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How to promote
fruit and **vegetable** consumption
in **schools:** a toolkit

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Abstract

Schools are a key environment to teach children healthy eating, thus helping them to form long-term positive dietary behaviours. School-based interventions can reach large groups of children of all social classes, and messages learned may be taken home to impact behaviours in the family and elsewhere. As children often consume at least one meal or snack at school, eating healthily in these meals reinforces their healthy eating knowledge and behaviour. This policy toolkit aims to support the EU Action Plan on Childhood Obesity 2014-2020, particularly the area for action 'Promote healthier environments, especially in schools and pre-schools'. This area aims to establish children's health as a priority at schools and has as one of its objectives to increase daily consumption of fresh fruit and vegetables.



How to promote fruit and vegetable consumption in schools: a toolkit

Using this toolkit and its content

This toolkit should be seen as a guide and a source of inspiration for starting actions in schools to promote fruit and vegetable intake among children and adolescents. Here below are its key messages and how to use the toolkit to address them.

1. Consider which intervention and which components are appropriate for your school setting, the age and population group(s) you are targeting.

- Consult *Tables 1-3* for education, environment and parental components extracted from interventions that have increased fruit and vegetable intake in children or adolescents.
- Refer to our overview of original studies (*Annex III*, online only: link on *p. 6*) to select those matching your components of choice and consult it for further insights into study design, implementation, effect sizes, etc.

2. Consider using multiple intervention components.

- Combining efforts at education, environment and parent level ups the chances for the intervention to be effective.
- Again, you can refer to *Tables 1-3* for tested intervention components and the detailed overview (*Annex III*, online only: link on *p. 6*) to see how previous interventions have combined them successfully.

3. Plan and implement the intervention thoroughly.

- Define your stakeholders; consult *Table 4* and *Table 5* for expert views and experiences regarding key stakeholders and how to engage them.
- Anticipating challenges, preparing contingency plans, and delivering the intervention faithfully, all contribute to the success of the intervention; consult *Table 6* and *Table 7* for feasibility and sustainability issues as well as potential side effects and equity concerns related to these types of interventions.

4. Make time for proper evaluation.

- Evaluation needs to be planned in advance; it is linked to the activities, outputs and indicators identified during the design phase of the intervention and will likely require baseline measurements and data.
- Evaluating the outcome as well as the process helps define the extent of success and offers insights for improvement, thus promoting intervention durability. Evaluation tools are freely available; *Table 8* provides an example of how to use them. Use our *Additional resources* section for more guidance and examples.

5. Still have questions?

Contact us at jrc-nutrition@ec.europa.eu.



Why promote fruit and vegetable consumption in children and adolescents?

Fruits and vegetables are core ingredients in healthy eating. They provide 'vitamins and minerals, dietary fibre and a host of beneficial non-nutrient substances including plant sterols, flavonoids and other antioxidants.'¹ Sufficient daily intakes of fruit and vegetables (see *Infobox*) can help prevent non-communicable diseases (NCDs) such as cardiovascular disease, diabetes, and certain types of cancer. Considering the growing prevalence of these diseases and childhood overweight and obesity, it is important to include fruits and vegetables in children's diets, replacing energy-dense, nutrient-poor foods where appropriate.

A diet lacking in fruit and vegetables is associated with an increased NCD risk. An estimated 5.2 million deaths worldwide were attributed to low fruit and vegetable intake in 2013.² Worryingly, only 1 in 3 girls and 1 in 4 boys aged 15 years reported eating at least one piece each of fruit and vegetable daily in 21 EU Member States in 2009-2010³ (see *Figure 1*). Consequently, gains from improved fruit and vegetable consumption could be huge for individual and public health as well as for healthcare systems and the overall economy.

Infobox: WHO recommendations

'As part of a healthy diet low in fat, sugars and sodium, WHO suggests consuming more than 400 g of fruits and vegetables per day to improve overall health and reduce the risk of certain NCDs.'¹

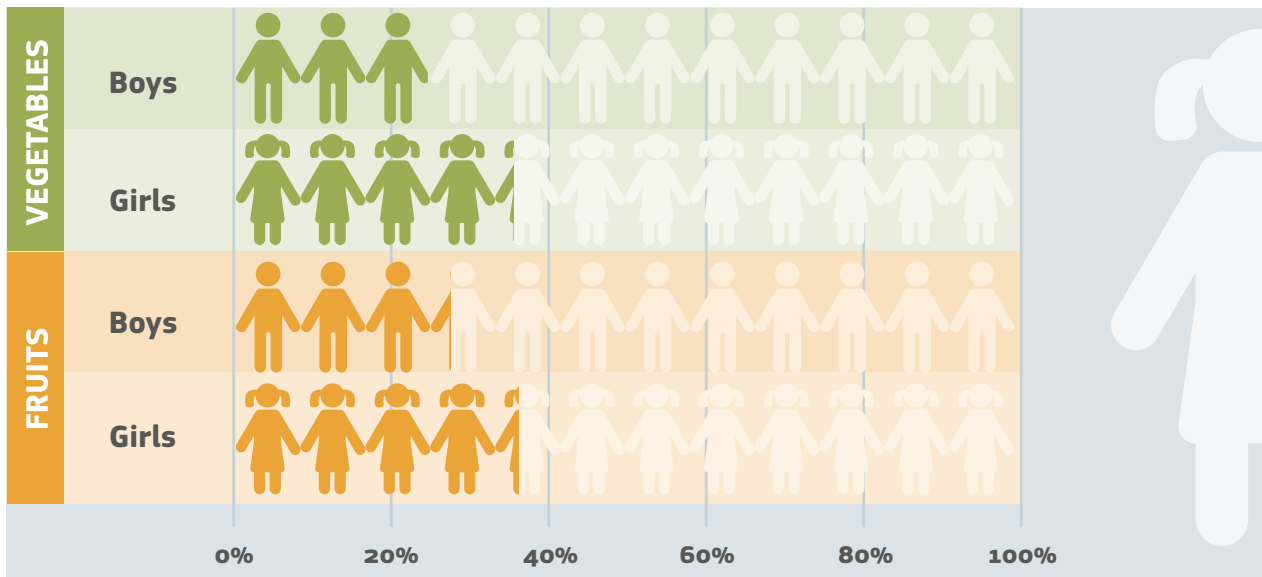


Figure 1. Daily fruit and vegetable eating among 15-year-olds, 21 EU countries, 2009-10.³ Percentage of boys and girls aged 15 that eat at least one piece each of fruit and vegetable daily.

