

# A Systematic Review of the Impact of Multi-Strategy Nutrition Education Programs on Health and Nutrition of Adolescents

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## ABSTRACT

**Objective:** To update evidence on the impact of multi-strategy nutrition education interventions on adolescents' health and nutrition outcomes and behaviors.

**Design:** Systematic review of randomized controlled studies of multi-strategy interventions encompassing nutrition education published from 2000 to 2014 guided by the Preferred Reported Items for Systematic Reviews and Meta-analyses statement.

**Setting:** Secondary schools in developed countries.

**Participants:** Adolescents aged 10–18 years.

**Main Outcome Measures:** Anthropometric and dietary intake.

**Analysis:** Systematic search of 7,009 unduplicated articles and review of 11 studies (13 articles) meeting inclusion criteria using qualitative comparison.

**Results:** Four studies reported significant changes in anthropometric measures and 9 showed significant changes in dietary intake. Type of nutrition education varied. Components of the interventions that showed statistically significant changes in anthropometric and dietary intake included facilitation of the programs by school staff and teachers, parental involvement, and using theoretical models to guide the intervention's development. Changes in canteens, food supply, and vending machines were associated with significant changes in dietary intake.

**Conclusions and Implications:** Multi-strategy interventions can have significant impacts on nutrition of adolescents when the nutrition education is theoretically based and facilitated by school staff in conjunction with parents and families, and includes changes to the school food environment.

**Key Words:** adolescents, dietary intake, nutrition education, school, healthy eating, overweight, fruit, vegetable, sugar-sweetened beverage (*J Nutr Educ Behav.* 2016;48:631–646.)

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## INTRODUCTION

Adolescence is a critical period of development when optimal nutrition to maximize growth and establish healthy eating habits is crucial for transition into adulthood.<sup>1</sup> As the social environment for adolescents diversifies and they become more independent, the key influences on their eating practices begin to change.

Social norms, friends, and peers as well as the accessibility of food start to have a greater influence on their nutrition-related behaviors.<sup>2</sup>

Previous evidence-based reviews identified key components that contribute to the effectiveness of nutrition education interventions for school-aged children.<sup>3–8</sup> The most effective components were found to have a behavioral focus and use

theory-based instructional strategies, adequate dose, peer involvement, self-assessment and feedback, and environmental interventions that complemented the behavioral lessons and community involvements. The findings of these reviews were consistent with the growing body of evidence related to whole-school approaches. The evidence recognized the importance of extending beyond just the classroom curriculum to include the school community, its members, and the environment to affect students' health and well-being outcomes.<sup>9,10</sup> The use of multiple strategies and activities was inherent in this approach. Much of this evidence existed only for younger children.

In 2002, Hoelscher et al<sup>5</sup> reviewed nutrition interventions aimed specifically at adolescents. The reviewers identified 14 population-based studies conducted in schools, clinics, or

