure to air. This lesson plan did not have to take class time away from another subject, but was able to teach the students about FV during a science class.

The lesson plans also need to be implemented more often than twice during the school year. Other interventions have included 10 - 16 lesson plans, generally 45 minutes in length (Liquori et al., 1998; Perry et al., 1998a). It seems reasonable to have one lesson plan taught per month, for a total of 10 lesson plans throughout the year. Lesson plans should: contain formal evaluation, be culturally relevant and developmentally appropriate, focus on behaviour change, and consider the needs of students, teachers and the school (Perez-Rodrigo & Aranceta, 2003). Students also appreciate fun and

interactive lessons (i.e. science experiments, cooking, etc.) (Dufresne & Levy Milne, 2001).

2) Environmental Interventions: The nutrition messages children learn in the classroom should be supported by the nutrition messages they see surrounding them in the school environment. School nutrition policy should be created to encourage healthy foods in cafeterias, vending machines, at special school events and for fundraisers.

Schools should support nutritionally vulnerable students through healthy meal programs. In cafeterias, the attractiveness of healthy foods, including FVs can often be improved (i.e. adding fruit to cereal instead of serving a plain banana), to encourage the children to choose the healthy option instead of less nutritious competing foods. Nutrition promotion in the school environment can also occur through taste testing and posters, even if the school does not have a cafeteria.

3) Parent Outreach: This component can include an introductory letter to explain the nutrition program and encourage FV promotion at home. Other options include take-home activities and newsletters that involve participation of both parents and students. These can include FV recipes, tips on buying in-season or less expensive produce, coloring sheets, etc. Parent information meetings can be offered with the assistance of community nutritionists.

A school gardening project is another idea to promote interactive involvement of both parents and children. The school garden may work well in a community in which many families do not have access to a garden at home.

4) Community Component: Community involvement in the nutrition program can include partnership with local grocery stores or farmers markets. A community grocery store may be willing to supply schools with free or discounted FVs, so that the students can have increased access, and taste different FVs. The students can also take field trips and tours of a grocery store or farmers market, to learn about how different FVs are grown and sold. Also, the local media can be involved in publicizing the school's healthy nutrition efforts and writing articles to support healthy eating in schools and communities.

Strengths & Limitations

A strength of the 5-TODAY pilot evaluation included the use of three different tools to evaluate the success of the program. A limitation of the 24-hour food recalls and FFQs was that they collected reported food intake as opposed to actual food intake, and therefore may not always have been accurate. Another limitation of the 24-hour food recall procedure was lack of time to conduct a multiple-pass method. A limitation of the FFQ was that portion sizes were not determined. The average FV intake in all groups averaged over all three time periods was 3.49 servings according to the 24-hour food recall and 3.18 times per day according to the FFQs. The 24-hour food recall and FFQ were significantly correlated, indicating that students often consume one serving of FV at one time. Yet, FFQ results could not be compared to 24-hour recall data, as it calculated times FV were consumed per day as opposed to servings per day. While face validity of the FFQ was established, it may be useful in the future to add questions to determine

serving sizes. During validation of the KAP survey, it was discovered that most students did not know the definition of a “serving size”. For future use, the amount of a serving size should be described to the students before they answer the question.

The 5-TODAY program met some best practice criteria for successful school nutrition intervention programs. These include integration of nutrition education with other academic subjects, directly involving students (Weis & Kein, 1987), fun and interactive curriculum and having a specific message versus a broad nutrition message (Dufresne & Levy Milne, 2001). The 5-TODAY program also attempted to use a combination of approaches, by including optional activities to promote FVs throughout the school and community, although teachers did not implement these suggestions. One best practice strategy that was not met by the 5-TODAY program was adequate time and intensity (Perez-Rodrigo, 2003). The program required only two lesson plans taught throughout the school year. Most nutrition interventions include 10 to 15 hours of classroom instruction time (American School Health Association, 1997). Due to the 5-TODAY program being a smaller component of a larger healthy living intervention, and lack of teacher time to implement extra classroom lesson plans, the 5-TODAY program could not have involved more time or intensity.

The 5-TODAY program took place in a real setting, and was taught by teachers in the classroom. While this makes the results more realistic, it also provided some limitations to this research project. The 5-TODAY lesson plans are not concrete, and offer more than one idea to teach about a topic. As well, teachers were free to add in their own ideas, or modify the lesson plans. Since the teachers determined what was taught and

when, there was variability among different classrooms and schools. This made it difficult to assess the effectiveness of the 5-TODAY program.

Conclusions

The 5-TODAY program did not increase FV intake, or improve attitudes towards FV. One important finding of this study is that the sample population did not consume enough FVs; therefore this is an important nutrition area to target. More multi-component FV interventions are required within Canadian schools to improve the nutrition and health of children. In addition to classroom curricula, nutrition programs should target the school environment, and include parents and communities. Future nutrition interventions should be evaluated to determine which components and activities are most successful at increasing FV intake in school children.

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Appendix A: 5-TODAY Program

AS! BC 5-TODAY PILOT PROGRAM

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ACTION SCHOOLS! BC 5-TODAY PILOT PROGRAM INTRODUCTION

VISION

- Healthy eating opportunities are available to all students.
- Students are aware of and participate in the 5-TODAY program.
- Schools, families and communities support the 5-TODAY program.
- Healthy eating and overall well-being goals are achieved and sustained.

5-TODAY PROGRAM GOALS

- Increase fruit and vegetable consumption among school-aged children to decrease the incidence of chronic disease.
- Increase awareness of health implications and the importance of consuming 5 fruit and vegetables a day.
- Expose students to a variety of fruit and vegetables to increase awareness and consumption.

AS! BC PILOT REQUIREMENTS:

There are two requirements for the AS! BC Pilot 5-TODAY Program:

1. Each classroom must “pick two lessons and do two lessons” and
2. Complete the 5-TODAY Challenge.

CLASSROOM LESSONS (Pick 2 do 2)

1. Why Eat Fruit and Vegetables?
2. Science of Fruit and Vegetables
3. Eating Fruit and Vegetables
4. What do we know about Fruit and Vegetables?

Two lessons and the 5-TODAY Challenge must be completed by May 2004.

5-TODAY PROGRAM OUTCOME MEASURES

Continual systematic evaluation of the Action Schools! BC 5-TODAY program will be completed in order to develop a successful and sustainable program that increases the consumption of fruit and vegetables in school-aged children. Quantitative assessment of nutrient intake will be measured by nutritional analysis and food group analysis, which will be completed at the beginning of the pilot program (September 2003) and throughout (i.e. January 2004 and May 2004) to determine changes in fruit and vegetable consumption. Qualitative data obtained through focus groups involving students will also be evaluated to determine if students' awareness of fruit and vegetables has increased and what aspects of the 5-TODAY program facilitated this awareness and/or contributed to an increased consumption of these foods. Teachers will also be invited to participate in focus groups to evaluate aspects of the 5-TODAY program.

5-TODAY in the Action Zones

Action Zone 1: School Environment

Goal Statements

- Increase the availability of fruit and vegetables within the school.
- Support healthy eating habits by providing healthy choices at school.
- Develop and implement policies to educate students and increase participation in the 5-TODAY program.

Action Ideas!

Note: the reference numbers correspond to the list of teaching tools provided in the Resources Section.

- Provide each classroom with fruit and vegetable educational resources.
- Create opportunities for students to purchase fruit and vegetables and make healthier food choices. This could be accomplished by providing healthy choices in the vending machines and having school wide fruit and vegetable days where students can purchase fresh produce (30, 31).
- Provide educational opportunities for staff to develop their knowledge on healthy eating and the 5-TODAY program.
- Have school staff participate in the 5-TODAY program, actively modelling healthy food choices.
- Celebrate successes and provide incentives for staff and students to participate in the 5-TODAY program and healthy eating (1).
- Develop or support fundraising activities to sell healthy foods at school and within the community (30, 31, 32, 33).
- Purchase resources that create opportunities for students to achieve the goal of eating five fruit and vegetables a day (6, 7, 8, 9).
- Allocate resources and funds to increase students' knowledge and participation in healthy eating (5, 6).
- Provide healthy food choices at school events. For example offer 100% fruit juice instead of just pop or provide fresh and dried fruit instead of just chips and chocolate bars (5, 6).
- Stock vending machines with 100% fruit juice and healthy snacks.
- Invite guest speakers to talk about healthy living and healthy eating at school wide assemblies.
- Develop School wide Policies on healthy eating to increase opportunities for students to meet the 5-TODAY challenge goal of eating at least 5 servings of fruit and vegetables a day (31). Develop and implement policies that:
 - Encourage the sale of fresh fruit and vegetables at school.
 - Provide healthy food and beverage choices in the vending machines.
 - Create outdoor garden space for students to grow their own produce.
 - Emphasize healthy eating as an important topic in the curriculum.
 - Offer nutritious foods for all food-related events.
 - Provide nutritional education for all grades.

AS! BC Pilot Requirements:

There are no pilot requirements in this zone, but the list is meant to inspire ideas and actions that are simple and effective to schools and teachers to consider.

Action Zone 3: Classroom Action

Goal Statements

- Educate students about fruit and vegetables in a fun and exciting manner.
- Increase awareness of the 5-TODAY program.
- Expose students to a wide variety of fruit and vegetables.
- Add elements of fruit and vegetables into curricular themes and lessons.
- Increase fruit and vegetable consumption.

Action Ideas!

- Complete 2 of the 5-TODAY Program lessons.
- Complete the 5-TODAY Challenge (1).
- Recognize 5-TODAY participants (1).
- Develop themes that can incorporate fruit, vegetables and healthy eating components (3, 6, 8, 9, 22, 23, 24, 26, 27, 28).
- Educate students on serving sizes of fruit and vegetables (2, 7, 11, 23).
- Introduce students to variety by having them bring in different fruit and vegetables to show and taste.
- Invite guest speakers to come in and educate on fruit and vegetables from a variety of perspectives (i.e., the farm, nutrition, health).
- Ask students to create ideas on how to increase their own consumption of fruit and vegetables at home and at school (6, 10, 11, 21, 22, 24).
- Do fundraising activities in which the class or school sells and promotes fruit and vegetables (30, 31, 32, 33).
- Discuss fruit and vegetables in terms of seasons and when fresh produce is available (27).
- Educate students on the health benefits of eating fruit and vegetables (6, 10, 11, 13, 14, 15, 17, 18).
- Incorporate agriculture, fruit and vegetables, and healthy eating information into classroom curriculum that focuses on the body, health and the environment (6, 9, 10, 11, 15, 16, 17, 18, 26, 27, 20, 23).
- Plan field trips to super markets, orchards and local farms (29).

