Outcomes of a school-based intervention (RESCATE) to improve physical activity patterns in Mexican children aged 8–10 years

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Abstract

The aim of this study was to evaluate the impact of an intervention program on the patterns of physical activity in 8- to 10-year-old Mexican children from lower socioeconomic status. This study performed a randomized controlled field trial in 498 children aged 8–10 years from 10 public schools of low socioeconomic status in Mexico City. Schools were randomly assigned to intervention (n = 5) or control (n = 5) groups and followed up during 12 months. Physical and sedentary activities were assessed at the beginning of the program and after 6 and 12 months. At the end of follow-up, there was a significant increase in the performance of moderate physical activity (MPA) among children in intervention group who had not performed MPA at baseline any day of the week (40%, P = 0.04) but not in the control group (8%, P = not significant). The intervention group also showed a significant reduction in the proportion of children who spent more than 3 hours a day playing video games (from 23 to 13%, P = 0.01), while control group did not show significant changes. Given these findings, we conclude that intervention was able to modify positively physical activity and reduce time spent on such sedentary activities as video games among those at highest risk studied children.

Introduction

Cardiovascular disease remains among the leading causes of death in Mexico and throughout the world [1]. Obesity is one of the most important risk factors for cardiovascular disease [2], and it has recently undergone a considerable increase throughout the world, particularly among children and adolescents [3–5]. In 1999, the prevalence of overweight and obesity in schoolchildren (from 5 to 11 years of age) in Mexico was around 19% [6]; by 2006, it had grown to 26% [7].

Although biological factors may influence children’s risk for becoming overweight, compelling evidence suggests that children’s contexts such as the home and school environments promoting unhealthy eating and exercise habits are precursors of obesity [8]. Physical activity and inactivity are the most variable components in energy output and are to some degree under voluntary control [9]. Since growth and development during childhood require considerable nutritional intake, increased physical activity results in better weight control than diet alone [10].

Childhood and adolescence are critical periods for the acquisition of healthy habits, including physical activity. There is evidence that levels of physical activity diminish significantly during the
first years of adolescence in lower socioeconomic groups [11].

Schools have been recognized as the ideal spaces to implement health strategies because of their influence on the family and community [12, 13]. School programs also have the advantage of providing and sustaining effective educational initiatives within the existing institutional structures [14]. Thus, from the public health perspective, school programs that promote physical activity for children are considered to be the most effective strategies for reducing the risk of chronic degenerative diseases associated with sedentary lifestyles [15, 16].

Studies in the United States [14, 17], the United Kingdom [18] and Mexico [19, 20] have shown the benefits of schools’ intervention programs to modify the student’s pattern of diet and/or physical activity. Salmon et al. [21], in a narrative review of 76 interventions to promote physical activity among children and adolescents, established that interventions delivered in the school setting that involved activity breaks or that included family strategies appeared to be the most effective among children.

The aim of the present study was to evaluate the impact of an intervention program on the patterns of physical activity in 8- to 10-year-old Mexican children of low socioeconomic status. This is a subanalysis derived from a larger study focused on evaluating the effectiveness of an intervention for cardiovascular risk reduction (RESCATE program), which included a physical activity and nutritional components, in 8- to 10-year-old students from low socioeconomic status [19].

**Methods**

**Participants and recruitment**

The RESCATE program [19] was a randomized controlled field trial that included 619 children of both sexes in Grades 4 and 5 from a convenience sample of 10 public primary schools of low socioeconomic status in Mexico City. The participating schools were randomly assigned to the intervention group (IG = 5) or the control group (CG = 5). The RESCATE intervention began in the 2005–06 school year and continued as students progressed through Grade 4 and 5, ending in the 2006–07 school year.

Written informed consent was obtained from the school principals, teachers, parents and the students themselves for participation in the program activities. Children were included if they and their parents signed an informed consent form that was sent home the day before all measurements were made. Children with a contraindication for physical activity, with a secondary hypertension or with any congenital abnormality were excluded. The study was approved by the Ethics and Investigation in Humans Committee of the Secretaría de Salud del Gobierno del Distrito Federal.

Of the 619 children selected, 498 (IG = 245 and CG = 253) finished the follow-up period, and these are the children included in the present report.

**Measures**

‘Physical and sedentary activities’ were assessed on all 498 children at the beginning of the program and after 6 and 12 months using the Spanish language version of the Student Physical Activity and Nutrition (SPAN) questionnaire [22] from the Child and Adolescent Trial for Cardiovascular Health (CATCH) program [23]. The reproducibility and validation of the Spanish version used were evaluated in a Hispanic population [22].

Information on ‘moderate-to-vigorous physical activity’ (MVPA) was obtained by asking: How many days during the last week did you exercise or participate in sports activities for at least 20 min that made your heart beat fast and made you breathe hard (for example, basketball, jogging, fast skating, fast dancing, swimming laps, tennis, fast bicycling or aerobics)? The answers were (i) never, (ii) 1–3 days and (iii) more than 3 days.

