

ORIGINAL RESEARCH

An educational initiative for Mexican school-aged children to promote the consumption of fruit, vegetables and physical activity

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Abstract

Aim: To present the results of a community initiative focused on strengthening physical activity and the consumption of fruits, vegetables and natural water while discouraging the use of highly energetic food and sugary drinks in public schools of Morelos.

Methods: A quasi-experimental study with an educational initiative focused on the school community of two primary schools and two junior high schools. Pre- and-post initiative measurements were made. The study took place in the municipality of Yautepec, Morelos, Mexico, in a rural area and an urban area, from August 2010 to July 2011.

Results: Water consumption among school-aged children increased from 15.1% to 20.1% and soda consumption decreased from 21.4% to 13.2%. A slight increase in the consumption of fruits and vegetables was also measured (oranges, jicamas, bananas, tomatoes, prickly pear pads, lettuces), that are accessible in the region. It was found that the supply of fresh food is limited and that high energy density foods have an oversupply in both study areas. Physical activity increased with actions such as football and dancing, in accordance with the baseline measurement. No changes were observed in the nutritional condition of school-aged children (n=150; 13.3% with overweight and 7.3% with emaciation), or in adults who presented a body mass index higher than normal, 60.2% to 88.4%.

Conclusion: In addition to educational activities, schools need to implement strategies to improve the access and availability of fresh foods while limiting the access of high energy-density foods.

Keywords: diet, educational initiative, Mexico, nutritional condition, school-aged children.

Conflicts of interest: None.

Introduction

Currently, the number of Mexican children and adolescents with overweight and obesity (O/O) is a public health problem (1), which has increased in school-aged children aged from 5 to 11 years. According to The National Nutrition Survey (ENN in Spanish) in 1999, the increase was of 19.5%. The National Survey of Health and Nutrition (ENSANUT in Spanish) in 2006 reached 26%, and the ENSANUT 2012 went up to 34.4%, representing an increase of over 80% (1-3).

The “Health in the World 2002” report of the World Health Organization (WHO), has pointed out health risks in different continents. In Latin America, addictions, blood pressure, low weight, together with overweight and obesity, represent one sixth of the morbidity burden. In this report, different cost-effective actions are mentioned to reduce the risks, such as decreasing salt and saturated fats intake to diminish the risks associated with cardiovascular diseases. It also states that one of the priority actions is to promote healthy environments for children (4).

Strategies for healthy communities and schools consider that cities, towns and schools are the most adequate spaces to promote healthy lifestyles for the entire population and specifically for school-aged children. Since children and young people are in a formative stage of life, schools become an ideal place for educational initiatives, so that they can incorporate knowledge, skills and health practices that not only circumvent risk behaviours, but improve health (5).

Various studies report educational initiatives aimed at school-aged children in their educational atmosphere. Some of these studies focus on increasing the knowledge of school-aged children in relation to healthy food (6,7). There are also researches about school-aged children’s food intake preferences, which indicate that vegetables are not the food of their choice (8). Other initiatives are aimed at increasing school-aged children consumption of fruits, vegetables and reduce the consumption of beverages and high-energy density products and increase physical activity (9-13). Some authors mention that in the educational initiatives they have carried out, they focus on the entire school community (school-aged children, parents and teachers) in order to obtain better results and because parents and teachers help shape school-aged children behaviour (9-11).

The objective of this manuscript is to present the results of an educational initiative focused on strengthening physical activity and the consumption of fruits, vegetables and natural water, while discouraging the intake of highly energetic food and sugary drinks in the school community of public schools in Morelos, Mexico.

Methods

A quasi-experimental study through an educational initiative focused on the school community of elementary and junior high schools was implemented. Previous and post-initiative measurements were made. The study was conducted in the municipality of Yautepec, Morelos, in a rural area and an urban area, from August 2010 to July 2011. We employed a convenience sampling (n=150 students and n=178 adults) across rural and urban areas, and applied a pre-post test design based on quantitative and qualitative data. The educational initiative was carried out with students of the 4th, 5th and 6th grades of elementary school, and the 1st, 2nd and 3rd grades of junior high school located within the localities. In addition to school-aged children, teachers, managers and administrative staff of the schools,

as well as parents were included in order to strengthen the changes proposed for school-aged children and make them sustainable (9-11).