AS! BC Pilot Requirements:

- "Pick two do two" of the lessons provided within the timeframe from October to May 2004.
- Each classroom must also complete the 5-TODAY Challenge.

Action Zone 4: Family & Community

Goal Statements

- Identify opportunities in the community to aid in educating the students on fruit and vegetables.
- Develop relationships with families and people within the community that can support and assist in promoting the 5-TODAY program.
- Provide resources and information for families to adopt the 5-TODAY program.

Action Ideas!

- Involve families and community organisations in activities and programs that focus on increasing fruit and vegetable consumption of the students and community members (32, 33).
- Organize meetings to inform the community of how the 5-TODAY program fits into the Schools Action Plan.
- Develop partnerships with community members and businesses to create opportunities for students to get practical experience in an environment related to fruit and vegetables. This could include businesses like IGA or Safeway (32,33).
- Start a school or community garden in which families can participate in growing vegetables.
- Provide workshops for parents to learn about the importance of eating fruit and vegetables and tips on healthy eating practices.
- Encourage parents to adopt the 5-TODAY program (5, 11, 12, 13, 19, 20, 22, 23, 24).
- Put on cooking classes at the school or within the community to teach healthy ways to prepare easy, affordable meals including fruit and vegetables.
- Develop a healthy eating club in which students and staff can exchange healthy recipes (19, 20).
- Plan family picnic days or barbecues in which families can bring healthy dishes and promote the 5-TODAY program.
- Develop dinner fundraisers (30, 32, 33).

AS! BC Pilot Requirements:

There are no pilot requirements in this zone, but the list is meant to inspire ideas and actions that are simple and effective to schools and teachers to consider.

Action Zone 5: Extra-Curricular

Goal Statements

- Encourage students to make lifestyle changes towards healthy eating and overall well-being.
- Create activities and programs that stimulate the interest of the students in healthy eating and the 5-TODAY program.
- Create 5-TODAY mentors for younger students.

Action Ideas!

- Have student-run fruit and vegetable stands before and after school and during lunch hour.
- Develop fundraising activities for the students in which they sell fresh BC fruit and vegetables (30, 32, 33).
- Have a garden in which the students can work and participate in growing fruit and vegetables.
- Offer cooking and tasting classes, which focus on healthy meals and snacks, emphasizing fruit and vegetables (19, 20).
- Sell healthy food choices including fruit and vegetables at school events, such as fresh or dried fruit, veggies and dip and granola bars (30, 32, 33).

AS! BC Pilot Requirements:

There are no pilot requirements in this zone, but the list is meant to inspire ideas and actions that are simple and effective to schools and teachers to consider.

Action Zone 6: School Spirit

Goal Statements

- Increase school spirit by promoting healthy living.

- Integrate healthy food choices including fruit and vegetables at school spirit events.

Action Ideas!

- Promote Action Schools! BC 5-TODAY program at school assemblies (1, 32).
- Develop school wide events and challenges based on healthy living and healthy eating (1).
- Sell healthy food items including fruit and vegetables at school events (30, 31, 32, 33).
- Use fundraising money to support healthy living events and activities (30, 32, 33).
- Encourage the school to participate in a school wide 5-TODAY challenge (1).
- Recognize and award 5-TODAY students and classes (1).

AS! BC Pilot Requirements:

There are no pilot requirements in this zone, but the list is meant to inspire ideas and actions that are simple and effective to schools and teachers to consider.

Provides detailed information on Fruit and Vegetables, including nutrient content.

Cost: Free Download.

Contact: http://www.dole5aday.com/ReferenceCenter/R_Home.jsp

16. Mission Nutrition

A, C, E

Lesson plans on healthy eating and active living.

Cost: Free Download.

Contact: www.missionnutrition.ca/english/teachers/eat_resources.asp

17. Health Canada

C, E

Government website linking to the Canadian Food Guide to Healthy Eating.

Cost: Free Download.

Contact: www.hc-sc.gc.ca/nutrition

18. National Institute of Nutrition

C, E

For up to date information regarding nutrition and the health of Canadians.

Cost: Free Download.

Contact: www.nin.ca

19. Recipe and Cooking Tips

C, E

Easy and tasty recipes to increase fruit and vegetable consumption.

Cost: Free Download.

Contact: <http://dccps.nci.nih.gov/5aday/RECIPES.HTML>

20. 5 to 10 a Day Recipes

C, E

Provides 1000's of recipes based on fruit and vegetables for the beginner cook to the expert chef.

Cost: Free Download.

Contact: <http://www.5to10aday.com/eng/search.cfm>

21. Dole 5 A Day – Fun Activities for students

C, E

Interactive webpage that provides information about fruit and vegetables in a fun and exciting manner. Great for students to explore on their own or in groups to learn more about fruit and vegetables. This site provides music and games, easy recipes and a reference center to learn all about a variety of fruit and vegetables.

Cost: Download for free

Contact: http://www.dole5aday.com/Kids/K_Index.jsp

22. Freggie Tales For Parents and Educators

A, C, E

A Canadian site that provides exciting ways to learn about fruit and vegetables – Portion Sizing and Recipes. Freggie and Freggie Tales represents the promotion efforts of the "5 to 10 a day" campaign for elementary aged school children (5 - 12 years old). Freggie and Freggie Tales are designed to provide children with the opportunity to learn about fruit and vegetables in a fun and exciting manner. The take home message being that it is OK to eat and like fruit and vegetables.

Cost: Free Download.

Contact: www.freggietales.com/Default.aspx?DN=1757,1746,Documents

23. Five A Day Educators

A, C, E

Emphasizes the importance of eating five or more servings of colourful, nutrient-rich fruit and vegetables every day. Activities and lessons are tailored for the K-3 and grade 4-6 audiences. An informative teacher's guide corresponds with fun and interactive activities, colouring pages, and take home literature to help students remember to put a rainbow of colour on their plates every day. Provides a curricula and activity sheets for easy and fun learning.

Cost: Free Download.

Contact: http://www.5aday.com/html/educators/educators_home.php#

24. Resources to get your children to eat more vegetables and fruit

C, E

Provides guidelines and tips for parents to teach and influence their children to eat 5 servings of fruit and vegetables a day.

Cost: Free Download

Contact: http://www.dole5aday.com/Grownups/G_Index.jsp

25. The Chemistry of Fruit and Vegetables

A, B, C, E

Demonstrates the effects of different preparation and storage of fruit and vegetables

Cost: Free Download or Hard Copy

Contact: http://www.cfaitc.org/Lesson_Plans/409.html - California Foundation for Agriculture in the Classroom

26. Agricultural Distribution Process

A, B, C, E

Visual map out-lining the process that fruit and vegetables follow from Farm to Consumer.

Cost: Free Download or Hard Copy

Contact: http://www.cfaitc.org/Lesson_Plans/409.html - California Foundation for Agriculture in the Classroom

27. My Life as a Fruit or Vegetable

A, B, C, E

Provides a sequence of lesson plans to educate students on the life cycle of fruit and vegetables and their.

Cost: Free Download or Hard Copy

Contact: http://www.cfaitc.org/Lesson_Plans/409.html - California Foundation for Agriculture in the Classroom

28. Farmers Market Colouring Book

A, B, C, E

Farmers Market Colouring Book put out by the United States Department of Agriculture.

Cost: Free Hardcopy or Download.

Contact: <http://www.fsa.usda.gov/ca/colourA.htm>

29. Questions to ask when on Field Trips

Cost: Free Hardcopy.

Contact: See 5-TODAY Resource Package

Administrative Support

30. Fruit Tuck Shops

B, C, E

Practical guide to planning and running a Tuck Shop in schools.

Cost: Free Hardcopy or Download

Contact: See 5-TODAY Resource Package or Food Standard Agency Wales
http://www.hpw.wales.gov.uk/English/resources/leafletsandposters/fruittuck_e.pdf

31. Nutrition Guidelines for Schools – Policy Development

B, C

Guidelines and examples on how to go about developing and implementing policy changes to increase healthy food choices at school.

Cost: Free Hardcopy or Download or order report for \$11.00

Contact: See 5-TODAY Resource Package or Order Online at SSTA Research Centre Reports, <http://www.ssta.sk.ca/research/students/93-05.htm#why>

32. Fundraising For Schools – Community Nutritionist Council of BC

B, C

A resource which provides ideas for fundraising using fruit and vegetable themes to generate funds to further progress with fruit and vegetable education.

Cost: Free Hardcopy or Download

Contact: Rosw Soneff (250) 398-4600, http://healbc.ca/fundraising_for_schools.pdf
Or See 5-TODAY Resource Package

33. Alberta Fruit and Vegetable Campaign for Communities

B, C

Provides extensive information and tools to involve families and the community in increasing the awareness and importance of eating at least 5 servings of fruit and vegetables a day.

Cost: Free Hardcopy or Download.

Contact: www.cancerboard.ab.ca/pdf/cancer_prevention/eps_simply_healthy_cart.pdf

AS! BC 5-TODAY Program

LESSONS and RESOURCES

LESSON 1: Why Eat Fruit and Vegetables?
LESSON 1 RESOURCES

LESSON 2: Science of Fruit and Vegetables
LESSON 2 RESOURCES

LESSON 3: Eating Fruit and Vegetables
LESSON 3 RESOURCES

LESSON 4: What do we know about Fruit and Vegetables?
LESSON 4 RESOURCES

Prior to completing the 5-TODAY Challenge
“pick 2, do 2” of the lessons provided.

LESSON 1: Why Eat Fruit and Vegetables?

Grade: 5-6

Purpose:

- To educate the students on the importance of eating fruit and vegetables and there effects on health.
- To develop a link between eating fruit and vegetables and healthy living, including Physical Activity.
- To introduce the 5-TODAY program in a fun and exciting manner.

Learning Outcomes:

- Relate the life processes of humans to their use of nutrients and water.
- Relate dietary habits and behaviour to an organism's health.
- Explain the relationship between good nutritional habits and physical activity.

Lesson Ideas:

1.1. Start a discussion about fruit and vegetables by asking:

- Ask students what their favourite fruit or vegetable is? Why?
- Ask students to think about the merits of fruit and vegetables and discuss what they think are the best characteristics of being a fruit or vegetable.
 - The teacher could start this discussion and provide an example like “I think apples are the best because of their versatility – fresh, baked, juice, variety of colours, available all over the world and all ages like to eat them.”

1.2. Brainstorm a list of all the fruit and vegetables the class knows.

- This list will be useful in determining what new fruit and vegetables to introduce to the class and it gives a baseline for comparison at the end of the program.

