Key Elements in Elementary School-based Nutrition Interventions to Reduce Obesity in Mexico and the United States: A Systematic Review

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Objective: To identify and compare elements in school-based nutrition intervention programs that improved dietary habits and anthropometrics in populations of Hispanic children in the United States and Mexico.

Study Design, Setting, Participants, and Intervention: Articles, between 01-2005 and 12-2015, were extracted from PubMed, PsycINFO, and Web of Science using key words: school-based interventions, diet/nutrition, overweight/obesity, 6-12 year old children, Hispanic, Latino/a, and United States/Mexico. A 9- and 7-point inclusion and exclusion criteria, respectively, were established. Two researchers independently extracted articles, applied exclusion/inclusion criteria to titles and abstracts, and assessed the quality of included articles using the AND Evidence Analysis Manual.

Outcome, Measures, Analysis: Diet quality improvement included increased consumption of whole grains and fruits/vegetables, and reduction of total fats, added sugars, and salt. Anthropometric measurements included BMI, waist circumference and skin fold.

Results: A total of 149 articles were found, of which 40 articles were examined after exclusion/inclusion criteria. Ten articles (Mexico= 6; US=4) were included in the study based on quality assessment. Seven studies reported improvements in children’s anthropometric measurements. All studies reported improvement in at least one of the dietary behaviors. Elements associated with larger improvements in outcomes across countries and programs were: using a behavior change framework, using multiple frameworks, active community participation during design and implementation of intervention, and uniform messaging from school members and parents.

Conclusions and Implications: The evidence supports that efficacious elementary school-based interventions to reduce obesity included several behavior change frameworks and the active participation of stakeholders. Further research needs to examine the optimal combination of frameworks and specific elements that result in improved outcomes.

INTRODUCTION
Childhood obesity among Hispanic children is a public health issue in the United States and Mexico. In the United States, an estimated 30% of Hispanic children are overweight/obese1 and in Mexico, an estimated 33% of children are considered overweight/obese2. An alternative to reduce overweight/obese children in the United States and Mexico is to implement school-based nutrition intervention programs framed within behavior change theory3.

METHODS
- A 3-stage process was used to identify the articles that met the inclusion criteria of: (1) were published in peer-reviewed journals, (2) were issued during 2005-2015, (3) had an experimental design, (4) involved children between the ages of 6-12 years, (5) included overweight and/or obese children, (6) at least 50% of the population were Hispanic, (7) were conducted in a school, (8) were conducted in the United States and Mexico, (9) the outcomes included diet and/or nutrition, and (10) the outcomes included anthropometric measurements.
- Articles meeting this criteria were then assessed for quality using AND’s Evidence Based Manual4 for relevance and validity. Validity scores ranged from 0 (poor quality) to 10 (high quality). Articles were deemed of high quality with a score between 9-10.

RESULTS

- 10 articles were included in this systematic review (Fig. 1). Mexico (n=6) and US (n=4).
- Average internal validity scores for studies were 9.2 ± 0.49 (Mexico) and 9.1 ± 0.80 (US).
- The objectives for most of the studies were to determine the effectiveness of their programs on modulation of obesity associated indicators.
- Most, 6/10, studies used the ecological framework or the community-academic participatory (CAP) framework.
- 4 studies used a combination of theories that included either the ecological or CAP frameworks.
- 2 studies used either ecological or CAP frameworks solely.
- 3 studies did not specify a theory, but used attributes within the ecological or CAP frameworks.
- 1 study used the peer learning theory.

