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# Interventions to increase physical activity and healthy eating among overweight and obese children in Mexico

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## Abstract

**Objective.** The purpose of the present study was to conduct a systematic literature review of obesity interventions that focused on increasing physical activity and healthy eating among overweight and obese children in Mexico. **Materials and methods.** Data was taken from a larger literature review focused on obesity interventions for Latinos in Latin America and the United States. Study design suitability, quality of execution, and effect size were assessed for a subset of these articles. **Results.** There were six intervention studies included in the present review. Five studies showed reductions in obesity-related outcomes, while one study reported gains in body mass index (BMI). **Conclusions.** Physical activity and healthy eating remain constant components in obesity treatment interventions, which highlights the importance of understanding evidence-based strategies to guide future research to reduce childhood obesity in Mexico.

Key words: child; overweight; obesity; review; Mexico

Eisenberg CM, Sánchez-Romero LM, Rivera-Dommarco JA, Holub CK, Arredondo EM, Elder JP, Barquera S. Intervenciones para incrementar la actividad física y alimentación saludable en niños mexicanos con sobrepeso y obesidad. *Salud Publica Mex* 2013;55 supl 3:S441-S446.

## Resumen

**Objetivo.** El propósito del presente estudio fue realizar una revisión sistemática de la literatura en intervenciones relacionadas con la obesidad enfocadas en incrementar la actividad física y alimentación saludable en niños mexicanos con obesidad y sobrepeso. **Material y métodos.** La información forma parte de una revisión sistemática de la literatura enfocada en intervenciones para prevenir o tratar la obesidad en población latina habitante de Latinoamérica y Estados Unidos. La adecuación del diseño del estudio, la calidad de ejecución y el efecto de la muestra fueron evaluados para una submuestra de estos artículos. **Resultados.** Se incluyeron seis estudios dentro de la revisión. Cinco estudios encontraron una reducción en los resultados relacionados con la obesidad, mientras que un estudio encontró ganancias en el índice de masa corporal (IMC). **Conclusiones.** La actividad física y alimentación saludables fueron componentes constantes de las intervenciones para tratamiento de la obesidad. Esto resalta la importancia de entender las estrategias basadas en evidencia para guiar futuras investigaciones en la reducción de la obesidad infantil en México.

Palabras clave: niño; sobrepeso; obesidad; revisión; México

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Obesity rates continue to reach epidemic proportions worldwide. Developing countries, such as Mexico, are becoming some of the most obese in the world.<sup>1</sup> The obesity rates in Mexico are now the second highest worldwide, following the United States (US).<sup>2</sup> According to the Encuesta Nacional de Salud y Nutrición 2006 (ENSANUT; Mexican National Health and Nutrition Survey), the prevalence of overweight and obesity in Mexico for children ages five to eleven is about 26.0%, which is a 39.7% increase from 1999.<sup>3</sup> Obese children are more likely to remain obese during adulthood, which makes them at risk for other chronic diseases, such as diabetes and cardiovascular disease.<sup>4,5</sup> Based on the current situation in Mexico, action must be taken to prevent the continued increase of childhood obesity rates in this country as well as reduce the existing prevalence of childhood obesity.

The high prevalence of obesity rates among children in Mexico may be due in part to the urbanization of its population and the process of nutrition transition.<sup>6,7</sup> Countries which are currently or were recently low-income countries, including Mexico, were once primarily concerned with malnutrition and underweight, but are now also dealing with the problem of overconsumption and obesity.<sup>8</sup> As Mexico adopts a more Westernized, energy-dense diet and continues to grow economically, fewer opportunities exist for physical activity.<sup>7</sup> For example, in Latin American cities that are becoming more industrialized and where neighborhood crime is prevalent and there is a lack of outdoor playgrounds or parks, children remain indoors and engage in more sedentary behaviors.<sup>6</sup> In addition, Mexico has seen a striking increase in the amount of caloric beverages, such as whole milk, juices, and soft drinks, and fatty foods consumed by children.<sup>9-11</sup> According to the ENSANUT 2006, school-age children consume 20.7% of their total energy from caloric beverages, and 28.0% of their total energy intake comes from fat.<sup>11,12</sup>

Increasing physical activity and healthy eating continue to be the main focus of most childhood obesity interventions.<sup>13,14</sup> In Mexico, where the nutrition transition continues to progress, emphasis must be made to encourage healthy lifestyles.<sup>7,15</sup> Both healthy eating and physical activity have been shown to decrease body mass index (BMI) in children and adolescents.<sup>16</sup> Key components of obesity treatment interventions are promoting healthy eating behaviors, such as increased fruit and vegetable consumption and decreased sugary beverage consumption, and physical activity, such as greater weekly frequency of moderate to vigorous physical activity, regardless of the setting of the intervention.<sup>17</sup>

Data for the present study was taken from the parent project, "Guide to Obesity Prevention in Latin

America and the US (GOL)", a large systematic literature review of obesity prevention interventions among Latinos in Latin American and the US. The purpose of the present study was to conduct a systematic literature review of obesity interventions that focused on increasing physical activity and healthy eating among overweight and obese children in Mexico. By comparing different intervention strategies and their effects, researchers can utilize the results and evidence found in this review to further improve future childhood obesity interventions.

