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Editorial

Schools represent a unique setting for the promotion of fruit and vegetable intake in children: they reach large captive audiences and provide many opportunities to improve nutrition, including formal learning, feeding, as well as other activities such as cooking and gardening. In addition, school-based fruit and vegetable promotion programmes can in many cases be practical and implemented at low costs but they have to compete with other priorities in increasingly crowded curricula.

One important lesson learnt from other areas of public health point to the importance of creating an enabling environment within which public health can be promoted. It is thus important that an enabling school environment for fruit and vegetable consumption by children be generated. In developed countries, this might include a range of interventions from the inclusion of sufficient funding and policies for schools to provide adequate school food services including local fruit and vegetables, to reduced access to 'junk food' in schools to make the 'healthier choice' easier for children and consistent practice (at least in the school) of nutrition education lessons.

Evidence on the effectiveness of school-based interventions to promote fruit and vegetable intake (mostly from developed countries) indeed points to the benefits of comprehensive, multi-faceted approaches that include a long follow-up, increased exposure to fruit and vegetables among the whole school community, teacher training, integration within the curriculum, leadership and encouragement by peers and the school food service staff, and parents' involvement at school and at home.

The articles in this 6th issue of the IFAVA newsletter provide insights into nutrition interventions in schools and education to promote fruit and vegetables. Lyne Blanchette and Johannes Brug discusses the determinants of fruit and vegetable consumption among young children and key components of interventions that are effective in increasing intake. Theresa Nicklas then describes the results of the school-based 5-a-day interventions for children and adolescents. Finally, Tom Baranowski discusses how games can be an important medium for reaching children.

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Determinants of fruit and vegetable consumption among six to twelve-year-old children and effective school-based interventions to increase consumption

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This paper presents a review of the determinants of fruit and vegetable consumption among six to twelve year old children, as well as key components for school nutrition interventions aiming at the promotion of fruit and vegetable intake.

What factors determine fruit and vegetable consumption in children?

Evidence from the literature reviewed points to availability, accessibility and taste preferences for fruit and vegetables as the most important determinants in children aged six to twelve years old[1-6]. With regard to taste preferences, humans have certain innate predispositions, such as a preference for sweet and salty, an aversion for bitter and sour tastes, and possibly a tendency to readily learn to prefer tastes of energy-dense foods and to reject new, unfamiliar foods[7, 8]. On the other hand, most of these predispositions appear to be alterable via repeated exposure to food (approximately 10 exposures), in a positive social context[7, 9]. Additionally, the use of reward may also affect taste preferences. Indeed, foods given as rewards generally result in increased preference for those foods, while coercing a child to eat a less preferred food in order to obtain a reward can result in a further decreased liking for the food for which a reward is offered.

Other determinants may also be relevant for the consumption of fruit and vegetables for this age group. Parental behaviour (consumption/modeling) and child feeding practices are among these[4, 7, 10]. With regard to the latter, research indicates that highly controlling parenting may have a counter-productive influence on their children's diets, especially their fruit and vegetable intakes[7]. On the other hand, a clear division of feeding responsibilities appears desirable: the adult is responsible for providing appropriate food for the child in a positive environment, and the child is responsible for deciding how much of the food item is eaten[4].

Specific knowledge of the five-a-day intake recommendation, as well as food preparation, recognition and asking skills (i.e. abilities to ask parents to buy or prepare a favourite fruit or vegetable) are other relevant correlates of fruit and vegetable consumption[11].

Interventions to increase fruit and vegetable consumption of children

With regard to school-based interventions, the evidence indicates that a combination of classroom curriculum, parent home component and a school food service component, appears to be most effective[12-19].

Key determinants that should be targeted in a classroom curriculum are asking and preparation skills, as well as specific knowledge of recommended fruit and vegetable intakes. In addition, interventions should be theory-based, target specific behaviours with goal setting and monitoring of changes, include motivational strategies (self-assessments and feedback, discussion on media and social influences), and devote adequate time to nutrition education[20]. Furthermore, hiring staff specifically trained for the program, as opposed to the usual classroom teachers, appears to contribute significantly to the intervention success[16, 17]. Alternative solutions to the hiring and training of outside staff might be the use of interactive multimedia (combining individually tailored messages and entertainment), wherein the content and dose of the intervention is controlled by a computer expert system[14].

The parent-home component should aim to increase availability and accessibility of fruit and vegetables in the home, repeat exposure to fruits and vegetables in positive contexts, with reinforcements, and provide fruit and vegetable preparation skills. Parents should be aware of how taste preferences are developed and the potential positive or negative effects of rewards, the importance of parental consumption/modeling and child feeding practices as well as how to best divide feeding responsibility between adults and children. To date, it appears that the most effective method to involve parents is by having materials sent home to them, preferably in the form of "family homework"[12-14, 16, 21].

A school food service component should especially improve the availability and accessibility of fruits and vegetables (including increased variety, improved taste and portion-size), and repeated exposure to fruits and vegetables in positive contexts, with reinforcements.

Another type of promising school-based interventions are fruit and vegetable provision or subscription programs[10, 26-28].

Conclusions

Interventions should improve the availability and accessibility of fruit and vegetables to children, and should aim to improve their taste preferences for them. Such interventions should be of a multi-component nature, school-based and may include multi-media channels.