1. World Health Organisation (WHO). http://www.who.int/elena/titles/fruit_vegetables_ncds/en/. These recommendations are for adults; nonetheless WHO states that 'advice on a healthy diet for infants and children is similar to that for adults' and does not specify any different figures for children.
2. Global Burden of Disease Study 2013. https://www.healthdata.org/sites/default/files/files/research_articles/2015/GBD2013_RiskFactors_TheLancet_o.PDF.
3. OECD, 'Fruit and vegetable consumption among children', in *Health at a Glance: Europe 2012*, OECD Publishing. <http://dx.doi.org/10.1787/9789264183896-22-en>.



Why intervene in schools?

Schools are a key environment to teach children healthy eating, thus helping them to form long-term positive dietary behaviours. School-based interventions can reach large groups of children of all social classes, and messages learned may be taken home to impact behaviours in the family and elsewhere. As children often consume at least one meal or snack at school, eating healthily in these meals reinforces their healthy eating knowledge and behaviour.



Aims of this toolkit

This toolkit aims to support the *EU Action Plan on Childhood Obesity 2014-2020 (Action Plan)*, particularly the area for action entitled 'Promote healthier environments, especially in schools and pre-schools.' This area establishes children's health as a priority at schools and has as one of its objectives to increase daily consumption of fresh fruit and vegetables.⁴

This toolkit aims to provide policy-makers with:

- Successful measures to promote fruit and vegetable consumption in schools
- Support in implementing and evaluating these measures in schools

The process applied to achieve these aims is depicted in *Figure 2*.

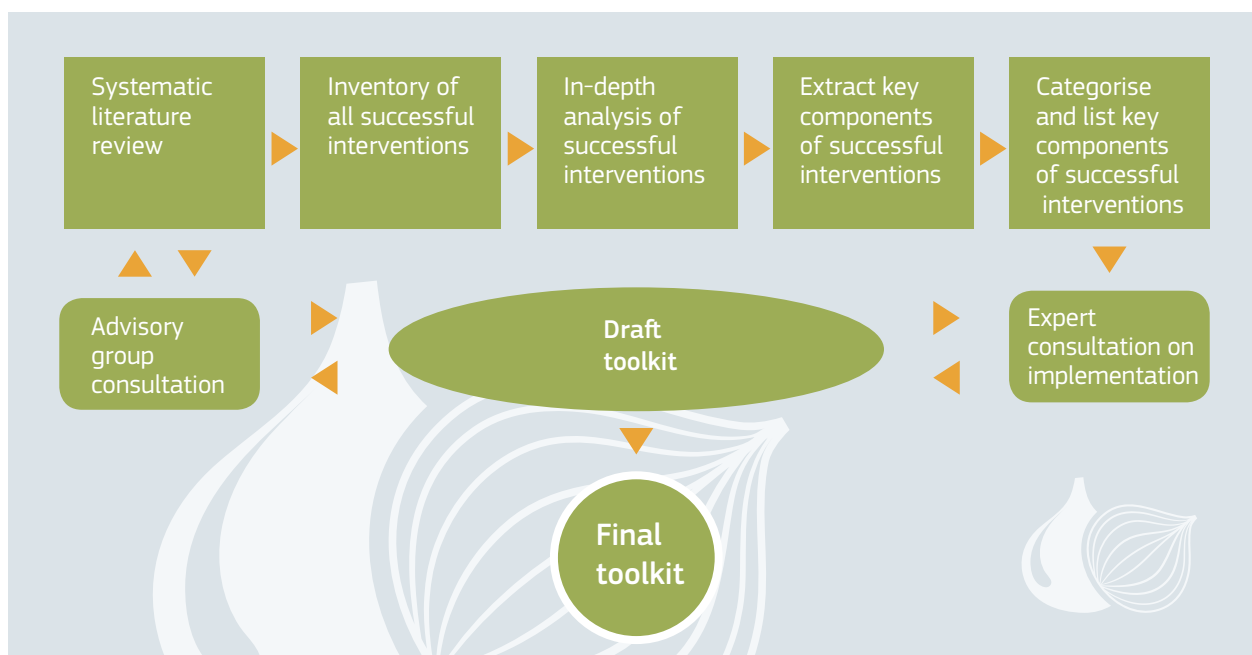


Figure 2. Process workflow used in the preparation of this policy toolkit.

4. EU Action Plan on Childhood Obesity 2014-2020. http://ec.europa.eu/health/nutrition_physical_activity/docs/childhoodobesity_actionplan_2014_2020_en.pdf.



What measures work to increase fruit and vegetable consumption in schools?

The *Tables 1 to 3* below list individual components of effective school-based interventions to increase fruit and vegetable consumption in children and adolescents. These measures were identified through an exhaustive analysis of the scientific literature (see *Annex 1* for details). Interventions were deemed effective or successful if they achieved significant increases in fruit or vegetable intake based on statistical analysis. For reporting purposes, the various components of these interventions are categorised into education (*Table 1*), environment (*Table 2*), and parental/family components (*Table 3*).