Tools and techniques for data collection

School-aged children

The following measurements were taken at the beginning and at the end of the study: weight and height using a standardized anthropometric methodology (14). The weight was measured with an electronic scale (Tanita brand, model 1583, Tokyo, Japan) with capacity of 140 kg and accuracy of 100g. Height was measured using a wooden stadiometer with capacity of 2 meters and precision of 1 mm. The ages and dates of birth were provided by the school-aged children and corroborated by their teachers or mothers. Anthropometric measurements were taken by the research team, which was previously trained according to standard techniques (15). The anthropometric indicators used to assess the nutritional condition of school-aged children were weight/height and height/age. Length and weight data were transformed into z-scores by using the WHO/ANTHROPLUS (16). A cut-off of -2.0 SD was used for classifying children as stunted based on individual height-for-age z-scores. A cut-off of +2 SD was used to classify children as overweight or obese, based on individual weight-for-height- age-z-scores (BMI)-for-age, according to international standards, sex- and age-specific.

Questionnaires applied at the beginning and at the end of the study included (17): i) *dietary information*: Food Frequency Questionnaire (FFQ). This questionnaire was taken from the school-aged children section of the 2006 National Health and Nutrition Survey, which is validated and was applied in all the regions of Mexico. The information was obtained using a 7-day semi-quantitative FFQ. For each food item, the number of days of intake per week, times-a-day, portion size (very small, small, medium, large, and very large), and number of portions consumed were asked. The food groups were as follows: milk and dairy, fruits, vegetables, sugar sweetened beverages and sugar-free beverages, water and sweets and candy, as well as consumption of fruits and vegetables; ii) *physical activity* questionnaire for school-aged children.

Adults

Initially, measurements of weight, height and waist and hip circumferences were made. The applied technique was in agreement with Lohman and Martorell and standardization was according to Habicht (6,7). Weight and height were measured with the same instruments used with school-aged children. Adults' waist was measured at the midpoint between the lower rib and upper margin of the iliac crest; it was taken with a rigid tape brand "Seca" with capacity of 2 meters and precision of 1mm. Hip circumference was measured horizontally at the widest portion of the buttocks. The indicators used to assess the nutritional status of adults were the Body Mass Index (BMI) and waist-to-hip ratio (WHR) circumference index. The classification used to categorize the BMI was taken from the WHO standards (18), which identifies four categories: malnutrition ($<18.5\text{kg/m}^2$) normal BMI (18.5 to 24.9kg/m^2), overweight (25.0 to 29.9kg/m^2), and obesity ($\geq 30.0\text{kg/m}^2$). The classification of the International Diabetes Federation was used as a reference for the waist circumferences, which defines as cut-off waist circumference of >80 cm for women and >90 cm for men (19). WHR was calculated as waist circumference divided by the hip circumference, and a WHR ≥ 0.90 in men or a WHR ≥ 0.85 in women was classified as that representing abdominal obesity (20).

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Schools and communities

In schools and communities there were carried out: i) observation guides for the ethnographic record; ii) guided focus-group interviews, and; iii) community mapping.

Description of educational activities

The educational initiative was based on the Paulo Freire's empowerment education theory, which departs of the knowledge, practices and circumstances of the population involved, and secondly is enriched with theory (new knowledge), so that people can make changes in their environment later on (21-23).

During the educational sessions with school-aged children, participatory and playful techniques were used to promote collective reflection. The sessions were coordinated by facilitators previously trained and lasted 50 minutes. Overall, 15 sessions were held once a week, in each of the school grades (4th, 5th and 6th grades of elementary school and 1st, 2nd and 3rd grades of junior high school). The sessions were divided into two axes: diet and physical activity.