## Materials and methods

A complete description of the methodological strategies for GOL has been published in this same special issue (see Nagle *et al.*). The review was conducted by investigators and their staff at San Diego State University (SDSU) and the National Institute of Public Health of Mexico (Instituto Nacional de Salud Pública, INSP). Electronic databases were searched for articles and grey literature (dissertations) published between 1965 and December 31, 2010, including PsycInfo, Medline / PubMed, CINAHL, Cochran Library, Current Controlled Trials, LILACS, Global Health, Global Index Medicus, ProQuest (dissertations) and Web of Science. Data from obesity-related interventions for Latinos were included. Interventions were considered eligible if the sample population contained at least 50% Latinos or if the results were stratified by ethnicity, if the study evaluated at least one obesity-related outcome measure before and after the intervention (e.g. BMI, weight, body fat percentage), and if an intervention group was compared to a non-intervention group (including pre-post designs). Interventions from the US and all countries from Latin America (excluding the Caribbean) were included.

Studies that were eligible for inclusion were abstracted according to the Centers for Disease Control and Prevention (CDC) *Community Guide*.<sup>18</sup> Design suitability and quality of intervention execution were also evaluated according to the guidelines developed by the CDC *Community Guide*. Each intervention was also placed into various categories based on different levels of intervention strategies, such as school-based healthy eating or school-based physical activity. Based on the data obtained through the abstraction process as well as effect size consistency, a breadth of evidence was compiled for effectiveness in each category. For the present review, all interventions that targeted physical activity and/or healthy eating behaviors for study samples of overweight or obese children from Mexico were included.

## Results

Of 325 obesity-related interventions identified in the GOL review, 113 met the inclusion criteria and were abstracted, excluding interventions with same-source data. Eight interventions were later excluded by investigators due to the utilization of prescription medications (e.g., Sibutramine) or because they involved a non-representative sample (i.e., sample consisting of individuals with mental health disabilities). The number of interventions reviewed was 105 [53.3% (n=56) conducted in the U.S., 23.8% (n=25) in Mexico, 15.2% (n=16) in Brazil, and 7.6% (n=8) in other Latin American countries]. Among these, there were six intervention studies that sought to increase healthy eating and physical activity among overweight or obese children in Mexico<sup>19-24</sup> (table I). Three interventions focused on both physical activity and healthy eating strategies,<sup>22-24</sup> and three focused only on healthy eating.<sup>19-21</sup> Most studies were multi-level interventions that included various components, such as school-based or family-based. Analytic sample sizes ranged from 18 to 178 participants. Two studies included children and their parents as the sample population,<sup>20,22</sup> and four studies included child participants only.<sup>19,21,23,24</sup> The average mean age of the child participants across all studies was 10.3 years and 48.3% were female. Intervention duration ranged from one week to twelve months with a dose frequency range of less than once per week to more than once per week. Intervention details are summarized in table II.

A variety of intervention settings were utilized: schools, homes, healthcare organizations, and a summer camp. Most interventions were delivered by various healthcare professionals, such as physicians, nutrition-

ists, and psychologists. Three interventions had the greatest design suitability (randomized controlled trial [RCT] or non-RCT),<sup>19,21,23</sup> and the other studies were either pre-post or time series design.<sup>20,22,24</sup> Most of the interventions had fair execution (2-4 limitations; n=5). One intervention had both greatest design suitability and good execution (0-1 limitations).<sup>19</sup> This RCT had only one limitation and a sufficient effect size ( $d=0.22$ ). It was a year long intervention and consisted of 12 consecutive weekly two-hour group sessions in the clinic, a simple food guide, weekly consultations with a registered dietitian for 12 weeks and monthly thereafter, individualized diets, and monthly consultations with a physician to monitor BMI and blood pressure. Diaz and colleagues<sup>19</sup> found that with an intervention focused on healthy eating, BMI was significantly reduced in the intervention group when compared to the control group at the end of the 12-month intervention period (-2.2 [95% CI: -3.4, -1.0] between group difference;  $p<0.01$ ). A distribution of the interventions based on execution, design suitability, and effect sizes is shown in figure 1.

