The Global Fruit & Veg Newsletter

n° 65

July/August 2021

Supports the

INTERNATIONAL YEAR OF FRUITS AND VEGETABLES 2021

SCHOOL-BASED INTERVENTIONS TO INCREASE FRUIT AND VEGETABLES CONSUMPTION: EFFICACY, SUCCESS AND CHALLENGES

Throughout the last decades considerable scientific evidence has shown that comprehensive school-based interventions for children are key for community obesity prevention efforts and for child´s health , by improving healthy behaviors where increasing fruit and vegetables (F&V) consumption is a top priority.

In the context of the International Year of Fruit and Vegetables (2021) this edition presents 3 contributions which explore the impact of school-based interventions for children.

The first article summarized by Cyrille Costa, based on the publication of Dabravolskaj *et al.*, highlights that researchers and scientific experts do not have the same priorities as policy-makers. Although health and education professionals have identified seven types of school-based interventions, there isn´t available evidence to guide the decision-making. One of the most common type of school based interventions studied by researchers are the ones which combines diet and physical activity. These are also the ones where significant positive effects on fruit intake has been found, but not on vegetable intake.

The second review of Yoong SL *et al.* showed that intervention strategies that incorporated behavior change techniques (BCTs) problem solving and action planning may be the most useful to support schools with implementing healthy canteen policies. These BCTs target the main reported barriers to healthy canteen policy implementation and could be delivered via a range of implementation support strategies including training, academic detailing and consensus processes.

The third article written by Verdonschot A *et al.* explores the role of caregivers' health promotion behaviours (HPB) in influencing healthy eating behaviours in primary school children and whether caregivers' HPB contribute to programme effectiveness of two widely implemented Dutch nutrition education programs: "EU-Schoolfruit" and "Taste Lessons". They conclude that caregivers' positive health promotion behaviour is associated with higher fruit and vegetables intake and nutrition knowledge in children. Moreover, children with less encouragement to eat healthily at home potentially benefit more from school-based nutrition education programmes than children receiving more encouragement.

The findings from these studies provide information that can be useful to enhance efforts in schools to promote healthier behaviours. They support the use of comprehensive interventions that address physical activity and nutrition, that incorporate behavior change techniques to improve the implementation of school-based nutrition policies and the important role of the home environment in supporting healthy eating behavior in children, particularly to increase fruit and vegetables.

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Effectiveness of school-based health promotion interventions

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The prevalence of childhood overweight and obesity has increased in developed countries over the past 30 years. The known causes include lack of physical activity and a diet of poor nutritional quality. In response to this situation, several countries have focused their efforts and resources on school-based interventions targeting these two causes[1]. However, health and education professionals consider that certain interventions should be given priority. Canadian researchers have examined the effectiveness of each type of intervention in light of the priorities set by health and education professionals[2].

Priority given to interventions combining diet and physical activity

Health and education professionals have identified the following seven types of school-based interventions, classified in order of priority:

- Priority 1: Interventions based on the comprehensive school health approach, combining actions focusing on physical activity, sedentary behaviours and a healthy diet;
- Priority 2: Interventions aimed at changing school nutrition policies;
- Priority 3: Interventions encouraging children to take part in the production and preparation of food;

- Priority 4: Interventions to increase provision of healthy foods in schools with the support of producers;
- Priority 5: Interventions aiming to modify the existing physical education classes;
- Priority 6: Interventions promoting extracurricular physical activities;
- Priority 7: Interventions addressing the foods/drinks sold and/or served in schools.

An analysis of the scientific literature published between 2001 and 2020 found 66 interventions carried out in 18 countries*. Twenty-nine of them combined several of these strategies.

Researchers and scientific experts do not have the same priorities as policy-makers

The three most common types of interventions identified in the publications were as follows:

- those classified as Priority 1 based on a comprehensive approach to health at school (18 interventions),
- those classified as Priority 5 aiming to modify physical education classes (18 interventions),
- those combining several types of interventions (29 interventions).

Very few of the studies focused on Priority 2 and 3 inter-ventions (with one and two interventions, respectively). This illustrates the gap between the available evidence and the evidence needed to guide decision-making.

Effects specific to each type of intervention

Priority 1 and 2 interventions had significant positive effects on fruit intake (an increased intake of more than 0.13 and 0.30 servings per day, respectively) but not on vegetable intake. This is consistent with other data showing that fruit is preferred and convenient to eat between meals[3,4].