Table 1. *Education components* of school interventions that led to increased fruit and vegetable (FV) consumption in children or adolescents (3-18 years).*

Classroom-based learning	Experiential learning	Games and competitions (± rewards and incentives)	Behaviour change approaches
<p>Dedicated lessons Explicitly teaching children about nutrition, healthy eating and the importance of FV</p> <p>Cross curricular Embedding healthy eating topics when teaching other subjects</p> <p>Homework Reinforcing healthy eating messages from lessons</p> <p>Videos/movies/DVDs Delivering healthy eating messages using multimedia</p> <p>Printed materials for children and parents Take-home information sheets/newsletters to reinforce healthy eating messages learned from lessons</p> <p>Web-tools Using web-based instruments to engage children with healthy eating information</p>	<p>School gardens Learning about FV through planting seeds and plants, maintaining school gardens</p> <p>FV tasting sessions Encouraging children to try new FV by tasting variety of FV</p> <p>Food preparation/creating recipes Learning to prepare snacks and meals with FV</p> <p>Food shopping Learning to shop for healthy foods, including FV and reading food labels</p>	<p>Board and computer games Interactive games to learn about healthy eating</p> <p>Quizzes Testing children's knowledge on healthy eating/FV learned from lessons</p> <p>Music Singing, rapping and song writing competitions</p> <p>Shopping games</p>	<p>Role models Including peers and cartoon characters</p> <p>Goal setting Targets set by children/teachers/parents to improve FV intake</p> <p>Individual feedback Receiving feedback on FV eating behaviour using web-tools or diary</p>

* In this toolkit, education components are those that target school children directly.



Table 2. *Environment components** of school interventions that led to increased fruit and vegetable (FV) consumption in children or adolescents (3-18 years).*

Availability of FV	Education of school staff	Changes at point of purchase (POP) or consumption (POC)
<p>Free distribution of FV At lunch or break</p> <p>Subscription to FV Paid for by parents</p> <p>Increase variety, choice and attractiveness of FV offered Provide wide range of options; include unusual FV to stimulate children's curiosity; FV cut up and served in age-appropriate portion sizes</p> <p>Modification of school meals Increase FV content of meals</p>	<p>Teachers Training teachers to deliver lessons on healthy eating to children through seminars, workshops (train the trainer model); encouraging teachers to promote a healthy eating environment for children beyond the lessons and continue lessons post intervention</p> <p>Catering staff Educating catering staff on the importance of healthy eating and ways to incorporate more FV into school meals and to engage children</p>	<p>Additional information at POP and POC To raise awareness of healthfulness of meals/food products</p> <p>Audit and evaluation of food/catering services For example on nutritional quality of meals and snacks provided to children</p> <p>Content modification of vending machines and tuck shops To reduce or eliminate snacks high in fat, salt and sugar and include (more) FV or foods made thereof</p> <p>Architectural changes Modify the display of products to enforce positive behaviour</p>

** In this toolkit, environment components are those that target the environment of the school, including school staff but not students.

Table 3. *Parental/family components*** of school interventions that led to increased fruit and vegetable (FV) consumption in children or adolescents (3-18 years).*

<p>Parents evenings and information sessions Inform parents of interventions or initiatives on healthy eating</p> <p>Homework with children Reinforce healthy eating messages learned from lessons</p> <p>Parent involvement in activities at school Fund raising, sports day, making cook book, cooking with children</p> <p>Information material Provided through recipes, gadgets, websites for parents</p> <p>Parental role modelling Encouraging parents to eat more FV and inspire their children to mimic their behaviour</p> <p>Home food preparation with children Encouraging parents to teach children about cooking and food preparation at home</p>
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*** In this toolkit, parental/family components are those that involve parents to reinforce the school intervention.

The majority of effective school-based interventions considered here adopt a multi-component approach (see *Figure 3*); they combine components from the education theme with components from the environment theme to reinforce the learning of healthy eating through changes to the school environment. Parental support is commonly sought to extend effects beyond the school setting.

