School-based nutrition education: lessons learned and new perspectives

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Abstract

Nutrition is a major environmental influence on physical and mental growth and development in early life. Food habits during infancy can influence preferences and practices in later life and some evidence suggests fair to moderate tracking of food habits from childhood to adolescence. Studies support that good nutrition contributes to improving the wellbeing of children and their potential learning ability, thus contributing to better school performance. Children and young people who learn healthy eating habits, are encouraged to be physically active, to avoid smoking and to learn to manage stress, have the potential for reduced impact of chronic diseases in adulthood. Nutrition education is a key element to promoting lifelong healthy eating and exercise behaviours and should start from the early stages of life; it should also address the specific nutritional needs associated with pregnancy, including reinforcing breastfeeding.

Food habits are complex in nature and multiple conditioning factors interact in their development. Young children do not choose what they eat, but their parents decide and prepare the food for them. During infancy and early childhood the family is a key environment for children to learn and develop food preferences and eating habits. As they grow and start school, teachers, peers and other people at school, together with the media and social leaders, become more important. Progressively children become more independent and start making their own food choices. The peer group is very important for adolescents and has a major influence in developing both food habits and lifestyles.

Community trials suggest that nutrition education is an accessible effective tool in health promotion programmes with a focus on the development of healthy eating practices.

Keywords

Children’s food habits
Nutrition education
School meals
Evaluation

School based nutrition education

The settings approach has become popular in health promotion. This approach recognizes that there is a valuable opportunity to influence health through policy measures and education within specific settings such as schools, workplaces, hospitals or cities. Schools provide the most effective and efficient way to reach a large segment of the population, including young people, school staff, families and community members.

School-based nutrition education should: (a) address the needs and interests of students, the teachers and the school; (b) be relevant to programme goals; (c) take into account what children already know and can do; (d) be culturally appropriate; (e) be delivered in a way children can understand and teach the skills and knowledge required to improve or strengthen healthy eating habits.

Identifying perceived needs and barriers to healthy dietary behaviour contributes to adequate programme development. Student input by focus groups can be useful in this respect. Student focus groups in the Gimme 5 programme reported lack of availability, lack of variety and inconsistency in taste as main barriers to increasing consumption of fruits and vegetables. The importance of making nutrition messages developmentally appropriate and delivering specific behavioural advice to help children make informed food choices has been emphasized.

Identification of students’ as well as teachers’ attitudes towards and perceptions of food and nutrition, including motivation, is an important element in the early stages of programme development. In a study carried out in the UK key motivators for healthy eating among children and adolescent boys were identified as sports, being strong and achievement of better performance, while girls...
reported personal appearance as the main factor. In this study key reported factors influencing children and adolescent food choices were availability of ready to eat food, taste, perceived filling quality and appealing packaging. The Take Five programme in the UK identified perceived practical opportunities to increase consumption of fruits and vegetables either as part of a main meal or a snack. In line with this, evaluation of school-based programmes aimed at improving consumption of fruit and vegetables or reducing cardiovascular risk factors, which incorporated an environmental-policy component, showed that effective policies to facilitate a positive school environment (including school food service) can contribute to the success of school-based nutrition education programmes. Tailoring interventions to individual characteristics, level of dietary intake, risk of poor nutrition, readiness to change, self-efficacy and sociodemographic aspects can enhance effectiveness.

Theoretical background for behaviour change

Previous literature reviews have identified educational strategies which are theory driven, with clear behavioural focus among the elements conducive to successful programmes. Recent evaluations of school-based nutrition education programmes, implemented mostly in the USA and also in some European countries, also support this idea. Framework models often referred to include the Social Cognitive Theory as described by Bandura, which emphasizes a strong behavioural component as well as environmental and individual aspects, reinforcing self-efficacy and decision making skills. A number of studies use the Stages of Change model defined by Prochaska and DiClemente to identify characteristics of study group and design matched intervention strategies accordingly. Consciousness raising, social liberation, emotional arousal and self-re-evaluation are relevant processes of behaviour change for people in pre-action stages. Increased awareness may contribute to a shift from pre-contemplation or contemplation stage to preparation as reported by Nicklas TA and colleagues. Several studies use a combination of theories as background construct, particularly adding the PRECEDE planning model (Predisposing, Reinforcing and Enabling Causes in Educational Diagnosis and Evaluation).