Table 1. Summary of Results of Systematic Analysis (n=10)

<table>
<thead>
<tr>
<th>Country</th>
<th>Population</th>
<th>Theoretical Framework</th>
<th>Diet Intake</th>
<th>Anthropometrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexico</td>
<td>3rd–4th Grades</td>
<td>Intervention: n=615</td>
<td>Health Belief Model</td>
<td>Decreased total intake (p=0.01); decreased bread consumption (p=0.01); decreased fat intake (p=0.05); increased sugar consumption (p=0.01)</td>
</tr>
<tr>
<td>Mexico</td>
<td>3rd–4th Grades</td>
<td>Basic Plus: n=624</td>
<td>Social Cognitive Theory</td>
<td>No significant change</td>
</tr>
<tr>
<td>Mexico</td>
<td>3rd–4th Grades</td>
<td>Control group: n=560</td>
<td></td>
<td>No significant change</td>
</tr>
<tr>
<td>Mexico</td>
<td>4th–5th Grades</td>
<td>Intervention: n=280</td>
<td>Health Belief Model</td>
<td>Decreased calories (p=0.01); consumed appropriate amounts of macronutrients</td>
</tr>
<tr>
<td>Mexico</td>
<td>4th–5th Grades</td>
<td>Control group: n=145</td>
<td>Social Cognitive/Ecological model</td>
<td>No significant intake changes</td>
</tr>
<tr>
<td>Mexico</td>
<td>5th Grade</td>
<td>Treatment group: n=304</td>
<td>Health Belief Model</td>
<td>Decreased sodium intake (p&lt;0.001)</td>
</tr>
<tr>
<td>USA</td>
<td>3rd-4th Grades</td>
<td>Treatment Group, RESCATE: n=304</td>
<td>Health Belief Model</td>
<td>Vegetable intake increased (p = 0.007), increased fruit and vegetable consumption (p&lt;0.001)</td>
</tr>
<tr>
<td>USA</td>
<td>3rd-4th Grades</td>
<td>Control Group, 1 school: n=737</td>
<td>Health Belief Model</td>
<td>No significant change in diet quality intake</td>
</tr>
<tr>
<td>USA</td>
<td>4th-5th Grades</td>
<td>Treatment Group, 4 schools: n=3032</td>
<td>Health Belief Model</td>
<td>Decreased risk of obesity (p=0.0001)</td>
</tr>
<tr>
<td>USA</td>
<td>4th-5th Grades</td>
<td>Control Group, 1 school: n=560</td>
<td>Social Cognitive Theory</td>
<td>No significant change</td>
</tr>
<tr>
<td>USA</td>
<td>5th Grade</td>
<td>Intervention: n=264</td>
<td>Social Cognitive Theory</td>
<td>No significant change</td>
</tr>
<tr>
<td>USA</td>
<td>5th Grade</td>
<td>Control: n=360</td>
<td>Social Cognitive Theory</td>
<td>No significant change</td>
</tr>
</tbody>
</table>

RESULTS & DISCUSSION

- Results indicate that by using a community-based framework (i.e. ecological and CAP frameworks) it was more likely to achieve improvements in participants’ BMI compared to those programs that did not include a framework or use a community-based approach.
- Similarly, implementation of either Ecological or CAP framework in combination with other theories resulted in improved children’s dietary behaviors (e.g. less consumption of fats and more consumption of vegetables).
- Improvements were seen as a result of components within each of the community frameworks; interactive communication, education, and action modeling. Both parents and school staff were involved in communicating nutritional information to children, providing tailored education materials to improve a child’s dietary behaviors, and practicing proper nutritional behaviors at homes and schools (Fig. 2).
- Importantly, regardless of the type of framework or where the study was conducted (i.e., Mexico or the U.S.), having a program that included nutrition education helped to improve children’s nutrition knowledge and behaviors to consume more fruits and vegetables and less calories, fats, and sodium.

CONCLUSION
Childhood obesity among Hispanics is on the rise in both the United States and Mexico. Implementing school-based interventions is an ideal option as children spend at least 50% of their time in school. However, children need support from parents, caregivers, schools, and other members of the community to promote a positive change in dietary behaviors. The Ecological model or Community-based framework encompass several key elements that could be more effective in promoting behavior change through school-based nutrition programs, and therefore, monitor, prevent, and control childhood obesity. Efforts and resources should be directed at addressing childhood obesity, especially among Hispanics.

REFERENCES