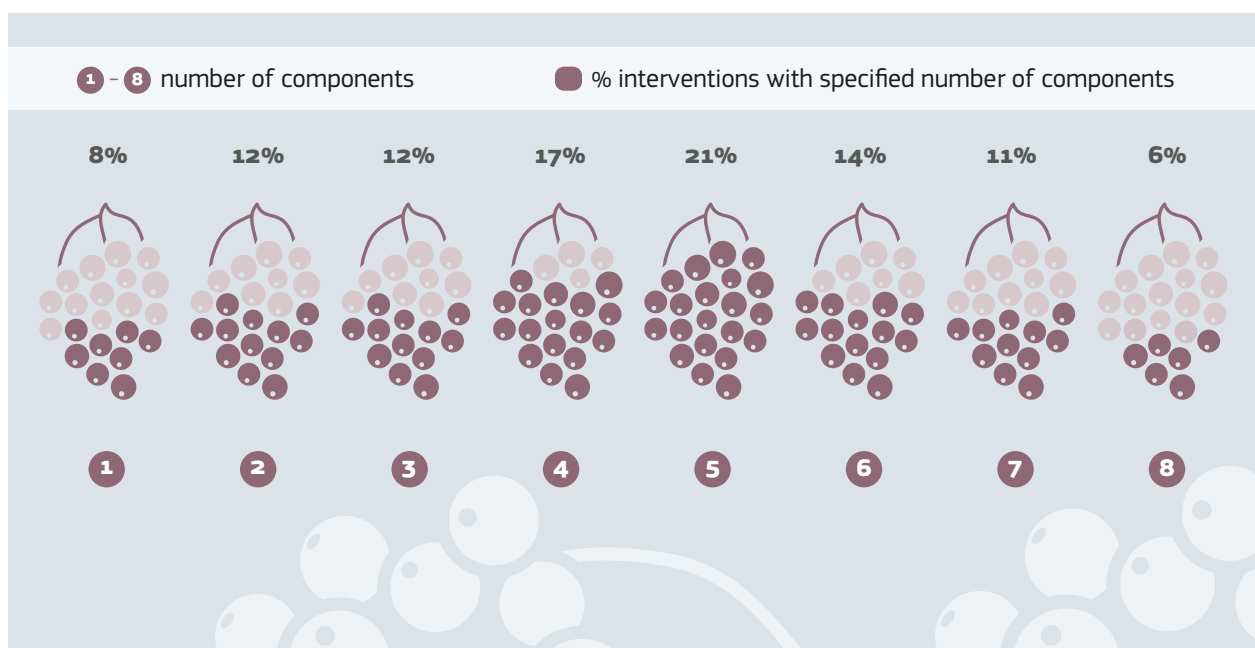


Figure 3. Breakdown of analysed, effective interventions (n=66) by number of components used.

A strategy where multiple components from the above tables are used in parallel in schools ups the chances for the intervention to be successful. Detailed descriptions of how these measures have been implemented and evaluated in successful school-based interventions can be found in *Annex III* (online only: <http://publications.jrc.ec.europa.eu/repository/handle/JRC100990>).

Implementing and evaluating school-based interventions to promote fruit and vegetable consumption

The components listed in the tables above have successfully increased fruit and vegetable intake in children and adolescents. The success of an intervention is however not solely based on its content; it is possible that the same components have also been reported and used in comparable, yet unsuccessful interventions. A well designed and executed implementation is vital; this section discusses several implementation issues and offers suggestions and learnings from national public health experts (see *Annex II* for interview details).

One major focus should be on engaging the right stakeholders. *Table 4* and *Table 5* provide expert opinions on who these stakeholders are, likely resistance issues, and how to gain their support. The age of the target group and the context of the schools (e.g. school size, human and financial resources, existing facilities and infrastructures, access to local resources and learning facilities) need consideration, too. Other feasibility issues—including limiting and leveraging factors to the success of the interventions—as well as equity and sustainability issues and potential side effects are detailed in *Table 6* and *Table 7*.



Table 4. Which stakeholders to consider for school-based, educational fruit and vegetable (FV) interventions and how to engage them?⁵

Stakeholders	Resistance/issues	Gaining their support
Kindergarten and school staff: including teachers and headmasters	<ul style="list-style-type: none"> • School staff role is not to teach nutrition or healthy eating habits to children and may lack basic training on nutrition • Lack of time and resources • May not see the importance of teaching kids healthy eating over e.g. maths, reading and writing • Sometimes moral dilemma of talking about healthy food and knowing children have little access to it or not being able to provide it 	<ul style="list-style-type: none"> • Provide time and competence by having externals to educate both the teachers and children, and allow them to do fun activities together. Barrier is starting such an initiative, but once over the first hurdle it will become easier • Administrative burden needs to be low • Communication strategy between project leader (e.g. nutritionist) and teachers
Ministry of Education/ School Education Board	<ul style="list-style-type: none"> • Challenge of introducing additional information in an already overcrowded curriculum 	<ul style="list-style-type: none"> • Best thing would be for national education authorities to run intervention; they have best channels and dialogue with schools • Use other subjects (e.g. languages, mathematics, etc.) to integrate FV education • Programme details need to link with school and national education priorities • Financing staff and school facilities
Health professionals: including school doctors, nurses, nutritionists and dieticians	<ul style="list-style-type: none"> • Lack of time 	<ul style="list-style-type: none"> • School nurses could deliver education sessions on healthy eating and nutrition to children (with agreement between Ministries of Health and Education).
School gardeners, landscape planners and caretakers		<ul style="list-style-type: none"> • Gardeners and caretakers of parks etc. may be happy to set up school gardens and educate children; a matter of finding time to work with schools
Private sector, e.g. food business operators	<ul style="list-style-type: none"> • Need to be careful about which actors to include; potential issue of indirect marketing 	
Parents and families	<ul style="list-style-type: none"> • Tend to rely on lay health information, often from internet, where they encounter information which is not evidence-based. Consequently, parents sometimes ask for <i>'healthier'</i> alternatives to be offered by the school that are not necessarily in line with evidence-based guidelines for balanced diet that the school adopted 	
School cafeteria owners, school meal providers, catering staff		<ul style="list-style-type: none"> • Components need to be linked and coherent with overall school environment (healthful food offer within the school and pedagogical aspects – practical learning experience for children) • FV taste and quality of meals must give credibility to educational message. Serving poor quality FV is counterproductive
Other stakeholders include: regional, municipality, local government; .../...		

5. Information collated from semi-structured interviews with national representatives from public health or education institutions of various EU Member States. See *Annex II* for interview structure details.



Table 4. (Cont.)

Stakeholders	Resistance/issues	Gaining their support
<p>.../... Local community; primary production sector, including local farmers; social security funds, health insurances; other national authorities including Ministry of Health and Ministry of Agriculture; NGOs, organisations who run projects for children at school and kindergarten</p>		<p>Abbreviations: FV: fruit and vegetable NGO: non-governmental organisation</p>

Table 5. Which stakeholders to consider for school-based, environmental fruit and vegetable (FV) interventions and how to engage them?⁵