1.3. Discuss the main health affects of eating fruit and vegetables.

- Example: decreases the risk of developing Cardiovascular Related Diseases, Cancer, Diabetes, Obesity and Muscle Degeneration.

Recommended Resources for LESSON 1:

- Health Effects of fruit and vegetables information sheet (1.3)
- Letter to parents informing them of the 5-TODAY program. It encourages them to participate and involve their children in the 5-TODAY program.

LESSON 1 RESOURCES:

1.3 HEALTH EFFECTS OF EATING Fruit AND VEGETABLES

Eating 5 to 10 servings of vegetables and fruit per day as part of a healthy diet can help reduce your risk of cancer, heart disease and stroke.

Vegetables and fruit can help reduce your risk of cancer

Fifteen of the world's leading researchers in diet and cancer recently reviewed more than 4,500 studies from around the world. Vegetables and fruit came out on top as the foods most likely to help reduce the risk of cancer. Researchers recommend that everyone should eat 5 or more servings a day, all year round.

Vegetables and fruit can help reduce your risk of heart disease and stroke

Over the past two decades researchers have gained a better understanding of how different foods influence the risk of heart disease and stroke. Reducing the amount and type of fat in one's diet has always been important, but only part of the answer. Considerable evidence now shows that eating more vegetables and fruit can also help reduce the risk of heart disease and stroke.

How vegetables and fruit can help reduce the risk of disease

Vegetables and fruit appear to reduce the risk of cancer, heart disease and stroke by providing protective substances such as vitamins, minerals, and fibre, as well as plant compounds called phytochemicals.

For example:

- A diet high in vegetables and fruit may help reduce the risk of cancer by stopping normal cells from changing into cancerous cells.
- Vegetables and fruit may help reduce the risk of heart disease by protecting artery walls from damage.
- When you fill up on vegetables and fruit, you may not be as hungry for less healthy foods.



Action Schools! BC

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Date: Fall 2003
 To: Parents
 From: Action Schools! BC
 Re: **5-TODAY** Nutrition Program

The 5-TODAY program is being implemented in our class. The **5-TODAY** program is a program that teaches children why eating 5 fruit and vegetables per day is important, increases children's awareness of the many fruit and vegetables available in British Columbia, and encourages children to eat at least 5 fruit and vegetables a day.

Recent information gathered from the Canadian Community Health Survey found that approximately 61 % of British Columbians consume less than Canada's Guide to Healthy Eating minimum daily recommended number of five servings of fruit and vegetables a day.

Research indicates that eating five fruit and vegetables a day can decrease the risk of chronic diseases including cancer, cardiovascular related diseases, obesity, diabetes, cataracts, muscle degeneration and chronic obstructive pulmonary diseases. Eating five servings of fruit and vegetables a day can decrease the risk of cancer by 20%, coronary heart disease by 20-40% and stroke by 25%.

Our vision is to make healthy eating opportunities available to all students, increase student awareness and participation in the 5-TODAY program, encourage family and community support for the 5-TODAY program, and to meet and sustain our goals of overall healthy eating and well-being.

The goals of Action Schools! BC's 5-TODAY program is to increase fruit and vegetable consumption among school aged children to decrease the incidence of chronic disease. The aim is to increase awareness of health implications and the importance of consuming five fruit and vegetables a day and to expose students to a variety of fruit and vegetables in order to stimulate interest and aid in reaching and sustaining our goal.

Continual systematic evaluation of Action Schools! BC **5-TODAY** program will be completed in order to develop a successful and sustainable program that increases the consumption of fruit and vegetables in school-aged children. Quantitative assessment of nutrient intake will be measured by nutritional analysis and food group analysis, which will be completed at the beginning of the pilot program (September 2003) and throughout (i.e., January 2004 and May 2004) to determine changes in fruit and vegetable consumption. Qualitative data obtained through focus groups involving students will also be evaluated to determine if students' awareness of fruit and vegetables has increased and what aspects of the **5-TODAY** program facilitated this awareness and/or contributed to an increased consumption of these foods. Teachers will also be invited to participate in focus groups to evaluate aspects of the **5-TODAY** program from their perspective.

We hope that you can assist us in making this program a success.



BRITISH COLUMBIA
 Ministry of Community, Aboriginal
 and Women's Services
 Ministry of Health Planning

LESSON 2: Science of Fruit and Vegetables

Grade: 5-6

Purpose:

- To learn the 'life cycle' of fruit and vegetables from seed to plate.
- To learn the important nutrients that fruit and vegetables contain.
- To examine fruit and vegetable preparation and storage.

Learning Outcomes:

- Describe the changing requirements of organisms as they grow.
- Identify living resources in the local environment.
- Describe how humans use B.C.'s living resources.
- Identify the nutritional needs related to physical activity.

Equipment For Lesson 2.4:

- Knife
- Fruit or vegetable for each group
- Lemon or Orange Juice
- Plastic Wrap

Lesson Ideas:

2.1 Discuss the main nutrients that are present in fruit and vegetables.

- Ask students what nutrients they think are present in fruit and vegetables.
- Ask students if they have heard of Vitamin A and C, Fibre, Folate or Potassium and Phytochemicals.
- Explain to the students that a variety of colourful fruit and vegetables contain these nutrients.
- Ask the students to help in making a list of different fruit and vegetables that fit into the different colour categories (blue, white, red, and green).
- Discuss the nutrient content of the different colours of fruit and vegetables.

2.2 From Farm to Table – Fruit and Vegetables

- As a class, discuss the life cycle of fruit and vegetables from the seed to the table.
 - In small groups get students to choose a fruit or vegetable and develop a flow chart or written sequence of its life cycle from the farm to the table.
- ❖ **Tip:** This provides a good opportunity to go on field trips to Farms and Grocery Stores so that students can see the process in practice.

2.3 What Part of the Plant are We Eating?

- Bring in a variety of vegetables (or have students bring some to class) that come from different parts of the plant, including:
 - roots (carrots, beets, radishes)
 - stems (celery, asparagus)
 - leaves (lettuce, spinach, cabbage)
 - fruit (cucumbers, squash, peppers, tomatoes)
 - flowers (broccoli, cauliflower, artichoke)
 - seeds (corn, peas, green beans).
- Explain how all plants have different parts, which are all needed for the plant to grow.
- Discuss that we eat different parts of various plants.
- Complete the Plant Parts Activity Sheets – Label the parts of the strawberry plant and then list different fruit and vegetables that represent different parts of the plant.
- ❖ **Tip:** Offer taste samples of each type of vegetable or have students assemble and eat their own "plant-part-salad" from the assorted vegetables.

2.4 Chemistry of Fruit and Vegetables

- The appearance of fruit and vegetables is very important to most people. Some imperfections do not affect the taste or safety of fresh produce while others do.
- In this activity, you will experiment with the browning of cut fruit and vegetables and the affects antioxidants like orange and lemon juice have on browning.
 - ❖ **Tip:** Conduct a blind taste test. Divide the students into groups. Have each group select a student to be a taster and blindfold him or her. Give this student a fresh cut piece of fruit, and then give him or her a piece of the same kind of fruit that has oxidized (turned slightly brown). Have the taster comment on the differences in taste and texture.

Recommended Resources for LESSON 2:

- Colour and Nutrients Information Sheet (2.1)
- Nutrients in Fruit and Vegetables (2.1)
- Nutrient Content Information Sheet (2.1)
- From Farm to Table Fruit and Vegetables Lesson Plan (2.2)
- Example From Farm to Table Cycle of Fruit and Vegetables Flow Chart (2.2)
- Example Field Trip Questions (2.2)
- A varied selection of fruit and vegetables (2.3)
- Plant Parts Activity Sheet (2.3)
- Chemistry of Fruit and Vegetables Lesson Sheet (2.4)
- Chemistry of Fruit and Vegetables Results and Questions Sheet (2.4)

LESSON 2 RESOURCES:

2.1 Colours and Nutrient Information

Fruit and vegetables come in a variety of **blues, reds, yellows, oranges, purples, and even whites**. The reason lies in the very substances that give fruit and vegetables their colours: phytochemicals. These natural plant compounds not only protect plants, but also may provide important disease protection to humans.

From cancer to anti-aging, heart disease to eyesight, scientists are focusing on a wide range of potential health benefits of fruit and vegetables.

Because colourful fruit and vegetables contain hundreds of different phytochemicals, no one colour group does it all. Eating regularly from each colour group provides the widest health protection possible. Phytochemicals work together naturally in ways that supplements simply can not duplicate. For healthy results, whole fresh foods are best.

“By eating fruit and vegetables from each colour group, you will benefit from the unique array of phytochemicals, as well as essential vitamins, minerals, and fiber that each colour group has to offer.”

Colourful fruit and vegetables provide a wide range of vitamins, minerals, fiber, and phytochemicals that the body uses to maintain good health, protect against the effects of aging, and reduce the risk of cancer and heart disease.

Many of the phytochemicals and other compounds that make fruit and vegetables a healthy choice also give them their colour. Thus, it is essential to sample the complete colour spectrum every day to get the full preventive benefits of fruit and vegetables.

Blue and purple fruit and vegetables contain varying amounts of health-promoting phytochemicals such as anthocyanins and phenolics, currently being studied for their antioxidant and anti-aging benefits. Include **blue and purple** in a low-fat diet to help maintain:

- A lower risk of some cancers.
- Urinary tract health.
- Memory function.
- Healthy aging.

Blackberries, Blueberries, Black currants, Dried plums, Elderberries, Purple figs, Purple grapes, Plums, Raisins, Purple asparagus, Purple cabbage, Purple carrots, Eggplant, Purple Belgian endive, Purple peppers, Potatoes (purple fleshed), Black salsify

Green vegetables contain varying amounts of phytochemicals such as **lutein** and **indoles**, which are of interest because of their potential antioxidant, health-promoting benefits. Include **green** in a low-fat diet to maintain:

- A lower risk of some cancers.
- Vision health.
- Strong bones and teeth.

Avocados, Green apples, Green grapes, Honeydew melon, Kiwifruit, Limes, Green pears, Artichokes, Arugula, Asparagus, Broccoflower, Broccoli, Broccoli rabe, Brussels sprouts, Chinese cabbage, Green beans, Green cabbage, Celery, Chayote squash, Cucumbers, Endive, Leafy greens, Leeks, Lettuce, Green onions, Okra, Peas, Green peppers, Sugar snap peas, Spinach, Watercress, Zucchini

White, tan, and brown fruit and vegetables contain varying amounts of phytochemicals of interest to scientists. These include **allicin**, found in the garlic and onion family. The mineral **selenium**, found in mushrooms, is also the subject of research. Including **white** in a low-fat diet helps maintain:

- Heart health.
- Healthy cholesterol levels.
- A lower risk of some cancers.