Components of School-based nutrition education programmes

Several successful programmes consider a multiple component prevention model, beginning in elementary school and extending to high school. A growing number of these include an environmental element in the strategy influencing the quality of food provided by school meals. School-based nutrition education should focus not only on the provision of nutrition information, but also on the development of skills and behaviours related to areas such as food preparation, food preservation and storage; social and cultural aspects of food and eating; enhanced self-esteem and positive body image and other consumer aspects. All of these areas are conducive to healthier food choices. Recently published successful programmes have included lessons in other subjects (e.g. maths and language). In these studies, teachers were responsible for curriculum implementation and were supported by qualified programme staff. There is a wide array of teaching methods that can be used according to learning objectives: from classroom discussions, worksheets and keeping food records; to shopping exercises, tasting, creating, or drama.

Extra-curricular activities are also challenging. For example, school gardening, developing cooking skills, exhibitions and other workshop activities. Incorporation of self-evaluation and feedback can be effective in interventions for older children. New technologies such as the Internet, the World Wide Web and CD-Roms also provide a chance for interactive learning experiences. To be effective, nutrition promotion strategies must be creative, engaging, inexpensive and widely disseminated.

School curriculum

In order to succeed, nutrition education needs to be incorporated into the school curriculum actively involving teachers, family and other community professionals. School-based nutrition education should focus not only on the provision of nutrition information, but also on the development of skills and behaviours related to areas such as food preparation, food preservation and storage; social and cultural aspects of food and eating; enhanced self-esteem and positive body image and other consumer aspects. All of these areas are conducive to healthier food choices. Recently published successful programmes have included lessons in other subjects (e.g. maths and language). In these studies, teachers were responsible for curriculum implementation and were supported by qualified programme staff. There is a wide array of teaching methods that can be used according to learning objectives: from classroom discussions, worksheets and keeping food records; to shopping exercises, tasting, creating, or drama.

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Implementation

Implementation is a complex and usually slow process. Characteristics of the teachers, educational materials and support provided by programme leaders and staff determine the level of implementation within the curriculum. Pre-testing the curriculum allows adaptation, improvement in the design and time for the programme to gain acceptance. Teachers often complain about the lack of explicit curriculum, suitable materials or training experience. Adequate time, intensity of the intervention, resources, as well as the provision of suitable materials and teacher training opportunities are essential to programme success. Outcomes of the intervention depend on the degree of implementation and fidelity to the intended plan. Teacher training conceptualized as a behaviour change process with explicit teacher motivation components can promote effective implementation of behaviour change curriculum in the classroom. Pre-service as well as in-service training opportunities for teachers and educators should be in place.
Environmental interventions are important components of intervention programmes, that contribute to the creation of opportunities for action by removing barriers to following a healthy diet. Literature reviews of successful programmes identified interventions in the school environment as an element advantageous for success. Comprehensive school health programmes as defined by Allensworth et al. include several interactive components: health education, physical education, health services, school food services, school counselling and social services, school-community efforts, faculty-staff health promotion and school environment. Environ-
mental interventions include changes in food supply, point of choice nutrition information, collaboration with private sector food vendors, workplace nutrition policies and incentives or changes in the structure of health and medical care related to nutrition. School organizational characteristics can moderate effects on outcomes of school health promotion programmes as described by Baranowski and colleagues.