Stakeholders	Resistance/issues	Gaining their support
<p>School cafeteria owners, school meal providers, external caterers, tuck shop owners, food industry</p>	<ul style="list-style-type: none"> • School cafeteria owners object if intervention affects profit • Public Private Partnerships (PPP) – conflict of interest (e.g., suppliers/sponsors of FV who also produce foods considered treats) • Vendors (food vans) around school can provide HFSS foods near the school gates 	<ul style="list-style-type: none"> • Pay cafeteria owners respect, give them visibility feature online where changes were implemented; remain available for questions (hotline) • Communications strategy between project leader and cafeteria owners to resolve issues
<p>School canteens</p>	<ul style="list-style-type: none"> • Challenge of clarifying principles and financial issues 	<ul style="list-style-type: none"> • Keep decisions under governance of schools/school canteens
<p>School staff (all people in school; management; all teachers)</p>	<ul style="list-style-type: none"> • Handling of food may only be allowed by personnel who have certified competence for work with food; teachers are excluded from this handling • Issue of commitment of time, resources and/or budget; need good arguments on why they should promote healthy eating habits to students • Headmasters' engagement is needed to conduct the interventions, but also to set the agenda 	
<p>Parents and children</p>	<ul style="list-style-type: none"> • Difficult for parents to engage in school-based activities (clash with work, time issue) • Some parents resist the policy • Campaign where children and students prepare healthy meal together often only attracts the same interested families 	<ul style="list-style-type: none"> • Provide parents with online and printed information, to consider in their own time
<p>Government and other authorities working together</p>	<ul style="list-style-type: none"> • Funding and financing FV provision or school meals • Need them to include FV topic in teaching 	
<p>Other stakeholders include: local farmers; non-governmental organisations; community environment (e.g. school zoning, food vans); health inspectors</p>		<p>Abbreviations: FV: fruit and vegetable HFSS: high fat, sugar and salt PPP: public-private partnership</p>

5. Information collated from semi-structured interviews with national representatives from public health or education institutions of various EU Member States. See *Annex II* for interview structure details.



Table 6. What other factors to consider when implementing education interventions to increase fruit and vegetable (FV) consumption in children?⁵

Feasibility issues: limiting factors	Feasibility issues: leverage points	Intervention sustainability issues	Equity issues	Potential positive side effects	Potential negative side effects
<p>Lack support from national education department</p> <p>Schools overburdened with curriculum, unable to prioritise healthy eating interventions or decide which available programme is useful</p> <p>Limited resources (both human and financial)</p> <p>Lack of motivation by staff</p> <p>Language barrier (in some countries)</p>	<p>Demonstrate that the intervention improves academic performance</p> <p>Translation of education material and use imagery and easy language</p> <p>Develop national nutrition strategy linked to other strategies; needs to be acted on and kept updated</p> <p>Appropriate teacher training essential</p> <p>Health education needs appropriate time allocation within the curriculum beyond the occasional seminars</p> <p>School environment important to enhance health literacy and knowledge acquired in class</p>	<p>Legal acts (but also national strategies and action plans) help by making implementation and continuity obligatory</p> <p>Demonstrate why interventions are important; they contribute to children's learning and quality of school</p> <p>Make it easy for schools to implement interventions</p> <p>Information needs to be easy to read and understand; translate scientific findings so can be understood by everybody</p>	<p>School-based interventions can reach all children</p> <p>Consider the language barrier to be able to reach immigrant families</p> <p>Social and economic problems get higher priority than nutrition</p> <p>Ethical issue of teaching children about healthy foods whilst knowing that not all children will have access to these</p> <p>Challenge for teachers to talk about health and nutrition to obese children; risk of stigma and shaming</p> <p>Schools have different facilities with varying teaching quality, which may deepen inequalities</p>	<p>Educating children on health, environmental and societal issues together, e.g. experiential learning – farm visits and school gardens</p> <p>Collaboration between teachers of different subjects</p> <p>Stronger collaboration between schools and health sector</p> <p>Positive impact on the family and broader community</p>	<p>Focusing solely on obesity, slimness, and appearance</p> <p>Teachers to work overtime for the intervention (also lack support from their employers)</p> <p>Unintentional deepening of health inequities, if health education is not targeted to needs of all groups involved (including marginalised groups)</p>

5. Information collated from semi-structured interviews with national representatives from public health or education institutions of various EU Member States. See *Annex II* for interview structure details.



Table 7. What other factors to consider when implementing environment interventions to increase fruit and vegetable consumption in children?⁵

Feasibility issues: limiting factors	Feasibility issues: leverage points	Intervention sustainability issues	Equity issues	Potential positive side effects	Potential negative side effects
<p>Insufficient funding</p> <p>Scarce time</p> <p>Inadequate management of resources (human, financial)</p> <p>Intervention fatigue – schools are asked to undertake many interventions to solve social issues</p> <p>General interventions (with some flexibility to adapt) can be inclusive, build momentum and enthusiasm but tend to cost more than targeted interventions</p> <p>Virtual (online) programmes may cut costs but schools need to have digital infrastructure and may risk missing out on experiencing and enjoying taste, texture and interaction in real life (offline)</p>	<p>School Fruit Scheme (SFS) and its continuity</p> <p>Demonstrate that intervention has positive impact in similar settings, that it is fun and can be run easily</p> <p>To include teachers in environment interventions beyond the classroom</p>	<p>Clear funding mechanism (at EU, national or local level) is needed</p> <p>Improving accessibility of FV in children is attractive to authorities – the arguments can be strengthened by including an environmental/ climate perspective</p>	<p>Socio-economic (SE) determinants are important. Need to increase education of parents; provide better housing, improve the quality of communities and neighbourhoods</p> <p>Provision of free school meals has a positive impact on narrowing SE differences in lifestyle and health, as accessibility to FV differs depending on SE groups. Schools have the opportunity to reach all children in all SE groups of society</p> <p>Intervention delivery to be adapted according to age and gender of children, e.g. frequency, timing and amount of FV provided</p>	<p>Stimulate interest in growing own FV, school gardens, cooking</p> <p>Raising awareness; healthy dietary habits development</p>	<p>Conflicts between the positive messages learned at school and the home environment, i.e. no FV available at home, particularly in lower SE households</p>

Abbreviations:
 FV: fruit and vegetable
 SE: socio-economic
 SFS: school fruit scheme

5. Information collated from semi-structured interviews with national representatives from public health or education institutions of various EU Member States. See *Annex II* for interview structure details.