Bananas, Brown pears, Dates, White nectarines, White peaches, Cauliflower, Garlic, Ginger, Jerusalem artichoke, Jicama, Kohlrabi, Mushrooms, Onions, Parsnips, Potatoes (white fleshed), Shallots, Turnips, White Corn

Yellow and orange fruit and vegetables contain varying amounts of antioxidants such as **vitamin C** as well as **carotenoids** and **bioflavonoids**, two classes of phytochemicals that scientists are studying for their health-promoting potential. Including **yellow and orange** in a low-fat diet helps maintain:

- A healthy heart.
- Vision health.
- A healthy immune system.
- A lower risk of some cancers.

Yellow apples, Apricots, Cantaloupe, Yellow figs, Grapefruit, Golden kiwifruit, Lemons, Mangoes, Nectarines, Oranges, Papayas, Peaches, Yellow pears, Persimmons, Pineapples, Tangerines, Yellow watermelon, Yellow beets, Butternut squash, Carrots, Yellow peppers, Yellow potatoes, Pumpkin, Rutabagas, Yellow summer squash, Sweet corn, Sweet potatoes, Yellow tomatoes, Yellow winter squash

Specific phytochemicals in the **red group** that are being studied for their health-promoting properties include **lycopene** and **anthocyanins**. Include a variety of **red** fruit and vegetables in a low-fat diet to help maintain:

- A healthy heart.
- Memory function.
- A lower risk of some cancers.
- Urinary tract health.

Red apples, Blood oranges, Cherries, Cranberries, Red grapes, Pink/Red grapefruit, Red pears, Pomegranates, Raspberries, Strawberries, Watermelon, Beets, Red peppers, Radishes, Radicchio, Red onions, Red potatoes, Rhubarb, Tomatoes

Nutrients in Fruit and Vegetables

Why Is Folate Important for Good Health?

Folate has been linked to the prevention of birth defects (such as spina bifida), heart attacks, stroke and colorectal cancer. Folate is a B vitamin and can also be referred to as folic acid or folacin.

Studies show that most Canadians do not eat enough folate, but at least 5 servings of fruit and vegetables a day and dried peas and beans several times a week can ensure that one's diet contains adequate folate for good health.

Below are examples of fruit and vegetables that are good or high sources of folate. Eating at least one fruit or vegetable that is a good or high source of folate every day can have a positive impact on one's health.

High Sources of Folate

High sources provide at least 20% (80 micrograms) of the recommended daily value of folate per serving.

Asparagus, Broccoli, Green Beans, Okra, Spinach, Tomato Juice, Turnip Greens

Good Sources of Folate

Good sources provide at least 10% (40 micrograms) of the daily recommended value of folate per serving.

Artichoke, Beets, Brussel Sprouts, Cabbage, Cantaloupe, Cauliflower, Grapefruit Juice, Leaf Lettuce, Romaine Lettuce, Okra, Oranges, Orange Juice, Papaya, Red Bell Peppers, Sweet Potatoes

Why Is Fibre Important for Good Health?

Dietary fibre is generally accepted as having protective effects against a range of diseases including obesity, heart disease, cancer, diabetes and GI tract disorders.

High Sources of Fibre

High sources provide at least 20% (5 grams) of the recommended daily value of fibre per serving.

Apples, Blackberries, Grapefruit, Oranges, Raspberries, Broccoli

Good Sources of Fibre

Good sources provide at least 10% (2.5 grams) of the recommended daily value of fiber per serving.

Avocado, Bananas, Blueberries, Cherries, Dates, Figs, Kiwifruit, Papaya, Pears, Prunes, Strawberries, Tangerines, Artichokes, Brussel Sprouts, Corn, Green Beans, Onions, Potatoes, Spinach, Sweet Potatoes

Why is Vitamin C important for Good Health?

Some of the many roles Vitamin C plays in keeping the body healthy include:

- Acting as an antioxidant preventing damage to tissue.
- Helping build tissues in the body.
- Assisting in making hormones that help cope with stress.
- Keeping the respiratory system healthy and helping to fight off colds.
- Helping treat and prevent cancer and other diseases.

High Vitamin C Containing Fruit and Vegetables

Apricots, Blackberries, Cantaloupe, Grapes, Honeydew Melon, Kiwi Fruit, Lemon, Lime, Orange, Papaya, Pineapple, Plum, Pummelo, Raspberries, Strawberries, Tangerine, Watermelon, Red Pepper, Broccoli, Brussel Sprouts, Cabbage, Cauliflower, Collards, Onion, Potato, Radishes, Red Cabbage, Rutabagas, Summer Squash, Sweet Potatoes, Tomatoes

Why is Vitamin A important for Good Health?

Vitamin A helps the body stay strong by:

- Promoting vision.
- Building new cells, tissues and skin.
- Supporting the immune system – fighting off colds, flu, and infections.
- Helping build bones.
- Promoting growth.

High Vitamin A Containing Fruit and Vegetables

Apricots, Mangos, Watermelon, Carrots, Leaf Lettuce, Hot Chili Peppers, Romaine Lettuce, Spinach, Sweet Potatoes, Tomatoes

Why are Phytochemicals important for Good Health?

Fruit and vegetables contain many phytochemicals.

A phytochemical is a natural bioactive compound found in plant foods that works with nutrients and dietary fiber to protect against disease. Research suggests that phytochemicals working together with nutrients found in fruit, vegetables and nuts, may help slow the aging process and reduce the risk of many diseases, including cancer, heart disease, stroke, high blood pressure, cataracts, osteoporosis, and urinary tract infections.

Pronounced "fight-o-chemicals," phytochemicals fight to protect the body. They can have complementary and overlapping mechanisms of action, including:

- Antioxidant effects, helping get ride of toxins in the body.
- Stimulation of the immune system to fight infections.
- Help in maintaining hormone metabolism, and antibacterial and antiviral effect.

"Phyto" is a Greek word that means plant and phytochemicals and is usually related to plant pigments.

So, fruit and vegetables that are bright in colour - yellow, orange, red, green, blue, and purple - generally contain the most phytochemicals and the most nutrients.

The benefits of all the phytochemicals and nutrients found in plant foods come from eating 5-9 servings of fruit and vegetables a day and eating more whole grains, soy and nuts.

More than 900 different phytochemicals have been found in plant foods and more will be discovered. These protective plant compounds are an emerging area of nutrition and health, with new research reported everyday.

Remember, to get Phytos eat 5-9 servings of colourful fruit and vegetables every day!

Plant Parts

Answer to Plant Parts Diagram p.26

Answers: 1. Root, 2. Stem, 3. Leaf, 4. Flower, 5. Fruit, 6. Seed

2.2 From Farm to Table - Fruit and Vegetables

1. Brainstorm a list of fruit and vegetables and a list of questions that students will need to answer as they develop a flow chart or write out the life cycle of a fruit or vegetable.

Example questions students should answer:

- How am I planted?
 - Where am I grown and why?
 - How am I grown?
 - What do I look like growing on the plant?
 - How am I harvested?
 - How am I transported?
 - What good things (nutrients) can I offer someone?
 - What potential problems could I cause, if any?
 - How long do I last?
 - How am I stored?
 - What kinds of things do people eat me in/with?
 - How am I prepared/cooked?
2. Pick one fruit and one vegetable from the list the class generated and proceed through the life cycle of that particular fruit and vegetable.

An example using apples:

1. Apples grow on trees in an orchard. Farmers plant the apple trees in the spring, but it will take many years of growth before they produce many apples.
 2. Apple blossoms start forming in the spring and turn into apples and grow over the summer. Late in the summer and in the beginning of the fall the apples are mature and ready to be picked by the farmers.
 3. Some of the apples may be sold at a local market or grocery store while others will be shipped to a processing plant.
 4. If the apples are to be sold fresh at market or at a grocery store they are loaded into a truck and shipped to the store, where families can buy fresh apples. At the grocery store apples are kept cool but not in a refrigerator. This helps them stay fresh longer.
 5. If there are a lot of apples they will have to be stored in a warehouse under controlled conditions and shipped to the grocery stores when there is a demand for them. This is how fresh apples can be bought year round.
 6. Some apples go straight from the farm to a factory where they are made into apple sauce, juice, jelly, pies and other apple products.
 7. These apple foods then go to the grocery stores and restaurants.
 8. At home apples are either stored in the fridge or on the kitchen counter.
 9. Apples can be used in many delicious recipes or eaten as a fresh fruit.
3. Encourage students to choose a fruit or vegetable of their own and write down a similar process, answering some of the suggested questions above.