Priority 1 and 5 interventions, and those combining several strategies, were effective for reducing the risk of obesity (reduction in BMI of 0.26, 0.16 and 0.18 points, respectively). Even slight changes in BMI point to a slowdown in the rate of increase in BMI, which is important for preventing obesity[5,6].

Priority 1 interventions had a positive effect on step-counts per day. No results were found with the other on types of interventions, possibly due to a lack of engagement on the part of students and staff, an absence of training for teachers, and poor compliance with protocols.

The data from this literature analysis suggest that policy-makers and local stakeholders should collaborate with researchers to identify and implement interventions with the aim of choosing those that are the most effective.

According to: Julia Dabravolskaj, et al. Effectiveness of school-based health promotion interventions prioritized by stakeholders from health and education sectors: A systematic review and meta-analysis. Prev Med Rep. 2020. DOI: 10.1016/j.pmedr.2020.101138

* United States, Australia, Canada, Denmark, Spain, United Kingdom, Norway, New Zealand, Germany, Ireland, Italy, Switzerland, France, Belgium, Sweden, South Korea and Israel.

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Behavior change techniques associated with the implementation of healthy canteen policies in primary schools?

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Globally, dietary risk factors are the leading cause of preventable death and disability[1]*. The implementation of dietary guidelines in schools are recommended as a strategy to improve child public health nutrition*[2]*. As such, many jurisdictions have introduced school-based policies to ensure availability of healthier items and beverages, and thus improve child diet*[3]*. However, few schools implement such policies consistently*[4]*. Effective strategies to support schools with implementing nutrition policies needed. According to a Cochrane systematic review, multicomponent interventions, including a combination of strategies such as materials, educational meetings, educational outreach visits, etc is effective to help support schools implement nutrition polices*[5]*. However the specific components of such interventions that are most useful to support schools with implementing nutrition policies remains unknown.*

This study therefore aims to examine which behavior change techniques (which provides an indication of the active components of interventions) primarily targeting canteen managers are associated with school's healthy canteen policy implementation in one state (New South Wales) in Australia. The healthy canteen policy "Fresh Tastes @ School" was a mandatory policy for implementation by all government schools in NSW, Australia. It supports the provision of products consistent with the Australian Dietary Guidelines. The policy requires schools to provide primarily "healthier" (green) food options and remove "unhealthy" (red) food items. As part for the policy, primary schools were required to remove all "red" (less healthy items: nutrient-poor, high-energy items, such as confectionary, deep-fried items, and chocolate coated or premium ice creams) or "banned" (like sugar-sweetened beverages) items from regular sale and ensure that "green" (healthier items that provide good sources of nutrients) dominated the menu (>50%).

This study used data from 199 primary schools participating in three school-based randomized controlled trials in New South Wales, Australia. The three trials assessed the impact of a "high", "medium", and "low" intensity intervention primarily targeting canteen managers on schools' implementation of a healthy canteen policy[6,7,8]. A total of 19 behavior change techniques (BCTs) were employed across the trials, delivered via a range of implementation support strategies. This included implementation support, consensus processes, performance monitoring and feedback, academic detailing, training, tools and resources, recognition, marketing strategies and executive support. (Table 1). The interventions primarily targeted canteen managers as those responsible for planning menus and providing food and beverages consistent with the guidelines. A cross-sectional regression analysis was used to identify which behavior change techniques were associated with increasing 'healthier' foods and reducing 'unhealthy' foods separately.