Evaluation is needed to assess how well an intervention has been conducted, whether it has delivered the intended results and to determine its overall success. Two types of evaluations are to be considered:

- 1) **Outcome evaluation:** assesses whether the intervention has been effective and has led to the intended effect or change. Uses quantitative measures to determine effectiveness; for example, by measuring and comparing fruit and vegetable consumption at baseline and post intervention in the intervention and control group.
- 2) **Process evaluation:** assesses whether an intervention was implemented as planned. This type of evaluation can explain why the intervention works and if/what particular components of the intervention contributed to the outcomes.

The RE-AIM framework⁶ and other similar tools^{7,8,9} can be used to evaluate the intervention process. *Table 8* exemplifies how an evaluation can be done in the case of a simple school lessons based programme to increase fruit and vegetable consumption.

Table 8. An example of a RE-AIM framed evaluation of a school-based education intervention to increase fruit and vegetable consumption.

RE-AIM components	Description ⁶	Example(s) in a lesson-based education programme	Additional Comments
REACH	The absolute number, proportion, and representativeness of individuals who are willing to participate in a given initiative, intervention or programme	<ul style="list-style-type: none"> • Number and percentage of children attending (all) the lessons planned in the programme • Characteristics and representativeness of children taking part in the lessons/programme 	A detailed characterisation of children will allow for an evaluation that is sensitive to gender or SES differences
EFFECTIVENESS	The impact of an intervention on important outcomes , including potential negative effects, quality of life, and economic outcomes	<ul style="list-style-type: none"> • A measure of F&V intake (e.g. objective measure of consumption of F&V) • Intention to consume or self-reporting of consumption) before and after the intervention • Children's knowledge about content delivered (see Implementation at individual level below) 	A measure of the learning by the pupils in this case will be important and should be looked at in the implementation evaluation
ADOPTION	The absolute number, proportion, and representativeness of settings and intervention agents (people who deliver the programme) who are willing to initiate a programme	<ul style="list-style-type: none"> • Number and percentage of schools/teachers/classes adopting the programme • Characteristics and representativeness of schools/teachers/classes that adopted the programme 	Participation rate and characteristics of adopters vs non adopters can provide useful information

6. About RE-AIM: http://www.re-aim.hnfe.vt.edu/about_re-aim/what_is_re-aim/.

7. Linnan & Steckler, 'Process evaluation for public health interventions and research: an overview', in *Process Evaluation for Public Health Interventions and Research*, edited by Steckler A, Linnan L, San Francisco: Jossey-Bass, 2002, 1-23.

8. Grant *et al*, *Trials*, 2013, 14:15: <http://dx.doi.org/10.1186/1745-6215-14-15>.

9. Androutsos *et al*, *Obesity Reviews*, 2014, 15:74-80: <http://dx.doi.org/10.1111/obr.12185>.



Table 8. (Cont.)

RE-AIM components	Description ⁶	Example(s) in a lesson-based education programme	Additional Comments
IMPLEMENTATION (at setting level)	Implementation refers to the intervention agents' fidelity to the various elements of an intervention's protocol, including consistency of delivery as intended and the time and cost of the intervention	<ul style="list-style-type: none"> • Number of lessons delivered • Programme duration • Observation of the lessons to evaluate fidelity to protocol (content, children's interest) • Questionnaire to teachers/pupils to evaluate fidelity to protocol • Time spent preparing and delivering the lessons • Costs associated with delivering the lessons 	Investigating on the need for adaptation of materials; facilitators and barriers as well as aspects of the lesson that worked well or less well are other important aspects to consider
IMPLEMENTATION (at individual level)	Implementation refers to clients' use of the intervention strategies	<ul style="list-style-type: none"> • Number of tests or homework given • Test results and homework quality 	
MAINTENANCE (at setting level)	The extent to which a programme or policy becomes institutionalized or part of the routine organizational practices and policies	<ul style="list-style-type: none"> • Will the programme be repeated next school year? 	
MAINTENANCE (at individual level)	Maintenance has been defined as the long-term effects of a programme on outcomes after 6 or more months after the most recent intervention contact	<ul style="list-style-type: none"> • Re-assess effectiveness (a measure of F&V intake as above) six months after the last lesson was delivered 	

From evidence to action

The school-based measures to promote fruit and vegetable consumption presented in this toolkit as (a list of) successful interventions are based on a systematic and transparent literature search and selection of reviews. The effects of interventions by age, gender or socio-economic status are not reported in this summary document. However, *Annex III* (online only: <http://publications.jrc.ec.europa.eu/repository/handle/JRC100990>) holds information about individual interventions, the respective target groups, and effect sizes observed. Summarising the amount of evidence considered here required pragmatic decisions and judgements on what evidence to include and how to interpret and report it. It inevitably includes judgements made by the authors of the original publications and of the systematic reviews as well as by ourselves and our interviewees. Many of the systematic reviews considered for the writing of this report conclude that there is 'mixed evidence' in favour of one or another intervention; while some studies illustrated strong findings in improving children's fruit and vegetable intake, some did not. Moreover, of those that showed positive intervention effects, many were only assessed or sustained for the duration of the intervention.

Policymakers must make decisions based on available evidence. Often public health interventions of sufficient scale and design to produce strong evidence are not feasible, resulting in a high level of uncertainty. Uncertainty about the potential impacts of policy decisions does not necessarily mean, however, that decisions and actions should not be



taken. As suggested by some,^{10,11} theory, causal models and observational evidence can be used within a transparent decision-theory approach to support rational public health-related decisions. Careful and continuous tailored monitoring and evaluation of the interventions implemented will then further inform the decision of sustaining their format.