Questions To Ask When On A Field Trip

At the Farm or Orchard

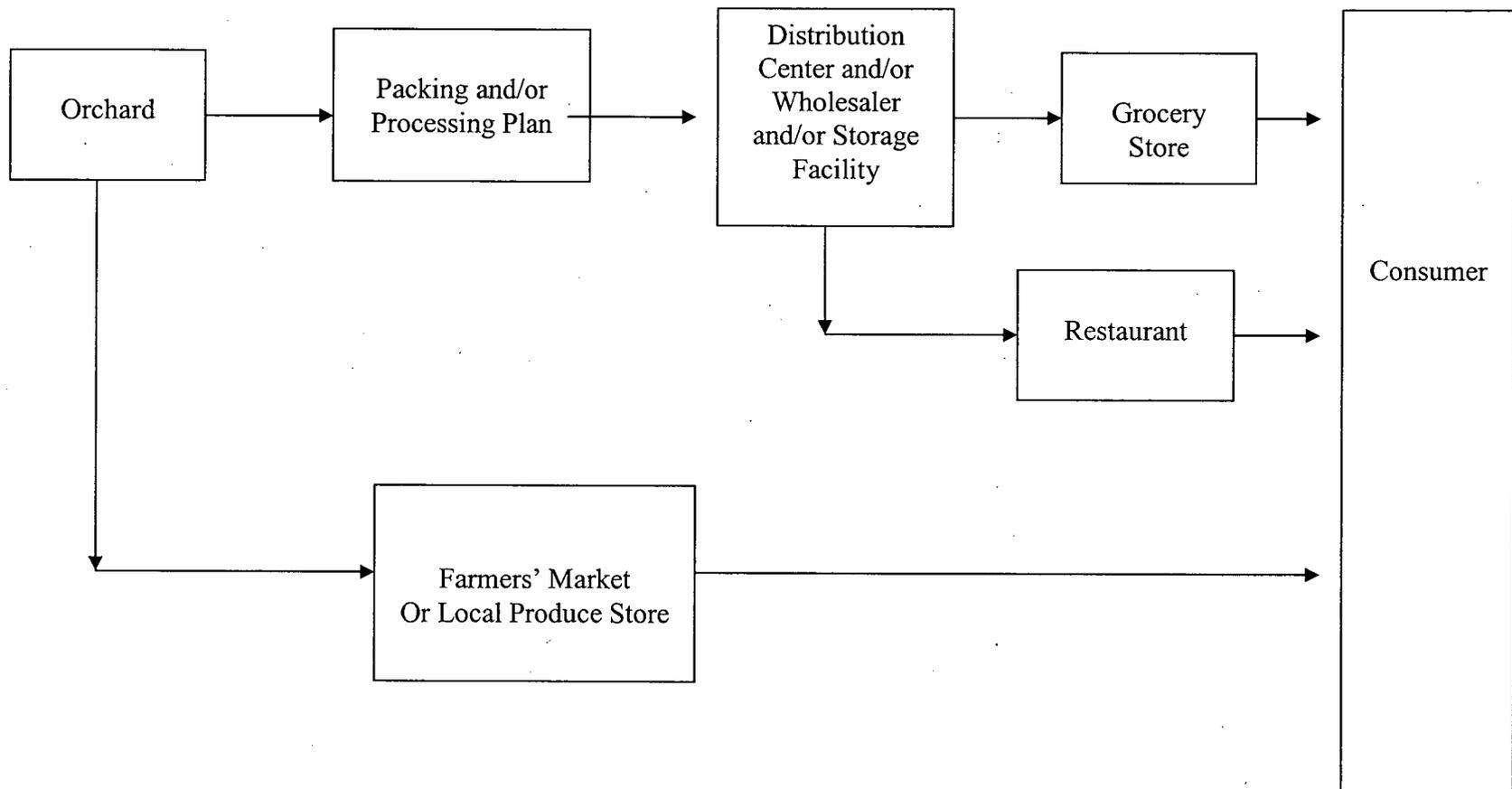
- What types of fruit and/or vegetables do you grow?
- Where do the fruit and vegetables grow? (Tree, ground, bush.)
- When do you harvest your crops?
- How are they planted?
- Where do they go after harvest?
- How are they stored?
- How long do they take to grow?

At The Super Market

- Where do you get your produce from?
- Ask about fruit and vegetables you have never seen before.
- How long are fruit and vegetables kept in the grocery store?
- What is the shelf life of fruit and vegetables?
- Do you sell locally produced fruit and vegetables?
- How long does it take for the fruit and vegetables to get from the farm to the supermarket?

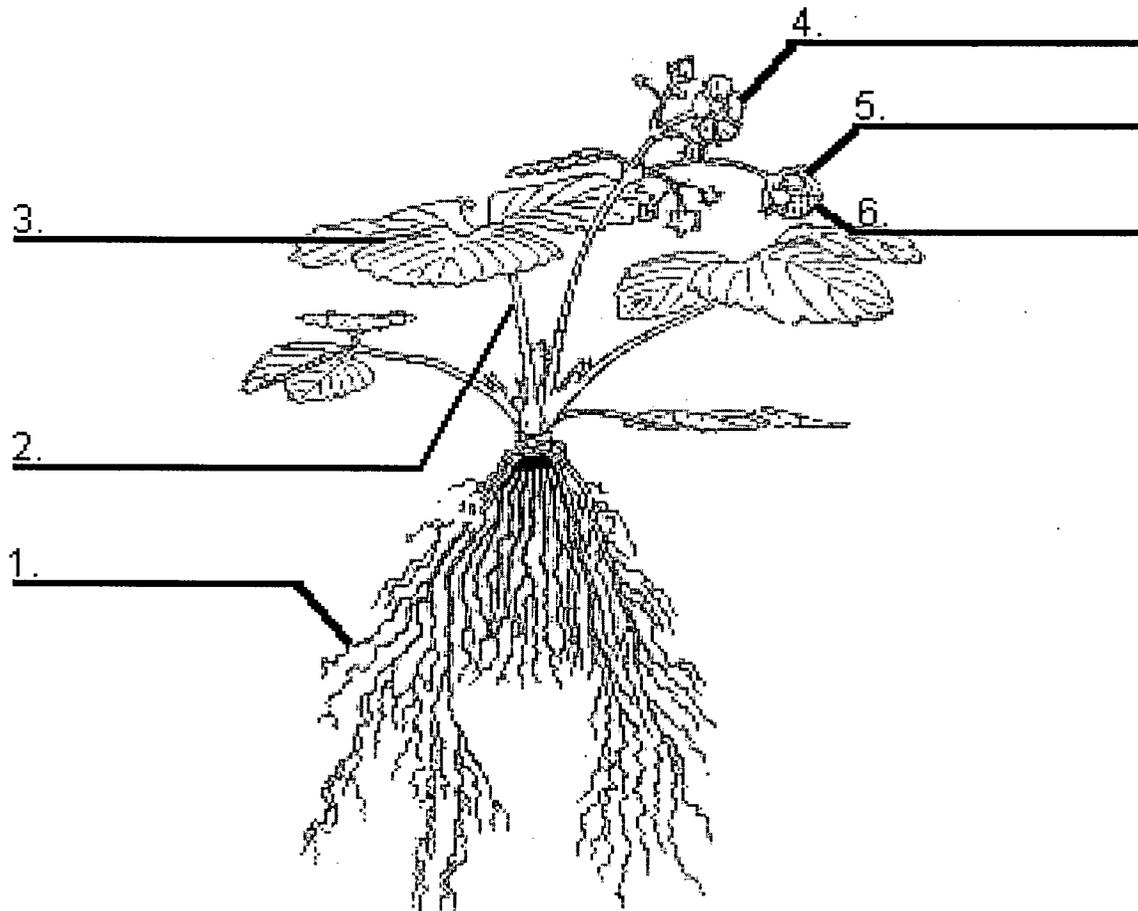
From Farm To Table – Fruit and Vegetables

- Example Flow Chart



2.3 Plant Parts: Strawberry Plant

- Name the different part of the strawberry plant



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Plant Parts That We Eat

Name two roots you eat: _____ and _____.

Name two leaves you eat: _____ and _____.

Name two stems you eat: _____ and _____.

Name two fruit you eat: _____ and _____.

Name two flowers you eat: _____ and _____.

Name two seeds you eat: _____ and _____.

2.4 The Chemistry of Fruit and Vegetables

All plants are made up of living cells that are held together by cell walls. When some fruit and vegetables are cut, the cell walls are broken and a chemical reaction occurs which causes the cut surfaces to darken. The chemical reaction is caused by exposure of the fruit or vegetable to oxygen in the air. This reaction is called oxidation and is promoted by enzymes that are released when the cells are cut open. Fruit and vegetables that have been discoloured from oxidation are still edible, despite the change in appearance.

The chemical reaction that causes darkening will not occur when:

- Ascorbic acid is present naturally in the fresh produce, or added right after cutting.
- The produce is heated to destroy the enzymes that cause discolouration due to oxidation.
- The food is covered to prevent oxygen from entering the cut cells.

Bruised and blemished produce is also edible if the imperfections are removed with a knife. However, moldy fruit and vegetables should be discarded because some molds produce toxins that are potentially harmful.

In this lesson, students will experiment with fruit and vegetables to determine if high enough levels of ascorbic acid are present in order to prevent discolouration of fruit and vegetables due to oxidation.

It is important to discuss with students that the agricultural industry establishes guidelines on how fresh produce should be shipped and stored so that quality produce gets to the consumer. It is equally important to discuss with students the appropriate produce storage and handling techniques they should use at home.

Procedure:

Day 1

1. With the students in groups of six, explain that they will be doing an experiment using fresh fruit and vegetables. Outline the safety requirements students should follow when using a sharp knife. Ask the students what they think will happen to various fruit and vegetables when they are cut open. Go over the following procedure with the students and have them record their hypothesis.
2. Each group of six will need to be divided up in to partners as each set of partners will be slicing an equal portion of the fruit or vegetable.
3. Prior to slicing the fruit or vegetable each pair should decide upon a treatment they will be doing to their portion of the fruit or vegetable. Each set of partners should select a

different treatment so that there are three treatments in each group. The treatments are as follows:

- **First slice:** leave exposed to the air (the control).
- **Second slice:** apply lemon or orange juice to all exposed surfaces.
- **Third slice:** seal tightly in plastic wrap.

4. Each group then receives one fruit or vegetable. After their portion is sliced the partners will without delay apply their chosen treatment to the slice.

5. Each pair of students will record their observations on *The Chemistry of Fruit and Vegetables* activity sheet. Observations should be made and recorded immediately after cutting and at regular 10-minute intervals for thirty minutes.

Day 2

1. Have the students make their final observations.

2. Hold a class discussion on fruit and vegetable discolouration and the effects ascorbic acid has on fresh produce. Discuss types of discolouration that affect the safety of the food such as mold and bruising.

3. Have each group discuss their results as well as draw and write conclusions. Students are responsible for all results in their group. Students should be able to make conclusions about the following and then complete their worksheets:

- The ascorbic acid content of the different types of produce in their natural states. (Some fruit and vegetables naturally have more ascorbic acid than others.)
- The effectiveness of orange or lemon juice in preventing discolouration.
- The effectiveness of plastic wrap in preventing discolouration.

Variations to Lesson 2.4

- Have the students write a formal lab report, which includes a purpose, hypothesis, materials list, procedure, results, and conclusion.
- Have students design their own experiments that will determine how discolouration of fresh produce can be reduced.
- Before the activity, have students brainstorm (hypothesize) what the results of the experiment will be. After the experiment, have the students compare their data with their predictions.

The Chemistry of Fruit and Vegetables

Results and Questions Sheet

Name: _____

Fruit and Vegetable Used: _____

Treatment of Food

- None (control)
- Lemon/Orange Juice
- Plastic Wrap

Hypothesis:

Results:

Colour Immediately After Cutting = _____

10 Minutes After Cutting = _____

20 Minutes After Cutting = _____

30 Minutes After Cutting = _____

Colour After 24 Hours = _____

Conclusion and Questions:

You are only going to eat 1/2 of an apple and want to store the other half to eat the next day. What storage technique will you use? _____

Why? _____

Explain what your experimental results might mean to a chef who wants cut fruit and vegetables to look attractive. _____

Other than those mentioned in this lesson, what other food storage techniques can you think of that keep food fresh, tasty, and healthful?

How do your results compare to those of another group?

LESSON 3: Eating Fruit and Vegetables

Grade: 5-6

Purpose:

- To educate the students on the importance of eating a variety of fruit and vegetables.
- To introduce a variety of fruit and vegetables to the class.
- To teach the students fun ways to prepare and eat fruit and vegetables.
- To have students learn how they can incorporate 5 servings of fruit and vegetables into their daily diet.