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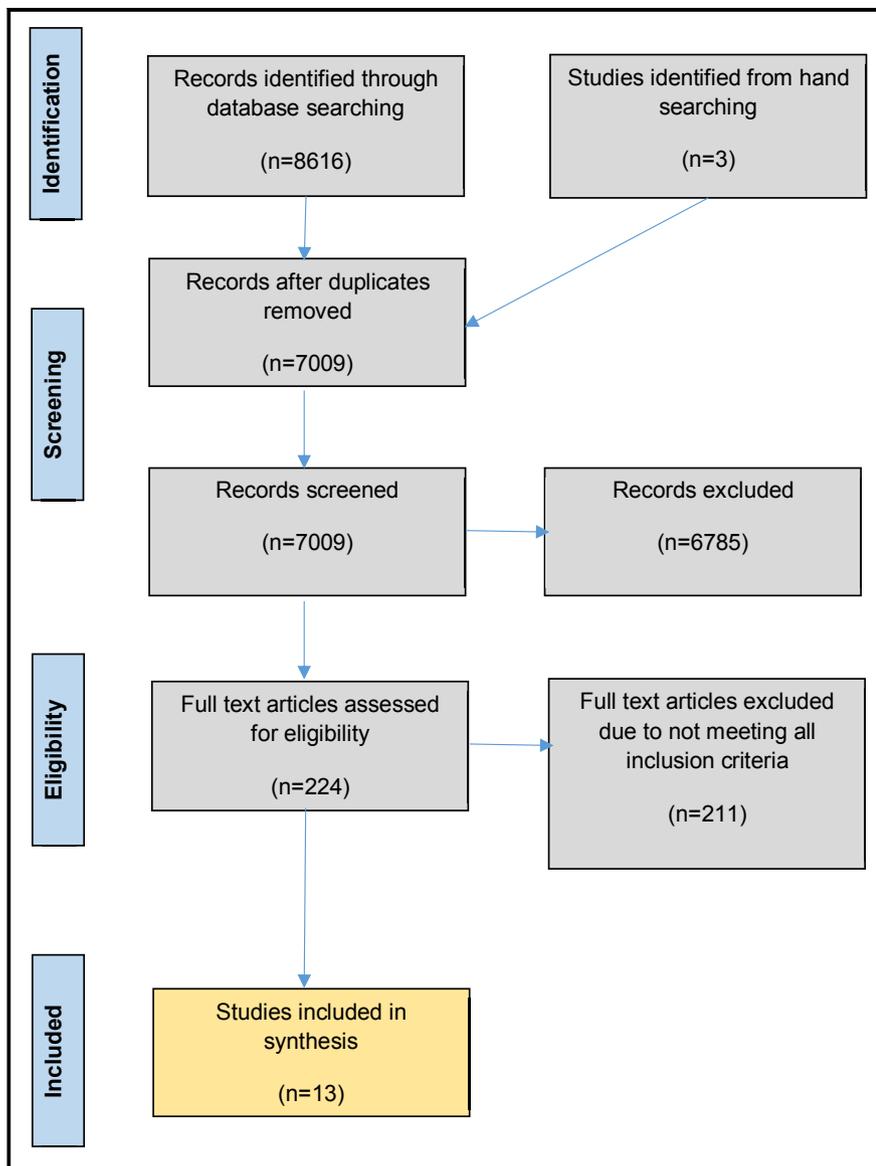
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**Figure.** Flowchart depicting selection process undertaken according to preferred reporting items for systematic reviews and meta-analyses.

communities published between 1994 and 2000 targeted at adolescent populations aged 11–18 years. Intervention components previously identified were echoed in that review; the more successful studies included multiple strategies such as having a behavioral focus, as opposed to a knowledge-based focus, using theory-based instructional strategies, focusing on individual and environmental behaviors related to diet and physical activity, and using appropriate dose (duration and intensity) and educational strategies.<sup>1,3</sup> This was in line with a review of reviews conducted by Roseman et al<sup>7</sup> related to school-based nutrition interventions, 2 of which included only adolescent

populations.<sup>5,11</sup> Hoelscher et al suggested that intervention components such as coordination for nutrition and physical education interventions, policy changes, use of technology such as CD-ROMs, and dissemination of effective programs would be future trends in developing effective nutrition interventions for adolescents.<sup>5</sup>

These reviews need updating to reflect increasingly complex challenges in the environments to which adolescents are exposed across the world. The aim of this systematic review was to update and build upon the review by Hoelscher et al<sup>5</sup> by exploring the impact of multi-strategy interventions that encompass

nutrition education on adolescents' health and nutrition outcomes and behaviors.

## METHODS

### Literature Search

No institutional review approval was required for this study as humans were not involved. The first author conducted a search in September, 2014 using the following key terms: “nutrition education interventions,” “adolescents,” and “developing” countries. The databases CINAHL Plus, EMBASE, ERIC, OVID Medline, PsycINFO, and Web of Science were searched with limits to studies published in English and conducted in humans. An example of the search term strategy is provided in the [Supplementary Material](#).

### Inclusion and Exclusion Criteria

Criteria for inclusion in the review were: (1) randomized control studies published from 2000 to 2014 designed to evaluate multi-strategy interventions that encompassed nutrition education, (2) studies investigating adolescent populations in developed countries, and (3) studies that reported on relevant health and nutrition-related outcome or behavioral measures. For the purposes of the review, adolescents were defined according to the World Health Organization definition of people aged 10–19 years and developed countries were identified using the World Bank's definition.<sup>12</sup>

Outcome measures included changes in at least 1 of the following: anthropometric measures (weight, body mass index [BMI], BMI z score, skinfolds, waist circumference, or percent body fat), biochemical markers, or dietary consumption data (using tools such as a food frequency questionnaire, 24-hour dietary recall, or 3-day food record). Changes in dietary consumption data recorded included changes in dietary intake of fruits and vegetables, snack foods, fat (total, saturated, polyunsaturated, and monounsaturated), sucrose, sugar-sweetened beverages, and soft drinks. Multi-strategy interventions were identified as interventions in which nutrition education was delivered in conjunction

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