## Discussion

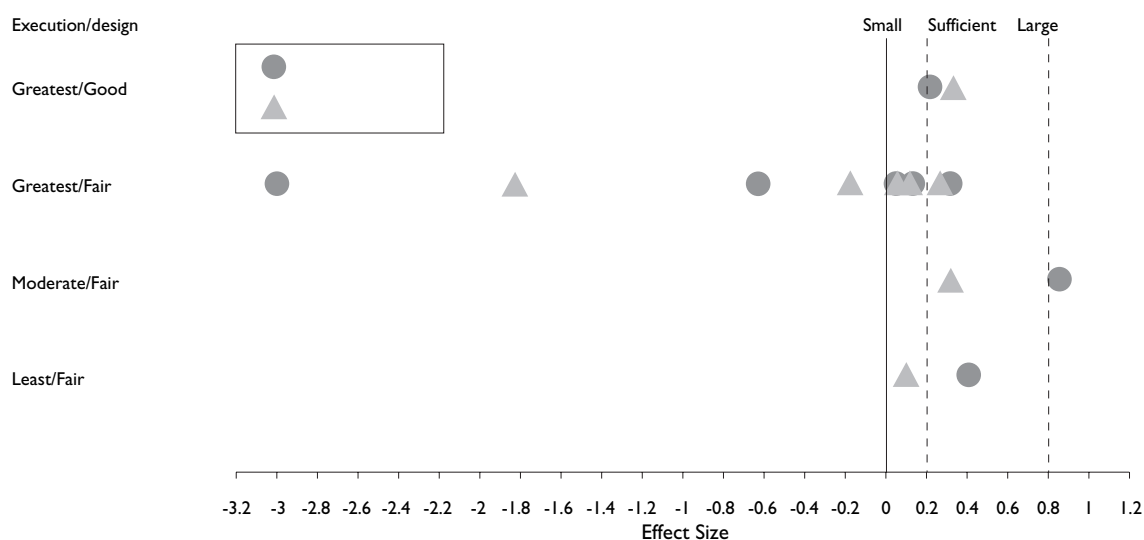
This study identified six interventions that targeted healthy eating and physical activity behaviors among overweight or obese children in Mexico. Two interventions (RCT and non-RCT design) showed significant differences between intervention and control groups as well as within the intervention group.<sup>19,23</sup> However, of these two interventions, one showed significant BMI reduction,<sup>19</sup> while the other showed gains in BMI.<sup>23</sup> One explanation for the increase in BMI results could be that the intervention was only one week in duration

**Table I**  
**SUMMARY OF DEFINING CHARACTERISTICS OF EACH STUDY TARGETING OBESITY REDUCTION FOR MEXICAN CHILDREN**

First author (Year)	Focus	Duration (Frequency)	Effect size - Cohen's <i>d</i> (Outcome)	Effect size - % relative (Outcome)	Study design
Díaz (2010)	Healthy eating	12 mo. (1x/ week)	0.215 (BMI)	8.28 (BMI)	RCT
Luna-Ruiz (2007)	Healthy eating	6 mo. (n/a)	0.85 (BMI)	11.68 (BMI)	Time series
Rosado (2008)	Healthy eating	3 mo. (1x/week)	0.128 (BMI, 1 dose) 0.048 (BMI, 2 dose) 0.315 (BMI, 1 dose + edu)	-0.422 (BMI, 1 dose) 0.823 (BMI, 2 dose) 3.734 (BMI, 1 dose + edu)	RCT
Sáenz-Soto (2004)	PA and healthy eating	2.25 mo. (> 1x/week)	0.102 (Nutritional index)	1.963 (Nutritional index)	Time series
Solís de Sánchez (2004)	PA and healthy eating	0.25 mo. (n/a)	-0.629 (BMI, obese)	1.245 (BMI, obese)	Non-RCT
Velázquez López (2009)	PA and healthy eating	4 mo. (<1x/ week)	0.41 (BMI)	5.28 (BMI)	Pre-Post