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5 A Day Initiative: School-based Interventions for Children and Adolescents

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Background of the 5 A Day Initiative

It has been approximately 15 years since the National Cancer Institute (NCI) instituted the National 5 A Day for Better Health Program to encourage Americans to eat 5 to 9 servings of fruits and vegetables every day[1]. This initiative is a public-private partnership between the NCI and the Produce for Better Health Foundation and includes federal, state and local government agencies, industry and volunteer organizations. The community component of the program attempts to reach consumers at the local level through a variety of mechanisms, including the development of coalitions.

Overview of 5 A Day Research

The research component of the 5 A Day Initiative is an extension of the community component. When this initiative began, the NCI funded nine research studies in 1993 to be conducted at worksites, schools, churches, and food assistance programs[1, 2]. The studies targeted specific channels (e.g., schools) and target populations (e.g., fourth-grade school children) for interventions designed to increase the consumption of fruit and vegetables. All of the interventions were based on one or more theories of behavior changes. Four projects targeted elementary school students in grades 4 and 5 (Alabama, Georgia, California, Minnesota), one program targeted high school students (Louisiana), one program targeted WIC participants (Maryland), three programs targeted worksites (Arizona, Massachusetts, Washington) and one program targeted adults through black churches (North Carolina). A number of countries have now adapted the "five-a-day" message. Since the completion of these intervention studies in 1997, scientists have made great strides in expanding behavior change research efforts targeting increased fruit and vegetable consumption of specific populations. Since the initiative began, there have been numerous research studies conducted in schools, communities, worksites, churches, supermarkets, and with large-scale populations. There are several articles that provide an excellent review of these studies[3, 4].

School-based interventions – What have they shown?

There have been a large number of school-based studies conducted with children and adolescents since 1993[5-20], predominantly randomized controlled trials. A majority of the studies were developed based on Social Cognitive Theory with very few using a combination of behavioral theories. Although the population widely targeted was 4th and 5th grade students, there were large variations in sample size and number of schools. Among these 16 programs conducted in Europe and in the USA, two studies selected Boy/Girl Scouts as their target audience ("Girl Scouts Eat 5" (Texas) (1997)[11] and "5-A-Day Achievement Badge" (Texas) (2002)[13]) and none of the studies were conducted with preschool children. The intervention of choice included a curriculum, cafeteria component, and parental involvement. The length of the intervention and the content of the curriculum varied across the studies. There were a few intervention activities common across a number of studies, including taste testings, meal/recipe preparation skills and increased availability of FV. A particularly innovative approach was tested in two studies using a multimedia game [Squire's Quest (Texas) (2003)][16] and a six-minute video episode [Food Dudes Healthy Eating Programme (UK) (2004)][14]. The most commonly used behavioral change techniques were role modeling, self-monitoring, goal-setting and problem-solving. Despite these noble efforts, most of the FV school-based interventions have not been especially successful. The obtained effect size ranged from 0.2 servings to 1.68 servings; majority being around 0.4 to 0.5 serving. The interventions appeared to be more successful in changing F consumption, particularly in school meals. Very little was shown in altering FV consumption in the home, which may reflect the very low dose of parental involvement. For most of the multi-component interventions, it is unknown what caused most of the change in FV consumption and which of the "multi-components" really did work.

Two studies used a single component intervention: "Cafeteria Power Plus" (Minnesota) (2004)[17] and "Squire's Quest" (Texas) (2003)[16]. The cafeteria intervention ("Cafeteria Power Plus" Program) produced no significant intervention effect on FV consumption. However, the multimedia game ("Squire's Quest" Program) resulted in a 1.0 serving increase in FV consumption. Although the success of these interventions has been modest, we have come a long way since this initiative started 15 years ago. We have a better understanding of what does not work and maybe we need to refocus on trying to understand "why children eat the foods they do"[21]. Understanding and intervening on the mediating variables related to FV consumption may be needed to successfully impact children's FV consumption.

Conclusion

The classical "classroom, cafeteria, and parent" approach used in the past may need to be updated. Innovative, state of the art, channels for helping children and their families increase their FV consumption are indicated. We may need to move away from theory driven interventions all together[22]; or, at the very least consider interventions that combine a number of behavioral theories.

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Playing to Change: Games, Comics, Fruit and Vegetables

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Getting children to eat more fruit and vegetables has been challenging[1]. New methods are needed to get past student resistance to these behaviors. Electronic games are a medium that engage large numbers of children on almost a daily basis, often for several hours[2], and most children report enjoying playing games[3].

Squire's Quest! was an interactive multimedia computer game in which behavior change procedures were inserted to promote eating more fruit and vegetables[4]. Ten sessions of approximately 25 min each were offered twice a week for 5 weeks. Each session addressed skills (e.g. decision making, recipe preparation, problem solving), knowledge, goal setting, food self schema and related components[4]. These behavior change components were inserted within a fun storyline wherein the child agreed to become a knight to help King Cornwell and Queen Nutritia fight invaders who were destroying the kingdom by destroying the fruit and vegetables, the source of energy.

Twenty six elementary schools were recruited to participate; 1578 4th grade students participated. Schools were randomly assigned to treatment and control groups. Four days of diet assessment were conducted before and after the 5 week intervention. At the end of 5 weeks, the treatment group was eating one more serving of fruit or vegetables per day than the control group, after controlling for baseline differences[4].

Similar kinds of programs have been developed for at risk of overweight 8 year old African American girls after a 4 week summer day camp program[5]; and for a Boy Scout 5 A Day badge program[6].

Electronic games provide attractions to engage the child and focus their attention; and provide a medium into which behavior change principles and procedures can be inserted[7]. Electronic games offer an important channel for reaching large numbers of children. We are only in the earliest stages of learning how to capitalize on these strengths for promoting fruit and vegetable intake.

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