Under the first axis, the following topics were addressed: *a*) the healthy eating plate (24); *b*) the importance of eating fresh fruits and vegetables; *c*) drinking natural water; *d*) the damage caused to the human body by high energy density foods and sugary drinks; *e*) personal commitments to increase the intake of fruits, vegetables and natural water, and; *f*) actions within their family, school and community for healthy eating.

For the second axis, the following topics were addressed: *a*) the importance of physical activity; *b*) the damage caused when being sedentary; *c*) personal commitments to carry out physical activity, and; *d*) actions within their family, school and community to perform physical activity.

School-aged children carried out a series of activities (mural newspaper, school radio, health fairs, community tours, poster competitions, murals, sports tournaments and races within the school and their community) to spread their knowledge and make practical actions, both in their school and in their community.

At the end of the educational sessions, a school committee was established in each school in order to address nutrition and physical activity issues. It also carried out advocacy actions with the schools' directors and local authorities to improve the type of food and beverages that are offered within the educational institutions and the community, as well as various other actions to promote physical activity. Workshops with parents were conducted in eight weekly sessions (two hours per week). With teachers and school staff, the workshops were held in four monthly sessions, where each session lasted five hours long. At the end of each workshop, the groups of parents and teachers made commitments to carry out actions aimed at improving diet and physical activity in various fields such as: personal, family, school and community.

Data analysis

Quantitative component: for the anthropometric analysis, anthropometric indexes based on the measurements of weight, height and age were used. The indicator used for children, adolescents and adults was the BMI. For the classification of children in various categories, BMI distributions were used as well as the criteria proposed by the International Obesity Task Force (IOTF). This system identifies specific BMI breakpoints for each age and gender. The Anthroplus program and the Stata v13 statistical package were used. Univariate and bivariate analyses were obtained from the questionnaires' data. Measures of central tendency were used for numerical variables, whereas frequency distributions were used for categorical variables. Percentages were analyzed and described at the beginning and at the end of the

initiative. The following statistical programs were used for the analysis: Stata v13, Excel 2007 and WinEpi.

Qualitative component: systematization of community mapping, ethnographic records and focus groups.

Results

The analysis was performed with 159 school-aged children with complete questionnaire data: food intake frequency, anthropometry, socio-demographic characteristics, and physical activity (pre- and post-intervention). Mean age was 12.3 ± 1.9 years. Anthropometric data were presented with 150 school-aged children. There were no substantial changes in the nutritional condition (Table 1).

Table 1. School-aged children anthropometry: Body Mass Index (BMI) by community according to gender (percentages)

Parameter	Rural			Urban	
	Total (n=150)	Men (n=17)	Women (n=19)	Men (n=59)	Women (n=55)
Overweight					
Pre	13.3	17.7	21.1	6.8	16.4
Post	13.3	17.7	15.8	11.9	12.7
Obesity					
Pre	1.3	5.9	0.0	1.7	0.0
Post	2.0	5.9	0.0	1.7	1.8
Emaciation					
Pre	7.3	11.8	15.8	3.4	7.3
Post	7.3	11.8	15.8	3.4	7.3

The mean BMI in the pre-intervention phase was 19.4 ± 3.8 , whereas in the post-intervention phase it was 20.5 ± 4.0 . It was found that most of the adult population was above the normal range of the BMI. In the rural community (n=121), it was found that BMI was between 60.2% (community groups) and 85% (parents) above the cut-off that is considered adequate. In the urban community (n=77), BMI ranged from 69.8% (community groups) and 91.7% (parents). The results for teachers in rural schools were: BMI above normal in 88% of them. In urban schools it was 57.1% above the normal BMI.

In 87% of rural schools parents, a $WHR \geq 0.85$ was found and 90.5% of them had a >80 cm waist circumference. Parents in urban areas showed 83.3% $WHR \geq 0.85$ and a >80 cm waist circumference (data not shown).

Consumption changes of drinks, fruits, vegetables and highly energetic food

Natural water consumption increased (not significantly) in school-aged children (from 15.1% to 20.1%) in a 2-4 day range per week. Soda consumption significantly decreased in school-aged children who consumed it daily (from 21.4% to 13.2%) and significantly increased in those who never consumed it or did it once a week (from 8.2% to 9.4% for the first case and from 30.8% to 42.2% for the second case) (Table 2).