Learning Outcomes:

- Relate the life processes of humans to their use of nutrients and water.
- Explain the relationship between good nutritional habits and personal well-being.
- Set and modify nutritional goals.

Equipment:

- A variety of fruit and vegetables including fresh, frozen, and canned.
- Cutlery and bowls to serve the fruit and vegetables.
- Variety of unique fruit and vegetables.

Lesson Ideas:

3.1 Look Feel and Taste

- Bring in a variety of fruit and vegetables that the students have not tried before and get them to look, feel and taste. (This would be known if activity 3 in lesson 1 was completed).
- Information regarding the origin of the fruit and vegetable and typical uses should also be given.

3.2 "Guess the Mystery Fruit or Vegetable" Contest

- This is a great activity to do when students are between classes or during spare time. On a table place a box with a small hole cut in the top where students can reach in and feel a mystery fruit or vegetable. Place a piece of paper and pencil where students can write what they think is in the box. (For younger students - give them 3 to 4 options and let them vote). The next day have the mystery fruit or vegetable displayed with some basic information about it including what part of the plant it is, what nutrients it contains, where it is grown, etc.

Here are some ideas for mystery foods that students may have never seen, touched or tried:

- Acorn Squash, Artichokes, Asian Pears, Avocados, Banana Peppers, Bell Pepper, Blood Oranges, Brussels Sprouts, Chayote, Eggplant, Honeydew Melons, Italian Peppers, Papayas, Plantains, Pomegranates, Portabella Mushrooms, Red Cabbage, Red/ Spanish Onions, Sugar Snap Peas, Zucchini Squash

3.3 Fruit and Vegetable Recipes

- Try some of the recipes listed in the resources, or bring in some of your own. This could be a whole class activity (stew or vegetable soup) or small group activity in which more than one dish is prepared.

3.4 How are we going to eat 5 servings of fruit and vegetables a day?

- Brainstorm ideas with the students on how they are going to eat at least 5 servings of fruit and vegetables a day.
- Prompt the students with Breakfast, Lunch, Snack and Dinner Ideas.
- Discuss with the class where they can purchase fruit and vegetables.
- Ask students for suggestions on how to make sure fruit and vegetables are available at home, at school, and even when eating out.
- Or provide scenarios where fruit and vegetables are not readily available and discuss how students can ask for more of them. (For example; you are at a friend's house after school and he/she asks if you want some chips for a snack. Will you offend your friend if you ask for an apple?)
- Write down all the suggestions and make copies for each student to take home and share with their parents.

Recommended Resources Provided for LESSON 3:

- Meal and Snack Ideas Handout (3.2/3.4)
 - Recipes (3.3)
- ❖ **Tip:** Provide the students with a copy of the Meal and Snack Ideas handout to take home for their parents.

LESSON 3 RESOURCES:**Meal and Snack Ideas to increase fruit and vegetable intake**

Breakfast	Lunch	Dinner	Snacks
Glass of Juice	Salad	Vegetable Side Dish	Piece of Fruit
Half a Grapefruit and Toast	Vegetable Soup	Stir-fry with vegetables	Dried Fruit
Fruit on Cereal	Sandwich with Veggies	Veggie Pizza	Canned Fruit Cup
Banana and Cereal	Raw Vegetables	Pasta or Rice with Cooked Veggies	Juice Box
Fruit Shake	Carrot and Celery Sticks and dip	Fruit for Dessert	Veggies and Dip
Fruit with Yogurt	Fruit Plate	Vegetable and Chicken Wrap	Fruit Leather
Fruit with Pancakes	Piece of Fruit	Bean and Vegetable Wraps	Yogurt and Fruit
Vegetable Omelet	Peanut butter and Banana Sandwich	Macaroni and Cheese with Veggies	Apple Slices with Peanut Butter
Fruit Salad			Nuts and Raisins

3.2 Fruit and Vegetable Recipes

Strawberry Yogurt Breakfast Split

Makes 1 Serving

Ingredients:

1 banana
4 oz. (1 cup) fresh strawberries
4 oz. (1/2 cup) vanilla yogurt
1 tablespoon chopped, toasted almonds

Method:

Peel and split 1 banana. Place banana halves in serving bowl. Top with strawberries, yogurt, and almonds. *This is an official 5 A Day recipe.*

Recipe provided by the California Strawberry Advisory Board.

Nutrient analysis per serving: 312 calories, 7g fat, 5mg cholesterol, 5g fiber, 75mg sodium, 19% calories from fat.

Peaches with Raspberry Yogurt Sauce

Makes 4 Servings

Ingredients:

4 fresh peaches
Sauce:
1 cup frozen unsweetened raspberries
1/2 cup low fat yogurt
1 tablespoon honey

Method:

Peel peaches and slice. Spoon peaches into individual dishes and spoon sauce over peaches. Garnish with fresh raspberries or mint. *This is an official 5 A Day recipe.*

Nutrient analysis per serving: 140 calories, 2mg cholesterol, trace of fat.

ABC Vegetable Soup

Makes 6 Servings

Ingredients:

1 teaspoon vegetable oil
1/2 cup chopped onion
1 clove garlic, chopped
2 cans (14 1/2 ounces each) reduced salt chicken broth
1 can (28-ounces) crushed tomatoes
1/3 cup alphabet pasta
1/2 cup parsley leaves
1 cup chopped broccoli
1 cup chopped carrots
1 cup sliced celery
Salt and pepper to taste
2 tablespoons grated Parmesan cheese, optional

Method:

1. Heat oil in a saucepan over medium heat. Add onion and garlic and cook until the onion is soft, about 2 minutes. Stir occasionally.
2. Add chicken broth, tomatoes, pasta, and parsley to the saucepan. Bring the liquid to a boil, reduce heat, and simmer for 10 minutes.
3. Add broccoli, carrots, and celery to soup; cook 10 minutes. Add salt and pepper to taste.
4. With adult help, ladle soup into serving bowl and sprinkle with Parmesan cheese before serving, if desired.

Chinese Vegetable Stir-fry
Makes 4-6 servings

Ingredients:

Sweet 'N' Sour Sauce

3/4 cup pineapple juice
1 tablespoon sugar
1 tablespoon lemon juice
1 1/2 teaspoons cornstarch
1 teaspoon light soy sauce

Stir-Fry Vegetables

4 teaspoons vegetable oil
1 cup broccoli florets
1 cup sliced carrot
1 cup cauliflower florets
1 cup sliced celery
1 cup chunked red bell pepper
1 cup sugar peas, stems removed

Method:

1. Combine the ingredients for the Sweet 'N' Sour sauce in a mixing bowl.
2. Heat oil in a skillet over medium high heat. Add broccoli, carrots, cauliflower, and celery, cook for 2 minutes. Add bell pepper and sugar peas, cook for 2 minutes. Add Sweet 'N' Sour sauce, bring to a boil and cook for 1 minute, covered. Serve vegetables while hot.

Vegetable Pasta Italiano
Makes 6 Servings

Ingredients:

1/2 pound lean ground turkey
1 red bell pepper, seeded and thinly sliced
1 tablespoon paprika
1 can (14 1/2 ounce) crushed tomatoes
1 can (14 12 ounce) reduced-sodium chicken broth
2 cups uncooked bow-tie pasta
2 cups broccoli florets, washed
1 cup cauliflower florets, washed

Savory Toppings:

1/2 bunch parsley
1/4 cup seasoned dry bread crumbs
1/4 cup grated Parmesan cheese

Method:

1. Crumble ground turkey into a skillet. Brown over medium high heat for 2 minutes, stirring occasionally. Add red pepper strips and paprika, cook for 2 more minutes.
2. Add crushed tomatoes, chicken broth, and pasta to the skillet. Bring mixture to a boil, reduce heat, cover and simmer for 15 minutes.
3. With adult help, remove the lid and arrange broccoli and cauliflower over the pasta.
4. Replace lid and continue cooking for 10 minutes.
5. Prepare the savory topping. Pull leaves from parsley stems and combine with bread crumbs and grated cheese; toss. Sprinkle savory topping over vegetables in skillet. Let sit for 3 minutes before serving.

Crunchy Vegetable Burrito Banditos
Makes 4 servings**Ingredients:**

1/2 cup shredded carrots
1/2 cup chopped broccoli
1/2 cup chopped cauliflower
2 green onions, thinly sliced
4 ounces shredded low fat Cheddar cheese
1/4 cup nonfat ranch salad dressing
1/2 teaspoon chili powder
4 (7-inch) flour tortillas
1 cup torn iceberg lettuce, bite-size pieces

Method:

1. In a mixing bowl, combine carrots, broccoli, cauliflower and onions with cheese, dressing, and chili powder.
2. Lay tortillas flat on the counter and spoon about 1/2 cup vegetable mixture and 1/4 cup of lettuce down the center. Wrap each tortilla around the vegetable mixture.

Spunky Vegetable Pizza
Makes 8 servings**Ingredients:**

3/4 cup pizza sauce
1 large Italian pizza shell
1 cup chopped broccoli
1 cup shredded carrots
1/2 cup sliced red or green bell pepper
5 to 6 ounces, shredded, low fat mozzarella or Cheddar cheese

Method:

1. Preheat the oven to 230 C or 450 F.
2. Spoon pizza sauce on pizza shell.
3. Put pizza shell on a cookie sheet.
4. Arrange vegetables over sauce.
5. Sprinkle on the cheese.

Bake for 10 minutes. When baked, cool pizza for 3 minutes before slicing. Cut into 8 wedges.

Trees In A Broccoli Forrest
Makes 4 servings

Ingredients:

2 carrots, peeled
3 cups broccoli florets
4 cherry tomatoes
3 tablespoons parsley leaves

Dipping Sauce:

1/4 cup plain nonfat yogurt
1/4 cup light sour cream
2 teaspoons honey
2 teaspoons spicy brown mustard

Method:

1. To prepare dipping sauce, combine yogurt, sour cream, honey, and mustard in a small bowl.

2. Hold carrots against cutting board and trim off ends. Cut each half, crosswise, then lengthwise to make four pieces.

3. Arrange each plate by putting two carrot pieces side-by-side in the center. Arrange broccoli around the carrots forming a cluster. Arrange the tomatoes at the top of the plate.

4. Spoon dip around the base of carrots and sprinkle with parsley.

LESSON 4: What Do We Know About Fruit and Vegetables?**Grade:** 5-6**Purpose:**

- Educate the students that a variety of colourful fruit and vegetables are the best for our health.
- Learn the best ways to eat fruit and vegetables and why.
- What are my best choices?