Closing remarks

It is our hope that this toolkit will help decision-makers to take actions in developing appropriate interventions to improve fruit and vegetable consumption in children and adolescents. Guiding children to develop healthy eating behaviour from an early age can lead to profound health impact in later life. School is a key setting for children to learn about, engage in and thus practice healthy eating. This toolkit presented examples of tried and tested methods to increase fruit and vegetable intake of children and adolescents at school. Well-planned and implemented interventions coupled with appropriate evaluation will increase the chances of success in bringing positive changes to children's eating behaviour.

Additional resources

Web resources cited in this document

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Selected relevant EU projects

- JANPA (Joint Action on Nutrition and Physical Activity) – <http://www.janpa.eu>.
- I.Family (Investigating the determinants of food choice, lifestyle and health in European children, adolescents and their parents) – <http://www.ifamilystudy.eu>.
- IDEFICS (Identification and prevention of Dietary – and lifestyle – induced health Effects In Children and infantS) – <http://www.ideficsstudy.eu>.
- TOYBOX (Multifactorial evidence based approach using behavioural models in understanding and promoting fun, healthy food, play and policy for the prevention of obesity) – <http://www.toybox-study.eu>.
- ENERGY (European Energy balance Research to prevent excessive weight Gain among Youth) – <http://www.project-energy.eu>.
- NUTRIMENTHE (The effect of diet on the mental performance of children) – <http://www.nutrimenthe.eu>.
- EU SFVS (EU School Fruit and Vegetable Scheme) – http://ec.europa.eu/agriculture/sfs/index_en.htm.

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Author contributions

Tsz Ning Mak and Stefan Storcksdieck genannt Bonsmann contributed to the conception and design of the project, acquisition, analysis and interpretation of data, and drafted and revised the toolkit.

Sandra Caldeira contributed to the conception and design of the project, acquisition of data, and drafted and revised the toolkit.

Jan Wollgast contributed to the conception and design of the project and revised the toolkit.

All authors read and approved the final toolkit.



ANNEX I

Identifying effective public health interventions to increase fruit and vegetable consumption in children and adolescents

ABSTRACT

This is the protocol for an overview of successful public health interventions to increase fruit and vegetable consumption in (pre-)school-age children and adolescents. The specific objectives of this overview were to: a) identify systematic reviews (SRs) of interventions to increase the consumption of fruit and vegetables in children and adolescents (ages 3 to 18 years); b) extract from the SRs the interventions that demonstrated positive effects; and c) systematically summarise the measures used in those successful interventions.

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RESEARCH QUESTION

What concrete interventions are effective to increase the consumption of fruit and vegetables in children and adolescents (3 to 18 years)?

OBJECTIVES

The objectives were to:

1. Search the published literature for systematic reviews (SRs) and meta-analyses—hereafter collectively referred to as SRs—of interventions to promote fruit and vegetable consumption in children and adolescents (ages 3 to 18 years).
2. Extract those interventions that demonstrated positive effects, including information about the actual intervention and the effect size.
3. Systematically describe the measures used in successful interventions.
4. Provide information on cost and resources of interventions if available.

DESCRIPTION OF THE INTERVENTIONS

Interventions were classified according to the component(s) used. The focus was on interventions that were at least partly school-based, *i.e.* implemented in schools by teachers or hired personnel. This kind of programme ensures the participation of the children and gives the opportunity to combine different activities in one place that is a reference for the children.

LITERATURE SEARCH

INCLUSION CRITERIA FOR SRs

Types of reviews

We included SRs for the assessment of our main objective. Key characteristics of SRs are:^a

- A clearly stated set of objectives with pre-defined eligibility criteria.
- An explicit, reproducible methodology.
- A systematic search that attempts to identify all studies that would meet the eligibility criteria.
- An assessment of the validity of the finding of the included studies, such as risk of bias assessment.
- A systematic presentation and synthesis of the characteristics and findings of the included studies.

Only SRs rated 5 to 10 using the Health Evidence Quality Assessment Tool (HE-QAT)^b were included in this overview to guarantee a minimum quality of the results.

Types of participants

We only included interventions targeting children and adolescents aged 3 to 18 years. We considered evidence from developed countries worldwide (defined by the World Bank criteria^c). If a SR included studies from both developed and developing countries, it was included in the data extraction.

a. <http://handbook.cochrane.org>.

b. http://theevidence.org/documents/our-appraisal-tools/QA_tool&dictionary_18.Mar.2013.pdf.

c. <http://www.worldbank.org>.



Types of interventions

Bearing in mind the focus on school-based interventions, we included SRs that evaluated any intervention or combination of interventions designed to increase the amount of fruit and vegetables in the diet of children and adolescents (3-18 years).

Inclusion criteria

- Focused on interventions that modified the main outcome, namely fruit and vegetable consumption in children and adolescents (3-18 years).
- Scored 5 to 10 according to HE-QAT.
- Included interventions implemented in developed countries (if a SR included studies from both developed and developing countries, this SR was included in the data extraction).
- Included interventions targeting healthy and/or overweight/obese children.

Exclusion criteria

- SRs focussing on children with specific diseases or conditions with the exception of overweight and obese children and adolescents.

Types of outcomes

Fruit and/or vegetable intake: change in consumption (servings, portions, grams); change in biomarkers of fruit and vegetable intake. As this is the main objective of this review of SRs, we included those papers from SRs in which the intervention had any effect on the intake of fruit and vegetables in children and adolescents.

SEARCH METHODS FOR IDENTIFICATION OF SRs

We followed the process detailed here to identify moderate to high quality SRs meeting the inclusion criteria. We searched the Cochrane Database of systematic reviews. In parallel, we searched the HealthEvidence.org database for 'moderate and' 'strong' SRs (having been rated 5 to 10 with HE-QAT) using our search terms. We looked for SRs from the year 2005 up to mid-June 2015 in these two databases.