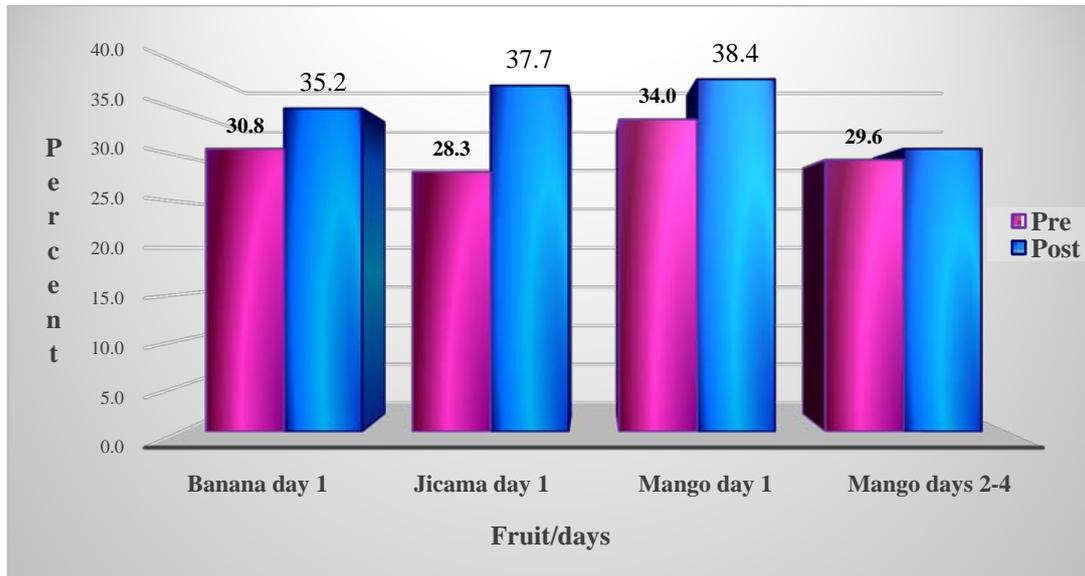
The consumption for at least once a week of some fruits and vegetables, increased regarding products that are common in the area, or inexpensive in certain periods of the year (jicama, apples, pineapples, lettuces, prickly pear pads, cucumbers, squashes and chayote). The intake of oranges, mangos and melons increased from once a week to 2-4 times per week. There was no increase in the consumption of broccoli, cauliflower, cabbage or green beans (Figures 1 and 2). No significant gender differences were found in the consumption analysis of water, soda, fruits and vegetables.

Table 2. Beverages' consumption of school-aged children per community according to intervention phase (percentages)

Type of beverage	Total		Rural		Urban	
	Pre (n=159)	Post	Pre (n=38)	Post	Pre (n=121)	Post
Natural water consumption per week						
Never	3.8	0.6	7.9	0.0	2.4	0.8
1 day	13.8	10.7	21.1	7.9	11.6	11.6
From 2 to 4 days	15.1	20.1	7.9	29.0	17.4	17.4
From 5 to 6 days	15.1	15.7	7.9	18.4	17.4	14.9
7 days	50.9	51.0	52.6	42.1	50.4	53.7
Did not answer	1.3	1.9	2.6	2.6	0.8	1.6
Soda consumption per week						
Never	8.2	9.4	2.6	10.5	9.9	9.1
1 day	30.8	42.2	42.1	42.1	27.3	42.1
From 2 to 4 days	30.8	23.9	34.2	34.2	29.8	20.7
From 5 to 6 days	8.8	11.3	5.3	7.9	9.9	12.4
7 days	21.4	13.2	15.8	5.3	23.1	15.7