Table 1: Examples of providing of BCTs incorporated into the interventions

Behavior change technique	Examples
1. Goal setting (behavior)	Canteen managers were supported to develop goals to increase implementation of the policy.
2. Problem solving	Project officers worked with canteen managers to support analysis of the problem, address any barriers and to support problems solving.
3. Action planning	Project officers supported canteen managers to develop specific plans (including specific information on frequency, duration and intensity) to implement the policy.
4. Review behavior goals	A feedback report detailing policy implementation was provided to schools to support reviewing goals and discussions with a project officer was undertaken to develop modified goals or strategies.
5. Discrepancy between behavior and goal	The feedback report and implementation support highlighted the discrepancies in implementation and behavior with the goal of healthy canteen policy implementation.
6. Feedback on behavior	The feedback report and implementation support were used to provide feedback on implementation behaviour.
7. Self-monitoring of behavior	A feedback report was provided up to four times in a year to allow canteen mangers to continue to monitor implementation behavior.
8. Feedback on outcomes of behavior	The project officers explored the impact of changes on other aspects of the school nutrition environment and provided this feedback to canteen managers.
9. Social support (unspecified)	Parents, principals and other members of the school community's support and feedback was solicited via marketing approaches and during consensus processes.
10. Instruction on how to perform behavior	An implementation plan was developed with specific resources and instructions on how to support policy implementation. This was also provided via training, academic detailing and project officer support.
11. Information about antecedents	The project officer provided this information and explored the barriers and enablers to implementation of the policy.
12. Information about social and environmental consequences	Written and verbal resources were provided that outlined the consequences of not implementing the policy and poor diet in children generally.
13. Demonstration of the behavior	Canteen managers were provided with sample menus that were compliant with the policy requirement. Case studies of successful implementation were also provided throughout the intervention.
14. Social comparison	The feedback report benchmarked individual school's policy implementation against all those participating in the trial.
15. Information about others approval	Feedback from others in the school community (e.g. parents and principals) were solicited and provided to canteen managers.
16. Behavioral practice	The project officers supported canteen managers with reading nutrition labels and using this to classifyf food and beverage items according to the policy categories (i.e. green, red).
17. Material reward (behavior)	Schools were provided with kitchen equipment for engaging with intervention strategies.
18. Nonspecific reward	Schools were provided with certificate and acknowledgement of compliance if they met all the requirements of the policy.
19. Adding objects to the environment	Visual posters outlining food classifications and the Australian dietary guidelines posters were displayed in food preparation areas.

Behavior change techniques significantly related with having no "red" or "banned" items and having more than 50% "green items" in the menu

We found different BCTs were associated with different implementation outcomes.

In our analysis, the strongest behavior change techniques associated with having no 'red' or 'banned' items were: problem solving, goal setting (behavior), and review behavior goals.

For having primarily healthier items ("green") the BCTs "problem solving", "instruction on how to perform the behavior", and "demonstration of the behavior" were the strongest, while "social comparison" and "discrepancy between current behavior and goals" had a negative relationship with the outcome.

According to this study, intervention strategies that incorporated BCTs problem solving and action planning may be the most useful to support schools with implementing healthy canteen policies. These BCTs target the main reported barriers to healthy canteen policy implementation and could be delivered via a range of implementation support strategies including training, academic detailing and consensus processes. Further this study highlighted a number of BCTs that need to be better considered in relation to delivery of feedback (e.g. social comparison and discrepancy between current behavior and goals). These findings provide insight to inform future efforts to improve the implementation of school-based nutrition policies.

Based on: Yoong SL, et al. An exploratory analysis to identify behavior change techniques of implementation interventions associated with the implementation of healthy canteen policies. Transl Behav Med. 2021 May 5.

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Caregivers' role in the effectiveness of nutrition education on healthy eating behaviour in children: Results of a Dutch evaluation study

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Healthy eating behaviour in early childhood is important for growth, development and may protect against several diseases later in life[1]. However, in many developed countries, most children do not adhere to the guidelines for a healthy diet[2]. Therefore, nutrition education programs are developed to support healthy eating in children, but data on successful components of such programs is limited[3]. The current study includes secondary analyses of data from an evaluation study on two widely implemented Dutch nutrition education programs 1) EU-Schoolfruit and 2) Taste Lessons, published elsewhere4 and examined the role of caregivers' health promotion behaviours (HPB) in influencing healthy eating behaviours in primary school children (n = 1460, aged 7–12 years) and whether caregivers' HPB contribute to programme effectiveness.

Children's nutrition knowledge, fruit and vegetables intake and caregivers' HPB (fruit and vegetables/sugar-sweetened beverages/sweets provision to take to school, cooking together and talking about healthy food at home) were measured by child-reported questionnaires at baseline, during, and 6 months post-programme.