In addition, we searched other databases (see list below) for SRs published in the 6 months prior to the end of the literature search period (June 2015) to ensure that recent SRs not yet listed in the Health Evidence database were included. The following databases were searched for this purpose:

- PUBMED
- OVID
- CAMPBELL
- ERIC
- ISI Web of Knowledge
- EMBASE

The search string used for all databases was the following:

(child* OR adolescent* OR youth OR young OR teen* OR student* OR girl* OR boy* OR pupil* OR school OR schoolchild* OR school-age OR preschool OR primary OR elementary OR secondary OR middle-school) AND intervention* AND (fruit* OR vegetable* OR diet* OR health* OR healthy eating OR nutrition OR food OR school meals) AND ("systematic review" OR "meta-analysis")

DATA COLLECTION AND ANALYSIS

SELECTION OF THE SRs

After applying our search strategy across the selected databases, we used the following 3-step selection process:

1. After removing duplicates we performed an initial screening by reading the title and abstract of all selected SRs.
2. Then we identified those SRs within the scope of the intervention approach and outcome (measuring changes in the intake of fruit and vegetables)
3. We excluded both SRs that did not have fruit and vegetable intake as a primary focus and SRs within the scope but considered of 'weak' strength according to HE-QAT.

We retrieved the full-text versions of those SRs that met the inclusion criteria (based on the title and abstract only). Two reviewers screened all full texts. Where there were differences of opinion, a third reviewer reviewed the paper and a consensus decision was taken between the three reviewers.

We assessed publications identified by the primary searches of relevance using the Health Evidence Relevance Tool for review articles as a pre-screening step consistent with Health Evidence methodology.^d SRs that were not on the Health Evidence database were rated using the HE-QAT and only those scoring 5 or higher retained.

Our search was limited to SRs published from 2005 to mid-June 2015.



PRISMA flowchart of the process for selecting Systematic Reviews (SR) and original publications to be included in the data extraction and synthesis.

d. http://healthevidence.org/documents/our-appraisal-tools/Relevance_tool&dictionary_18.Mar.2013.pdf.

e. Annex III (online only: <http://publications.jrc.ec.europa.eu/repository/handle/JRC100990>).



QUALITY OF THE INCLUDED SRs

All included SRs underwent a methodological quality assessment. In case a SR was not retrieved from the Health Evidence database, the HE-QAT score was computed and the SR discarded if it did not rate as 'moderate' or 'strong' (score 5 to 10).^f

QUALITY CHECK OF THE SELECTION OF SRs

An initial quality check was applied prior to the full selection of the SRs for data extraction to ensure a common understanding of the selection criteria. In this check, a reviewer different from the one who selected the SRs by title and abstract for inclusion reviewed 10% of the SRs to compare differences in inclusion criteria between reviewers. Based on this discussion, consensus was reached about the interpretation of the inclusion or exclusion criteria.

DATA EXTRACTION AND MANAGEMENT

Having selected all SRs that met the inclusion criteria, we identified 66 interventions analysed in the SR that effectively increased fruit and vegetable consumption in children and adolescents (ages 3 to 18 years).⁹ Interventions were deemed effective if they achieved significant increases in children's fruit or vegetable intake based on statistical analysis. Detailed information was compiled about the intervention measures used—including a thematic grouping into education, environment and parent/family measures—as well as the results for each outcome considered.

DATA SYNTHESIS

Two types of data synthesis tables were prepared from the selected effective school-based interventions. One contains detailed descriptions of the interventions, a rough categorisation of the study components used, the results, and references to the source publications.⁹ The other offers a detailed categorisation of the measures grouped by theme as follows.

- Education (4 subcategories; see *Table 1*)
 - Classroom-based information
 - Experiential learning
 - Games/competitions (+/- rewards)
 - Behaviour change approaches
- Environment (3 subcategories; see *Table 2*)
 - Availability of FV
 - Education of staff
 - Changes at Point of Purchase (POP)/Point of Contact (POC)
- Parental/family involvement (see *Table 3*)

All effective interventions can be searched and filtered by theme(s) of interest using an integrated filtering system.⁹

f. http://healthevidence.org/documents/our-appraisal-tools/Relevance_tool&dictionary_18.Mar.2013.pdf.

g. Annex III (online only: <http://publications.jrc.ec.europa.eu/repository/handle/JRC100990>).



ANNEX II

Questionnaire for semi-structured interviews with national public health experts

We conducted eight semi-structured telephone interviews with national representatives from public health or education institutions of various EU Member States to gather their views and experiences on a number of implementation issues associated with school-based interventions for promoting fruit and vegetable intake. Four of the interviews were related to education components of school-based interventions that targeted fruit and vegetable consumption behaviour in children (Sweden, Austria, France and Croatia), and four were related to environment interventions (Malta, Slovakia, Norway and Ireland). The box below illustrates the standard questions presented to the interviewees.

1. What are the stakeholders that you consider important to involve in this type of interventions?
2. Are there any acceptability issues that one should consider vis-a-vis the stakeholders identified above?
3. Can you envisage resistance from any of them? Can it be overcome?
4. And what about support? Who would be the main supporters?
5. Is it feasible to conduct the intervention in the context of your country/region/municipality?
Yes – any comments?
No – why not?
Yes, BUT (please state limiting factors and leveraging factors)
6. Is it feasible to conduct the intervention in the context of your country/region/municipality?
Yes – any comments?
No – why not?
Yes, BUT (please state limiting factors and leveraging factors)
7. Can we assume this type of interventions to be sustainable in the context of your country/region/municipality?
Yes – any comments?
No – why not?
Yes, BUT (please state limiting factors and leveraging factors)
8. Can you identify putative side effects (beneficial or harmful) for this type of school based interventions?
9. Linked to all above, apply the equity lens on this type of interventions, e.g. any gender or socio-economic status effects we should consider?

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