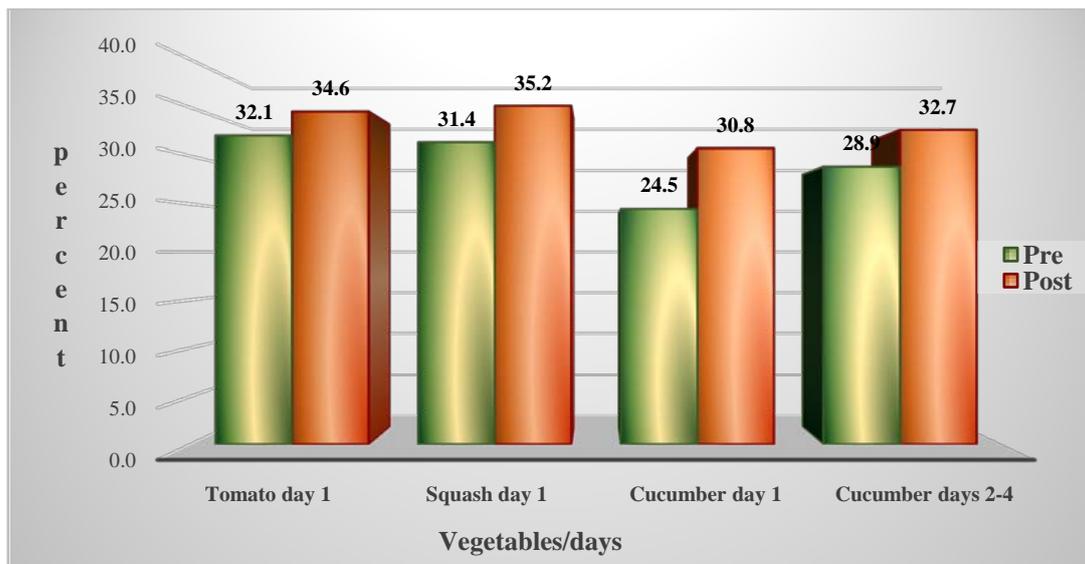
The frequency of fried food consumption decreased slightly (81.2% vs. 79.3%), as well as the intake of industrial pastries.

Figure 1. School-aged children's fruit consumption percentage per week days (n=159)



In schools, teachers promoted the accessibility of natural water for school-aged children, and also made modifications (increased the consumption of fresh food and decreased the intake of high energy density food) in the type of food offered to school-aged children. Focus groups with school-aged children reported that they increased natural water and fruits intake. Simultaneously, they pointed out that they decreased their sugary drinks and junk food intake.

Figure 2. School-aged children' vegetables consumption percentage per week days (n=159)



In addition, drinking natural water sweetened with fruits and the absence of soft drinks was observed in the ethnographic record of the rural community:

“According to what was taught, did you do any changes?”

– *“I drink more water and eat more fruits”.*

– *“We hardly eat junk food now”.*

– *“I barely use Valentina sauce and I add less sugar to my coffee or tea”* (junior high school and rural elementary school focus group: 33-44).

Differences were observed in focus groups with teachers, who reported positive changes for the urban elementary school and the rural junior high school:

– *“Did you notice any changes in the children?”*

– *“No doubt there were changes in the children and the school in general. Although, as you just said, only 4th, 5th and 6th graders participated in the educational activity, and now the children who were in 4th grade are in 6th grade. There were changes in the school: we no longer sell candy or soft drinks. There has been a change in the food that the school offers to students because of the advices and information that you gave us at the beginning of this project, along with the directions that have been implemented by the Basic Education Institute of the State of Morelos”* (urban elementary school teachers’ focus group).

In community mapping exercises of all groups, it was identified that there is a limited offer of fresh food, fruits and vegetables in both communities, while there is an oversupply of high energy density food and sugary drinks.

Physical activity and sedentary lifestyle

The calculation results of the metabolic rate measurement units (MET’s) of the students were as follows: mild MET: mean (SD)=17.8±13.7, corresponding to cleaning, games, board games, chats, music, reading and working; moderate MET: 18.2±20.2 corresponding to games or sports with a moderate wear out (skating, gym, swimming, riding bikes or motorcycles); vigorous MET: 64.4±48.1 including high physical performance activities (soccer, basketball, dancing, running, tennis, and the like). Weekly hours dedicated to each of the activities were as follows: mild activities: mean (SD): 6.3±5.2 hours; moderate activities: 3.96±5.1 hours; vigorous activities: 8.5±7.1.