Learning Outcomes:

- Describe the changing requirements of organisms as they grow.
- Identify living resources in the local environment.
- Identify the nutritional needs related to physical activity.
- Explain the relationship between good nutritional habits and personal well-being.

Equipment:

- Variety of fruit beverage containers.
- Sample of different fruit beverages.

Lesson Ideas:

4.1 Discuss Better Choices such as 100% fruit juices versus Tangs etc, eating the skins of appropriate fruit like apples, eating a variety of bright coloured vegetables versus just one vegetable.

- Display different containers of fruit beverages on a table (with or without labels) and let the students decide if it is real 100% juice or if it contains artificial ingredients like extra sugar, carbonation, etc. Include a variety of fruit-flavoured soft drinks, fruit flavoured sugar drinks, drinks that contain 10% or less real fruit juice and 100% fruit juices.
 - Ask the students if they know how to tell if a beverage is made from real fruit. (It says 100% fruit juice on the package or fruit juice is the main ingredient listed).
 - Explain that many fruit-beverages are made from sugar water and fruit flavor. Even drinks with 10% juice have less than 2 tablespoons of fruit juice in a one cup serving!
 - Ask whether the pictures on the label tell the truth about the product. Point out that many fruit drinks with little or no fruit juice often have pictures of real fruit on the label or package.
 - Offer samples of 100% fruit juice, including novel varieties such as tropical blends, orange/tangerine mix or apple/pear juice.

4.2 Fruit and Vegetables and the Importance of Colour

- As a class or individual activity list a variety of fruit and vegetables according to colour. Explain the importance of eating a variety of brightly coloured fruit and vegetables. (see Lesson 2)

4.3 Discuss the different methods of preparing fruit and vegetables

- Explain what methods are best to maintain the nutrient content of fruit and vegetables.

Recommended Resources for LESSON 4:

- Lesson 2 Colours and Nutrients Information Sheet (4.2)
- Methods of Preparing Fruit and Vegetables (4.3)

LESSON 4 RESOURCES:

4.2 Colours and Nutrient Information (refer to LESSON 2)

4.3 Methods of Preparing Fruit and Vegetables

The students will understand how a healthy diet and exercise can increase the likelihood of physical and mental wellness.

1. Start a discussion to see if the students know what methods of cooking are the most healthy and why.
2. Explain or demonstrate each cooking method.
3. Go on to explain what methods of cooking are the most healthy and why.

Eating fruit and vegetables raw is the most nutritious way to eat them. Many methods involve cooking the food, but some vitamins and minerals are lost in the cooking process.

Cooking Methods:

Fried - cooking at high temperatures in fat or oil; a very high fat method of cooking. Used for cooking meat, vegetables and donuts, too.

Stir-fry - cooking quickly at high temperatures in little or no fat or oil; best for saving vitamins and minerals. It is suggested that you demonstrate this method of cooking.

Bake - cooking in the oven with no fat added, with or without a lid.

Steam - cooking with a lid using very little added water, allowing vitamins to be saved. Used for vegetables.

Broil or grill - cooking at high temperatures on a rack so that the fat drips off.

Saute - cooking in fat at a medium temperature; high fat method.

Boil - cooking in broth or water at a high temperature; save water to retain vitamins.

Simmer - cooking in broth or water at a low temperature; low fat method.

Microwave - cooking method that requires little or no fat added.

Methods of food preparation and Health:

Eating fruit and vegetables raw is the most nutritious way to eat them.

Many methods involve cooking fruit and vegetables, but during this cooking process some vitamins and minerals are lost and extra calorie and fat can be obtained.

What are the Healthiest Cooking Methods for Fruit and Vegetables?

- The best way to eat fruit and vegetables is raw – maintaining all nutrients.

- The next best way to cook fruit and vegetables would be baking in its own skin – No nutrients are lost, all captured in the vegetable or fruit, examples: Potato, Apple. This can be accomplished in the oven or on a grill.
- Microwave or Steam – The vegetables are heated over only a little bit of water, so some nutrients are lost into the water or evaporated off with steam.
- Boiling vegetables causes nutrients to leech out into the water. So unless you drink the cooking water many nutrients are lost. (One can see this as over cooked vegetables change to a paler colour).
- Sautéing and pan stir-frying are the next best option as only a little amount of fat is added and there is minimal loss of nutrients.
- Frying – although most nutrients are retained, this method adds a lot of extra fat to the vegetables, making them less of a healthy choice.
- Fruit and Vegetables are very healthy food choices, but if large amounts of fat is added to them, or most of the vitamins are drained away during cooking there nutrient value and health properties are decreased. Fat intake is also increased when butter, cream, oils, salad dressings or gravies are put on top of fruit and vegetables.

The 5-TODAY Challenge

Grade: 5-6

Purpose:

- The 5-TODAY Challenge is a 5-day record of the amount and types of fruit and vegetables each student ate.
- To see who is eating at least 5 fruit and vegetables a day.
- Encourage all students to participate in the 5-TODAY Challenge.

Learning Outcomes:

- Set and modify nutritional goals.
- Explain the relationship between good nutritional habits and personal well-being.
- Explain the relationship between good nutritional habits and physical activity.

Equipment:

- Measuring devices – bowls, plates, measuring cups and spoons, fresh, frozen, and canned fruit and vegetables (examples: dried fruit, salad, juice, apples, canned peaches, cooked peas, cooked mixed vegetables, bananas, berries, melon).

5-TODAY CHALLENGE

1. Portion Sizing

- Demonstrate and explain what a portion/serving size is, using different types of fruit and vegetables. Props are a useful tool here.
- Use different measuring devices and actual fruit and vegetable items to show what a portion size is. There are actual fruit and vegetable models that can be purchased to aid in teaching portion sizing. See resources for more information.
- Have students practice correct portioning by getting them to physically portion out a serving of fruit or vegetables.
- Give the Portion Size handout to the students to be completed and taken up in class. This could be a group or individual activity.
- Discuss actual serving sizes versus perceived serving sizes (large versus medium apple, 1 serving versus a glass of juice).
- Include the students by getting them to bring in different fruit and vegetables including canned, frozen, dried and fresh, and as a class you determine the portion size of each item.
- ❖ **Tip:** Ask the students to practice at home and teach their families what a portion size is. Provide a portion sizing handout for parents.

2. Explain the purpose and outcome of the 5-TODAY Challenge.

- Explain and demonstrate how to complete the 5-TODAY Challenge recording sheets.

- Over one week get the students to complete the 5-TODAY Challenge by filling out their 5-TODAY Challenge forms.
- Once complete, chart the class results of the 5-TODAY Challenge and complete the 5-TODAY Challenge questions.
- After the class has completed their challenge the results should be recorded on two charts. One chart that gives overall class results and a second chart that compares different ages and Breakfast Eaters. This could be completed by the teacher or as a class activity.
- The class should then answer the 5-TODAY Challenge Questions.
- Acknowledge participants in the 5-TODAY Challenge.
- Return results to the Action Schools! BC Support Team.

Recommended Resources for 5-TODAY Challenge:

- Portion Sizing Handout (1).
- 5-TODAY Challenge Handouts for teachers and students (2)

ACTION SCHOOLS! BC
5-TODAY Pilot Program
Student Worksheet



Action Schools! BC

PORTION SIZING
What is a Serving Size?

Fruit and Vegetables	One Serving Size
Berries	
Spinach or Lettuce	
Orange (medium size)	
Dried Cranberries	
Watermelon	
Apple (medium size)	
Nectarine	
Strawberries	
Potatoes	
Raisins	
Grapes	
Mango	
Salad	
Frozen Peas	
Banana	
Tomato	
Grapefruit	
Cucumber	
Cantaloupe	
Broccoli	
Raspberries	
Apricots	
Papaya	
Mandarin Orange	
Green Pepper	
Fruit Leather	
Pear	
Blueberries	
Green Beans	
Corn	
Bok-Choy	
Onion	
Apple Juice	
Carrot	
Plum	

Photocopy one per student.

ACTION SCHOOLS! BC
5-TODAY Pilot Program
Answer Sheet



Action Schools! BC

PORTION SIZING

Demonstrate Portion Sizes with real fruit and vegetable examples and measuring devices including plates, bowls, liquid and dry measures.

Demonstrate using canned, fresh and cooked vegetable and fruit examples.

Fruit and Vegetables	One Serving Size
Fresh Fruit or Vegetable	One medium size
Fresh Frozen or Canned Fruit or Vegetable	125 ml or 1/2 a cup
Garden Salad	250 ml or 1 cup
100% Fruit Juice	125 ml or 1/2 cup
Dried Fruit	50 ml or 1/4 cup
Grapefruit	1/2 of one grapefruit
EXAMPLES	
Berries	125 ml or 1/2 cup
Spinach or Lettuce	125 ml or 1/2 cup
Orange (medium size)	1 whole fruit
Dried Cranberries	50 ml
Watermelon	1 melon wedge
Apple (medium size)	1 whole fruit
Nectarine	1 whole fruit
Strawberries	125 ml or 1/2 cup
Potatoes	1 medium size
Raisins	50 ml
Grapes	125 ml or 1/2 cup
Mango	125 ml or 1/2 cup
Salad	250 ml or 1 cup
Frozen Peas	125 ml or 1/2 cup
Banana	1 whole fruit
Tomato	1 medium size or 125 ml or 1/2 cup
Grapefruit	1/2 of whole fruit
Cucumber	125 ml or 1/2 cup
Cantaloupe	1 melon wedge



ACTION SCHOOLS! BC
5-TODAY Pilot Program
5-TODAY Challenge for Students

Record the amount of servings and type of fruit and vegetables you had each day for one week.

Class: _____

Name: _____

	Breakfast	Snack	Lunch	Snack	Dinner	Snack	Daily Total
Monday							
Tuesday							
Wednesday							
Thursday							
Friday							
Saturday							
Sunday							



Action Schools! BC

**ACTION SCHOOLS! BC
5-TODAY Pilot Program**

**AS! BC 5-TODAY Challenge
Charting Results**

Student Name	Average # of fruit & veg. servings each day	Did you eat Breakfast?	Most frequently eaten fruit?	Most frequently eaten vegetable?	Did you eat more cooked, canned or fresh fruit and vegetables?	Are you a 5-TODAY Student? YES / NO
TOTAL:						

Appendix B: Food Frequency Questionnaire



Fruit and Vegetable Food Frequency Questionnaire

Think about what you usually ate last week

•Please think about all the fruits and vegetables that you ate last week. Include those that were:

- Raw and cooked,
- Eaten as snacks and at meals,
- Eaten at home and away from home (restaurants, friends), and
- Eaten alone or mixed with other food

1) Over the past week, how many times per week or day did you drink 100% fruit juice such as orange, apple, grape or grapefruit juice? Do not count fruit drinks like Kool-Aid, lemonade, Hi-C, iced tea, cranberry juice drink and Tang.