**Table II**  
**INTERVENTION DETAILS FOR EACH STUDY TARGETING OBESITY REDUCTION FOR MEXICAN CHILDREN**

First author	Intervention details
Díaz (2010)	Setting: Primary care clinic Delivered by: Registered dietitian and physician Methods: Lifestyle intervention of 12 consecutive weekly, 2-hour group sessions in the clinic, plus a simple food guide, weekly consultations with a registered dietitian (and parent) for 12 weeks and monthly thereafter, individualized diets, monthly consultations with physician to monitor BMI and blood pressure.
Luna Ruiz (2007)	Setting: Family medicine clinic Delivered by: n/a Methods: Participants were given information surrounding the causes and consequences of obesity as well as how to treat it by practicing healthy eating and increasing physical activity. They also participated in a nutritional education group, performed group exercise activities each week, and were given individual diet counseling. Parents were also involved in the intervention alongside their children.
Rosado (2008)	Setting: Schools and homes Delivered by: Nutritionist Methods: Four study arms, the first received one serving of Ready to Eat Cereal (RTEC) daily, the second received two servings of RTEC daily, the third received one serving of RTEC daily plus nutrition education, and the fourth was the control group and received no intervention. All students and mothers received education guides with recommendations for healthy eating, but some received a 12-week education program.
Sáenz-Soto (2004)	Setting: n/a Delivered by: n/a Methods: A nine week program consisting of four nutrition education sessions and eight physical activity sessions. Parents also participated.
Solis de Sánchez (2004)	Setting: Summer camp Delivered by: Psychologist, endocrinologist, pediatrician, dietitian, nurse, and sports physician Methods: A one-week weight loss treatment camp with a multidisciplinary program.
Velázquez López (2009)	Setting: Home Delivered by: Nutritionist Methods: A 4-month intervention that focused on reducing obesity through improving nutrition through nutritional counseling, follow-up meetings to check adherence to improved diets, and encouragement of 2-3 days of activity per week and reduction of sedentary activities.



**FIGURE 1. EFFECT SIZES OF INTERVENTIONS TO REDUCE CHILDHOOD OBESITY IN MEXICO**

with a six month follow up. Measurements were taken at baseline and at the six-month follow up, which may have been too long of an absence of any intervention to create the desired effect, especially when the actual intervention was short. Three other interventions showed significant within group or between group effects for BMI reduction.<sup>20,21,24</sup> These interventions were of pre-post, time series, or RCT designs, respectively. The remaining intervention (time series design)<sup>22</sup> showed neither between groups nor within group effects even though the effect sizes indicated improvement in the hypothesized direction for the outcome variable. The outcome variable for this study was a Nutritional Index score, which is a measurement similar to BMI in that it is also based on one's height and weight measurements. The Nutritional Index compares a participant's percentage of height and weight to the 50<sup>th</sup> percentile of height and weight to determine whether the participant is overweight or obese.

Although five of the six interventions showed significant effects in BMI or Nutritional Index reduction, some studies were more effective than others, which may be due to their study design, intervention methods, or evaluation methods and measurement. This variation in effectiveness, strength of execution, and design suitability may be a call for future research on what intervention characteristics serve to be most influential in relation to intervention effectiveness. There is evidence to infer from the six interventions that healthy eating is an important intervention component when targeting the treatment of childhood obesity in Mexico, as all of the successful interventions targeted healthy eating behaviors in some capacity. Furthermore, most of the interventions also included parental participation in part of the intervention alongside their children. This may also have contributed to the children's BMI reduction because it is recognized that parents and the home environment can influence children's dietary and physical activity behaviors. As such, parental components should be highly considered in designing obesity interventions. However, in terms of intervention duration, dose frequency, study design, and other characteristics, the present review shows mixed results on which combination of the aforementioned characteristics is most effective. Given these mixed results, more research is needed to identify study design characteristics that are most effective in addressing obesity among children in Mexico.

Of the interventions highlighted in this review, overall this review showed positive effects for obesity treatment interventions for children in Mexico. However, there are several limitations that should be

addressed. The findings of this review are specific in nature in that they focus only on children in Mexico, and, therefore, cannot be generalized to other populations of children in other countries. Furthermore, interventions that only included an overweight or obese sample were examined in this review; other interventions that include a more diverse sample may also be effective in reducing child BMI. Threats to internal validity include the pre-post and time series study designs because they lack a comparison group. Conversely, the variety of intervention settings may increase the external validity since results may be generalizable to different childhood obesity treatment interventions regardless of where the intervention takes place.

Despite some limitations addressed in this review, it is important to note the relevance of this review in light of the current climate in Mexico. Mexico is one of the world leaders of obesity, and this review aims to summarize current interventions targeting overweight or obese Mexican children to find possible avenues for treatment of this epidemic. This review is also timely considering the *Acuerdo Nacional para la Salud Alimentaria: Estrategia contra el sobrepeso y la obesidad* (National Agreement for Healthy Eating: Strategy against overweight and obesity)<sup>25</sup> issued in January 2010 by the president of Mexico. It details a 10-item action plan to combat the nationwide obesity epidemic. Strategies for improvement include, among others, promotion of physical activity in the school environment, increasing the availability and consumption of water, decreasing the consumption of sugary beverages, and increasing the consumption of fruits and vegetables and fiber in one's daily diet. In addition, the agreement outlines regulations for the sale of beverages and snack foods in public schools in Mexico, ensuring that healthy options are available to the students.<sup>26</sup> Similarities can be seen between this national agreement and the intervention strategies in the present review. Physical activity and healthy eating remain constant components in both obesity treatment interventions and national policies, which further highlights the importance of understanding evidence-based strategies to guide future research and interventions to reduce childhood obesity in Mexico.

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*Declaration of conflict of interests:* The authors declare not to have conflict of interests.



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