School meals
School meals should be part of the educational process, providing a valuable opportunity to practice what children learn in the school setting, combined with other policies that facilitate a positive school environment. This includes a pleasant room, nice atmosphere and plenty of time to enjoy healthy food in the school, either food provided by the school or brought from home. The evaluation of the United States Department of Agriculture (USDA) School Meals and Breakfast Programmes and other European programmes show their contribution to total daily intake and the potential for intervention. Participation rates and acceptance of the food offered are important contributing factors to the success of a strategy that can be improved by food service style (particularly a family setting) providing a valuable opportunity to practice what children learn in the school setting, combined with other policies that facilitate a positive school environment.

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Any other places where children can get food supervision responsibilities are important elements in this framework and training of adults who have dining room meet dietary requirements, consistent with dietary guide-

planned accordingly. More suitable intervention strate-
gies and opportunities should be explored to improve and choices. Collaboration between educational and community-wide health promotion strategies can produce modest but lasting improvement in adolescent knowledge and choices. Communication between educational and health sectors, industry support, partnerships with catering companies, or other groups in the community can enhance school nutrition education and contribute to success. Again, opportunities should be explored and planned accordingly.

**Family involvement**

Family involvement enhances the effectiveness of programmes for younger children. Objectives for the family component in successful programmes focus on stimulating awareness and gaining parental support to encourage variety in the diet and availability of healthy foods at home. Methods used include brochures and activities with the Parents’ Association and the Parent-Teachers’ Association. The overall Child and Adolescent Trial for Cardiovascular Health (CATCH) family intervention focused on knowledge and attitudes. In this programme, evaluation of children’s knowledge and attitudes showed a positive association with the number of packs completed by an adult member of the household with the child; this association was more pronounced for minority and male students. Many studies report the difficulty of parental involvement. More suitable intervention strategies and opportunities should be explored to improve participation rates.

**Community involvement – partnerships**

Some studies show that multiple intervention components such as behavioural education in schools along community-wide health promotion strategies can produce modest but lasting improvement in adolescent knowledge and choices. Collaboration between educational and health sectors, industry support, partnerships with catering companies, or other groups in the community can enhance school nutrition education and contribute to success. Again, opportunities should be explored and planned accordingly.

**Evaluation of school-based nutrition education programmes**

Evaluation is often missing, incomplete or uses inadequate design to assess the effectiveness of an intervention. Evaluation is concerned with assessing the effectiveness and efficiency of interventions. However, it is important to follow progress towards major goals and to use the results of the evaluative process to encourage and enhance the strategy.

**Process evaluation**

Process evaluation is an important but infrequently conducted component of evaluating the impact of health promotion interventions, which results in identification of lessons learned leading to increased efficacy. Process evaluation focuses on programme implementation, quality control and monitoring that explains study outcomes. It analyzes the extent of implementation, fidelity to the programme, reach, use of materials, environmental mediators (for example, teacher training), curriculum delivery, parental involvement, participation in family activities, attendance at evening activities, availability and accessibility of healthy foods at home, school food service changes, food service staff, food industry support or external factors. For each intervention component process evaluation measures have to be developed to assess programme dose, penetration, utilization and external competing factors. Process evaluation component process evaluation measures have to be developed to assess programme dose, penetration, utilization and external competing factors.

Testing of curriculum with teachers and teacher training is part of formative evaluation for curriculum implementation. Teacher self-reporting and classroom observations can be useful tools for process evaluation. Inadequate implementation contributes to attenuate the impact of school health education programmes.

A growing number of studies are utilising process evaluation as part of programme evaluation. This helps to explain some of the weaker aspects of programme performance, variation by demographic characteristics or decline over time. Among other procedures, focus groups, information from peer educators, classroom observations, school-meal observations, checklists, analysis of factors affecting attendance, family involvement or obstacles to dietary change have been reported to be useful strategies. Process evaluation should ascertain participation of subgroups with special needs or difficult to reach groups, such as ethnic minorities or lower-income families. Further development in this area will contribute to a better understanding of how and why interventions achieve their effects, how best to conduct intervention programmes to maximize effects and the enhancement of internal and external validity of the studies. Process evaluation provides useful strategies for a more comprehensive approach to programme evaluation. Evaluation of process must be sensitive and involve the collaboration of all participants.