Caregivers' health promotion behaviour associated with children's fruit and vegetables intake and nutrition knowledge

Results indicated that caregivers' HPB was positively associated with children's healthy eating behaviours. For example, children who received fruit and vegetables frequently from home to take to school reported a significantly higher fruit and vegetables intake and had higher nutrition knowledge scores than children who received fruit and vegetables less frequently (see Table 1). This positive association was also found for sugar-sweetened beverages (SSBs) and sweets, with higher fruit and vegetables intake and nutrition knowledge if they received it less frequently. Further, children who helped with cooking at home more often reported higher fruit and vegetables consumption and nutrition knowledge, compared to children who infrequently helped with cooking. Similarly, a positive association was found between talking about healthy eating at home and fruit and vegetables intake and nutrition knowledge.

Contribution of the home environment to the effectiveness of nutrition education programs

The health promotion behaviour (HPB) results were categorised in 'low HPB', indicating children with caregivers who scored low in HPB (e.g., providing sweets ranging from every day up to 2-3 times a week), and 'high HPB', indicating children with caregivers who scored high in HPB (e.g., providing sweets ranging from never up to 1-2 times a week). Results indicated that programme effectiveness on fruit and vegetables intake in children was highest in those in the lower HPB subcategory.

In conclusion, caregivers' positive health promotion behaviour (HPB) is associated with higher fruit and vegetables intake and nutrition knowledge in children. Moreover, children with less encouragement to eat healthily at home potentially benefit more from school-based nutrition education programmes than children receiving more encouragement. This highlights the important role of the home environment in supporting healthy eating behaviour in children

Table 1. Association between caregivers' health promotion behaviour (HPB) and children's fruit and vegetables (FV) intake and nutrition knowledge, at baseline (T0)

		Total FV Intake, g/Day/Student		Nutrition Knowledge, Score	
Caregivers' HPB	N [a] (%)	Mean (SD)	B [b]	Mean (SD)	B [b]
FV provision	1382				
Never	164 (12)	214 (220)	ref	2.79 (0.829)	ref
1/week	138 (10)	307 (266)	93 **	2.94 (0.735)	0.15 **
2–3/week	177 (13)	357 (291)	143 **	2.90 (0.818)	0.11 **
3–4/week	269 (19)	333 (272)	119 **	3.10 (0.773)	0.31 **
Every day	634 (46)	357 (257)	143 **	3.04 (0.825)	0.25 **
SSBs provision	1367				
Never	552 (40)	343 (283)	ref	3.03 (0.798)	ref
1/week	156 (12)	402 (249)	59 **	3.01 (0.815)	−0.02
2–3/week	139 (10)	383 (278)	40	3.01 (0.727)	−0.02
3–4/week	110 (8)	350 (274)	7	3.05 (0.827)	0.02
Every day	410 (30)	268 (228)	−75 **	2.91 (0.857)	−0.12 **
Sweets provision	1373				
Never	455 (33)	334 (254)	ref	3.08 (0.816)	ref
1/week	340 (25)	364 (285)	30 *	2.95 (0.781)	−0.13 **
2–3/week	253 (18)	357 (260)	23	2.99 (0.792)	−0.09 *
3–4/week	147 (11)	299 (253)	−35	3.03 (0.789)	−0.05
Every day	178 (13)	255 (262)	−79 **	2.80 (0.876)	−0.28 **
Help with cooking	1374				
Never	157 (11)	261 (231)	ref	2.77 (0.832)	ref
Sometimes	746 (54)	304 (243)	43 *	2.98 (0.833)	0.21 **
1/week	106 (8)	374 (280)	113 **	3.17 (0.663)	0.40 **
2–3/week	130 (10)	414 (303)	153 **	3.31 (0.718)	0.54 **
3–4/week	78 (6)	370 (285)	109 **	3.03 (0.796)	0.26 *
Every day	157 (11)	396 (307)	135 **	2.85 (0.755)	0.08
Talking about food	1377				
No	300 (22)	270 (244)	ref	2.76 (0.818)	ref
Sometimes	747 (54)	326 (264)	56 **	3.00 (0.800)	0.24 **
Yes	330 (24)	396 (275)	126 **	3.16 (0.793)	0.40 **

* $p < 0.05$, ** $p < 0.01$. [a] = N is number of students; [b] = B indicates the difference in FV intake or nutrition knowledge for the HPB variables, compared to the reference (unstandardised).

Based on: Verdonschot, A., et al (2021). Caregivers' Role in the Effectiveness of Two Dutch School-Based Nutrition Education Programmes for Children Aged 7–12 Years Old. Nutrients, 13(1), 140.

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