<input type="radio"/>								
Never	1-2 X	3-4 X	5-6X	1 X	2X	3X	4 X	5 + times
	/ week	/ week	/ week	/ day				

2) Over the last week, how often did you eat french fries or fried potatoes?

<input type="radio"/>								
Never	1-2 X	3-4 X	5-6X	1 X	2X	3X	4 X	5 + times
	/ week	/ week	/ week	/ day				

3) Over the past week, how often did you eat other white potatoes? Count baked, boiled, and mashed potatoes, potato salad, and white potatoes that were not fried.

<input type="radio"/>								
Never	1-2 X	3-4 X	5-6X	1 X	2X	3X	4 X	5 + times
	/ week	/ week	/ week	/ day				

MORNING

- 4) Think about all the food you ate at your morning meal and snacks over the last week. On how many days did you eat fruit for your morning meal or morning snacks? Count any kind of fruit – fresh, canned, and frozen. Do not count juices.

<input type="radio"/>				
Never	1-2	3-4	5-6	Every day
	days/week	days/week	days/week	

- 5) Think about all the foods you ate at your morning meal and morning snacks. On how many days did you eat vegetables for your morning meal or morning snacks? Count lettuce salads, vegetables in mixtures (i.e. sandwiches, omelettes casseroles, Chinese dishes, stew, stir-fry, soup etc.), tomato pasta sauce and all other raw, cooked and canned vegetables. Do not include white potatoes.

<input type="radio"/>				
Never	1-2	3-4	5-6	Every day
	days/week	days/week	days/week	

LUNCHTIME AND AFTERNOON

- 6) Think about all the foods you ate at lunchtime and for your afternoon snacks last week. On how many day did you eat fruit and lunchtime or for your afternoon snacks? Count any kind of fruit – fresh, canned, and frozen. Do not count juices.

<input type="radio"/>				
Never	1-2	3-4	5-6	Every day
	days/week	days/week	days/week	

- 7) Think about all the foods you ate at lunchtime and for you afternoon snacks. On how many days did you eat vegetables at lunchtime or for you afternoon snacks? Count lettuce salads, vegetables in mixtures (i.e. sandwiches, omelettes casseroles, Chinese dishes, stew, stir-fry, soup etc.), tomato pasta sauce and all other raw, cooked and canned vegetables. Do not include white potatoes.

<input type="radio"/>				
Never	1-2	3-4 X	5-6X	Every day
	Days/week	days/week	days/week	

SUPPERTIME AND EVENING

- 8) Think about all the foods you ate at suppertime and for your evening snacks last week. On how many days did you eat fruit at suppertime or for your evening snacks? Count any kind of fruit – fresh, canned, and frozen. Do not count juices.

<input type="radio"/>				
Never	1-2	3-4	5-6	Every day
	days/week	days/week	days/week	

- 9) Think about all the foods you ate at suppertime and for your evening snacks. On how many days did you eat vegetables at suppertime or for your evening snacks? Count lettuce salads, vegetables in mixtures (i.e. sandwiches, omlettes, casseroles, Chinese dishes, stew, stir-fry, soup etc.), tomato pasta sauce and all other raw, cooked and canned vegetables. Do not include white potatoes.

<input type="radio"/>				
Never	1-2	3-4	5-6	Every day
	days/week	days/week	days/week	

Appendix C: Attitudes & Perceptions Survey



Active Schools BC

FRUIT AND VEGETABLE ATTITUDES & PERCEPTIONS SURVEY

1) How many servings of fruit and vegetables do you think you should eat every day to stay healthy?

2) How would you rate the amount of vegetables and fruit you eat now? Would you say it is

very high
 high
 in the middle
 low
 very low

3) Rate each question on whether you agree, in the middle (neutral), disagree or don't know.

a) Eating fruit and vegetables could help you prevent cancer

Agree
 In the middle
 Disagree
 Don't know

b) Eating fruit and vegetables could help you prevent heart disease

Agree
 In the middle
 Disagree
 Don't know

c) I like the taste of fruit

Agree
 In the middle
 Disagree
 Don't know

d) I like the taste of vegetables

Agree
 In the middle
 Disagree
 Don't know

e) My family eats lots of vegetables and fruit

Agree
 In the middle
 Disagree
 Don't know

f) My friends eat lots of vegetables and fruit

Agree
 In the middle
 Disagree
 Don't know

g) Eating vegetables and fruit makes me feel better

Agree
 In the middle
 Disagree
 Don't know

Appendix D: Twenty four-hour Food Recall Completion Instructions

Collecting 24 Hour Recalls

Explain to the student that you are going to ask them about everything they had to eat and drink yesterday. Begin by asking "What was the first thing you had to eat or drink after you got up yesterday?" Record each food eaten, amount and descriptive information (i.e. type & cut of meat, % of milk products, flavors, brand names etc). Then ask "What was the next thing you had to eat or drink?" Then: "Did you have anything else at that time?" Continue through the day in chronological order, probing the student to recall everything he/she ate including meals, snacks, nibbles, etc.

Don't bias the response by using the term "breakfast" unless the student does. The questions shouldn't suggest what you consider normal eating. Probe often, but gently with comments such as: "Did you eat anything else at that time?"

The following interviewing scripts demonstrate the recommended way to probe for information. Avoid the contrasting terms.

RECOMMENDED	AVOID
"Did you put anything on your toast?"	"Butter and ham on the toast like most people?"
"How was the egg cooked"	"Was the egg fried"
"When was the next time you had something to eat? What did you have? Where were you then? Did you put anything on your muffin?"	"What did you have for you morning snack....a donut, cookies or what?"
"So you made a tuna sandwich and had a glass of milk. What type of bread did you use? How many piece of bread did you use? Could you use these measuring cups to tell me how much tuna was in each sandwich? Did you put anything else on the bread besides tuna filling? Now for the milk; what type of milk was it? Do any of these glasses look the glass you used? How full was it? Did you have more than one glass?"	"A cheeseburger....ok, you probably had a large fries and coke. How you can eat all these greasy foods is beyond my understanding, but so be it"
"What did you eat/drink next? Dinner, ok. Yes, it can be hard to remember one day from the next. Take a minute to remember what was going on around dinner time last night"	"You can't remember! Just come up with what it might have been"
"Did you have anything else before going to be last night?"	"I guess that large supper held you off until bedtime?"



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CANADA'S

Food Guide

**TO HEALTHY EATING
FOR PEOPLE FOUR YEARS
AND OVER**

Enjoy a variety
of foods from each
group every day.

Choose lower-
fat foods
more often.



Grain Products

Choose whole grain
and enriched
products more often.

Vegetables and Fruit

Choose dark green and
orange vegetables and
orange fruit more often.

Milk Products

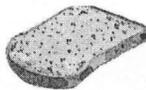
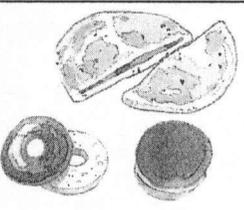
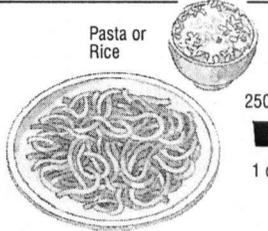
Choose lower-fat milk
products more often.

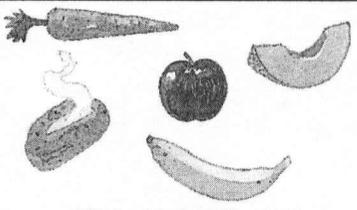
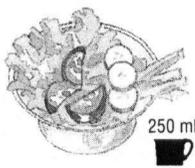
Meat and Alternatives

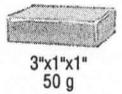
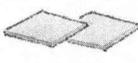
Choose leaner meats,
poultry and fish, as well
as dried peas, beans
and lentils more often.

Canada



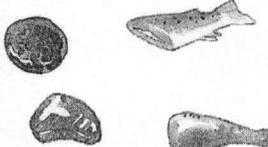
Grain Products 5 – 12 SERVINGS PER DAY	1 Serving  1 Slice  Cold Cereal 30 g  Hot Cereal 175 mL  3/4 cup	2 Servings  1 Bagel, Pita or Bun  Pasta or Rice 250 mL  1 cup
--	---	---

Vegetables and Fruit 5 – 10 SERVINGS PER DAY	1 Serving  1 Medium Size Vegetable or Fruit  Fresh, Frozen or Canned Vegetables or Fruit 125 mL  1/2 cup	 Salad 250 mL  1 cup	 Juice 125 mL  1/2 cup
--	--	---	---

Milk Products SERVINGS PER DAY Children 4–9 years: 2–3 Youth 10–16 years: 3–4 Adults: 2–4 Pregnant and Breast-feeding Women 3–4	1 Serving  250 mL  1 cup	 Cheese 3"x1"x1" 50 g  2 Slices 50 g	 175 g  3/4 cup
--	--	--	--

Other Foods

Taste and enjoyment can also come from other foods and beverages that are not part of the 4 food groups. Some of these foods are higher in fat or Calories, so use these foods in moderation.

Meat and Alternatives 2 – 3 SERVINGS PER DAY	1 Serving  Meat, Poultry or Fish 50-100 g  Fish 1/3-2/3 Can 50-100 g  1-2 Eggs	 Beans 125-250 mL  100 g  1/3 cup	 Peanut Butter 30 mL 2 tbsp
--	---	--	--

Different People Need Different Amounts of Food

The amount of food you need every day from the 4 food groups and other foods depends on your age, body size, activity level, whether you are male or female and if you are pregnant or breast-feeding. That's why the Food Guide gives a lower and higher number of servings for each food group. For example, young children can choose the lower number of servings, while male teenagers can go to the higher number. Most other people can choose servings somewhere in between.



Consult *Canada's Physical Activity Guide to Healthy Active Living* to help you build physical activity into your daily life.

Enjoy eating well, being active and feeling good about yourself. That's **VITALITY**.

*Appendix F: FFQ Conversions to Determine the Number of Times
Fruit and Vegetables were Consumed per Day*

(adapted from:

<http://riskfactor.cancer.gov/diet/screeners/fruitveg/scoring/bymeal.html>)

Frequency Response	Times Per Day
Never	0.0
1-2 days per week	0.214
3-4 days per week	0.5
5-6 days per week	0.786
1 time per day	1.0
2 times per day	2.0
3 times per day	3.0
4 times per day	4.0
5 times per day	5.0