**Outcome evaluation**

Outcome evaluation looks into programme effectiveness. Different designs have been used although good quality
Table 2 Process dimensions and outcome evaluation in selected school-based nutrition education programmes

<table>
<thead>
<tr>
<th>Programme</th>
<th>Grades</th>
<th>Process dimensions</th>
<th>Outcome evaluation</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Health Crete70</td>
<td>1</td>
<td>Not reported</td>
<td>Knowledge ††††, Food habits: ↑ fat, ↑ fruit &amp; vegetables, Physical activity: ↑ BMI: lower increase Serum cholesterol: lower levels</td>
<td>3 years follow-up 7 years</td>
</tr>
<tr>
<td>Minnesota Heart Health14</td>
<td>6</td>
<td>Not reported</td>
<td>Knowledge ††††</td>
<td>7 years Gender differences. Girls more favourable</td>
</tr>
<tr>
<td>GiMME 531,44,58,65</td>
<td>4–5</td>
<td>Curriculum implementation</td>
<td>Food consumption: ↑ fruit &amp; vegetables, Psychosocial measures</td>
<td>4 years Gender differences</td>
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<td></td>
<td></td>
<td>Fidelity of implementation</td>
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<td></td>
<td></td>
<td>Teacher training</td>
<td></td>
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<td></td>
<td></td>
<td>Participation, School food service, Family involvement</td>
<td></td>
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<tr>
<td>High 562,71</td>
<td>4</td>
<td>Curriculum implementation</td>
<td>Dietary behaviour: ↑ fruit &amp; vegetables, ↑ parent’s consumption of fruit &amp; vegetables, Psychosocial measurements</td>
<td>2 years Gender differences Girls more favourable</td>
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<td></td>
<td></td>
<td>Fidelity of implementation</td>
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<td>Participation, School food service, Family involvement</td>
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<tr>
<td>5-a-Day Power Plus34,67</td>
<td>4</td>
<td>Teacher lessons Food Service Staff Implementation</td>
<td>Diet: ↑ fruit &amp; vegetables, Health behavior</td>
<td>Gender differences Girls more favourable</td>
</tr>
<tr>
<td>CATCH15,33,37,56,69</td>
<td>3–5</td>
<td>Curriculum implementation</td>
<td>Diet: ↓ fat</td>
<td>3 years follow-up + 3 years after intervention completed</td>
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<tr>
<td></td>
<td></td>
<td>Fidelity of implementation</td>
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<td>Participation, School food service, Family involvement</td>
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<td></td>
<td></td>
<td>Physical activity program</td>
<td></td>
<td>Relevance of teacher’s and pack characteristics for implementation</td>
</tr>
<tr>
<td>Heart Health Montreal42</td>
<td>4</td>
<td>Curriculum implementation</td>
<td>Not reported</td>
<td></td>
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<td></td>
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<td>Fidelity of implementation</td>
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<td></td>
<td>Participation, School food service, Family involvement</td>
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<tr>
<td>Eat Well &amp; Keep Moving68</td>
<td>4–5</td>
<td>Curriculum implementation</td>
<td>Dietary intake: ↑ total fat, SFA†, ↑ fruit &amp; vegetables, ↑ vitamin C, fiber, TV watching hours +/-</td>
<td>2 years</td>
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<td></td>
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<td>Teacher training</td>
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<td>School Food service</td>
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evaluation studies are randomized, use quasi-experimental designs and include control groups with pre and post-intervention measurements.