There was a significant increase in the school-aged children’s physical activity like playing soccer (14% vs. 27%), and dancing (3% vs. 7%), among other activities, regarding the baseline.

Sedentary activities decreased: the percentage of students who did not watch movies increased (from 23.9% to 30.8%), or played videogames (from 40.9% to 44.0%), and the hours per week children used to watch movies decreased from 6 to 7 hours per week (from 3.8% to 0.6%).

Discussion

This study fostered changes in the eating habits of school-aged children, drinking natural water and eating more fruits and vegetables, while diminishing sedentary activities from the actions taken by the educational initiative.

There were no significant changes between the two anthropometric measurements carried out at the beginning and at the end of the initiative, which happens to be consistent with a study carried out with schoolchildren in Hawaii, who showed no significant changes between the measurements of BMI (25). Bayer et al. have reported similar results in a longitudinal study

in which no significant changes were obtained in the BMI (26). In a literature review of research carried out in Brazil, it was reported that there was an increase in the level of knowledge and food choices in school-aged children, but there were no changes in the nutritional status (27).

It was found that parents and teachers have high percentages of O/O, similar to the percentage reported by ENSANUT in 2012. This aspect is relevant since it points out that one of the factors associated with school-aged children O/O is the high BMI of their parents (28). Due to the above, it is important to incorporate parents and teachers into educational initiatives aimed at school-aged children so that dietary changes can be sustainable. In fact, the incorporation of parents and teachers has been reported in several studies (9-11), and in a study carried out in Mexico, the integration of parents and teachers was recommended since the beginning of the study in order to obtain better results (29).

The post educational initiative data showed an increase in water consumption and the elimination of sugary drinks at school, which is consistent with the findings of James et al. (30), who reported an increase in water consumption and a reduction of sugary drinks.

Other studies have reported an increase in healthy eating knowledge but without showing any changes in the nutritional condition, which is similar to the results of this research (6,31), but differs in that school-aged children made changes in their eating habits with the intake of fruits, vegetables and natural water, which was the main objective of the educational initiative. The results obtained in our study are similar to those reported in other studies (9,11-13).

Changes in the nutritional condition of school-aged children require the link between the educational initiative and structural social actions such as public policies addressing the type of food that is sold at schools and community environments, the production and manufacture of high-energy food and the strict regulations on food advertising aimed at this population. Wijesinha-Bettoni et al. have reported that, in Mexico, educational and health authorities do not have strategies or actions to provide vegetables and fruits to school-age children in food programs carried out in schools (32).

The information gathered from the teachers' focus groups showed that they appreciated the changes in school-aged children involved with the educational initiative, as well as their commitment and concern for school's diet, which is similar to what Schetzina et al. have previously reported (33).

Sedentary activities dropped after the initiative, which coincides with Veugelers et al. (34), and Lawlor et al. (11), who reported similar results in their studies.

The limitations of this study were: the educational initiative was targeted for the 4th, 5th and 6th graders; the implementation time was short and did not include another school for comparison. Other limitations of this study are related to the context of schools and communities, since the supply of fruits and vegetables is low in contrast to the oversupply of products and drinks of high energy density, and there are no spaces to perform physical activity. Due to the size of the population included in the study, the results cannot be extrapolated to other regions of the country.

Conclusions

This study shows that, although moderate, it is possible to achieve a change in behaviour with a specific educational initiative. This study should be expanded to increase the number of

educational sessions with school-aged children and with all members of the school community, to strengthen scientific evidence with diet and physical activity subjects that must be part of the school curriculum, to make progress on the health of this population group.

Educational activities that modify school-age children's behaviours are not enough for reducing overweight and obesity. The implementation of diverse and simultaneous actions is needed, such as an increase in the supply access and availability of fresh and healthy foods. This is why the promotion of policies and regulations regarding the type of food and diet at schools and communities is essential.

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