**End points**

End points commonly used include increased awareness, positive attitudes and related knowledge and behaviour change (i.e.- dietary habits, physical activity)\(^6^4\). A variety of methods have been used for that purpose, but often food frequency questionnaires, food records or repeated 24 hour recalls have been reported. Other instruments include psychosocial measures, telephone interviews with parents, observational assessments, impact factors at home, self-efficacy scales or social norms\(^6^5\). Some studies also include anthropometric measurements, biochemical or health indicators. In these studies length of follow-up ranges from 2 years up to 7 years\(^1^4,1^5,2^1,3^1,6^2,6^5\).

It is important to consider qualitative and quantitative dimensions of evaluation\(^2^1,6^6\). Multi-component school-based programmes, which include classroom curriculum, school food service and parental involvement have reported a significant increase in observed lunchroom intake of vegetables and fruit\(^1^4,1^5,2^1,6^7–6^9\); positive changes in fat content of school lunches and overall children’s diet as well as increased physical activity\(^6^4,6^8–7^0\). Some studies have observed an overall increase in reported fruit consumption, but not for vegetable consumption, among fourth and fifth graders\(^7^9\). A 14% increase in the usual daily servings of vegetables and fruits was observed in a high school programme, but this effect disappeared by 3rd year of follow-up\(^3^1\). Reynolds and colleagues reported increased consumption of daily servings of fruit and vegetables in fourth graders and their parents\(^7^1\). Many of these studies have reported gender differences in outcomes, with greater achievements among females. Poorer results have been observed in low-income\(^2^0\) and ethnic subgroups\(^3^1,6^5\).

The CATCH evaluation at 3 yr. follow-up without further intervention suggested that behavioural changes regarding diet and physical activity initiated during elementary school years persisted into early adolescence\(^1^4,6^2\). This study reported significant positive achievements in dietary behaviour and physical activity, but no significant changes were observed in physiological measures (i.e. serum cholesterol levels, blood pressure) attributable to the programme. Although short term positive effects may be rewarding and suggest the potential for intervention programmes, the problem of maintenance of changes and wider expansion of the intervention itself to benefit the wider community arises\(^7^0,7^1\). Long term effects on maintenance are desirable, and larger, long-term studies in free-living populations are required to assess behaviour changes that are enduring rather than transitory\(^3^0\).

**Recent initiatives**

In Europe, the World Health Organization Health Promotion Initiative has inspired a number of school-based initiatives, including the European Network of Health Promoting Schools\(^1^7\) and nutrition specific efforts\(^6^\). In this context, a framework curriculum for school-based nutrition education has been developed\(^1^9\) along with a planning and evaluation guide\(^5^7\) (the last two supported by the European Union). All of them use a comprehensive health promotion approach applied to both an individual (i.e. student) level through personal skills development, as well as to a local (i.e. school and community) level through healthy policies and supportive environments. These initiatives have encouraged further developments at the national and regional level. In the Basque Country (Spain) a collaborative group from the Departments of Education and Health including educators, nutrition experts and Public Health specialists has been set up to design and test a nutrition education curriculum for primary and secondary schools alongside an in-service teacher training programme. Similar processes have
already started in other European countries like the UK\textsuperscript{41} and the Netherlands\textsuperscript{38}.

The EURODIET project has addressed the potential of the school setting for the implementation of dietary guidelines\textsuperscript{39} and the new edition of dietary guidelines for the Spanish population will specifically address this issue. In the USA, the Centre for Disease Control and Prevention issued guidelines for school and community health programmes to promote lifelong physical activity\textsuperscript{10} and healthy eating\textsuperscript{8} among young people in 1997; Healthy People 2010 emphasizes the role of school-based health education with a focus both on unhealthy dietary patterns and inadequate physical activity. The School Health Index for physical activity and healthy eating has been recently published as a school self-assessment and planning guide\textsuperscript{72,73} to implement health promotion projects.

A growing body of evidence supports the effectiveness of school-based health promotion strategies with a focus on healthy eating. There are still questions to be answered in order to improve implementation, gain family support, reach the wider community and ensure maintenance of achievements. Recent developments in this area are encouraging and indicate the potential of this approach, although further research is required.

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