‘Moderate physical activity’ (MPA) was evaluated by the following question: How many days during the last week did you exercise or participate in physical activity for at least 30 min that did not make your heart beat fast and did not make you breathe hard (for example, walking quickly, slow
bicycling, skating, mopping the floor, jumping rope or playing tag)? The answers were (i) never, (ii) 1–3 days and (iii) more than 3 days.

‘Sedentary activities’ were assessed asking about the amount of specific behavior on the previous day. The questions included, ‘Yesterday, how many hours did you watch TV or video movies away from school?’ ‘How many hours per day do you usually spend on the computer away from school?’ and ‘How many hours per day do you usually spend playing video games like Nintendo, Sega, Play Station, Xbox, GameBoy or arcade games away from school?’ Response categories for each item included (i) none, (ii) 1–3 hours and (iii) more than 3 hours.

Procedures

The activities included in the program to improve physical activity were addressed at three levels: individual, school and family. The activities at each level are summarized in Fig. 1.

At the ‘individual level’, classroom lessons and exercise breaks were implemented. The educational component in the classroom involved lessons that emphasized the importance of physical activity. The lessons were 30 min long and were given weekly for 20 weeks by health teams (a physician, a dentist, a psychologist, a nurse and a social worker) permanently assigned to the schools. The health teams were trained to carry out this activity and received a procedure manual that included a teaching guide.

Exercise breaks in the classroom lasting 2–10 min were designed to increase energy output and promote physical activity in the classroom. The TAKE 10® program of classroom physical activity [24] was adapted for this purpose and included in the procedure manual for the classroom teachers who led the exercises.

‘School-level’ intervention included physical education classes. The aim of this component of the program was to increase the length of time that children participated in moderate to strenuous exercise during physical education classes. For 30 min twice a week, there was a substitution of regular exercise during physical education classes for new ones that required moderate to vigorous energy output. In terms of metabolic equivalents, or ME, moderate exercise in ME per hour is between 3.0 and

![Fig. 1. Activities included in the RESCATE program to improve physical activity at three levels: individual, school and family.](image-url)
Vigorous exercise in ME per hour is >6.0 [25, 26]. Physical education teachers received a manual with the appropriate exercise options.

The physical activity intervention was based on recommendations from the Center for Disease Control and Prevention for schools and community programs to promote physical activity in young people [27].

‘Family level’ involved family members in support and reinforcement of classroom lessons. Each child received a book of activities to take home with exercises that corresponded to the lessons at school and was implemented with collaboration with his parents. In addition, the parents received recommendations for achieving a more active lifestyle. Recommendations included decreasing time spent on sedentary activities like watching television, using a computer or playing video games.

Criteria of success

Success was defined as: (i) the initiation of MPA or MVPA among children who did not perform them at baseline and (ii) the reduction in the number of hours spent in sedentary activities among those children who spent more than 3 hours a day in these activities.

Data analysis

Results were expressed as mean ± standard deviation when the variables were continuous and in relative frequencies when they were categorical. For a baseline comparison of the continuous variables of the two groups, the Student’s t-test for independent groups was used. The $\chi^2$ test or Fisher’s exact test was used for categorical variables. Changes observed within each group after the intervention were evaluated by the McNemar’s test. Data were analyzed using the SPSS statistical program (SPSS 12.0 for Windows; SPSS, Inc., Chicago, IL, USA).

Results

The analysis included 498 children (IG = 245, CG = 253). Males made up 56% of IG and 47% of CG $[P = \text{not significant (NS)}]$, while mean age was 9.4 ± 0.7 for both groups.

All 10 schools maintained their participation in their allocated condition during the 12-month study period. No additional physical activity intervention program was administrated in any of the participating schools.

Assessment of physical activity at baseline showed that a high proportion of children in both groups did not perform MVPA (IG = 13%, CG = 15%) or MPA (IG = 16%, CG = 18%) any day of the week. Figure 2 shows the frequency of children that spend more than 3 hours a day in different sedentary activities. No significant differences were observed between the groups for MPA, MVPA and sedentary activities at baseline.

Tables I and II show the number of IG and CG students engaging in MPA and MVPA at least 1 day of the week and in sedentary activities at least 1 hour a day at baseline, 6 and 12 months. However, considering the criteria of success mentioned...

![Fig. 2](image-url) Baseline frequency of children that spent >3 hours a day in some sedentary activities.

### Table I. Percentage of children engaging in MPA and MVPA at least 1 day of the week at baseline and follow-up by study groups

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<thead>
<tr>
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<th>Intervention group (n = 245) (%)</th>
<th>Control group (n = 253) (%)</th>
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<tbody>
<tr>
<td></td>
<td>MVPA</td>
<td>MPA</td>
</tr>
<tr>
<td>Baseline</td>
<td>87</td>
<td>84</td>
</tr>
<tr>
<td>6 months</td>
<td>89</td>
<td>91</td>
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<tr>
<td>12 months</td>
<td>92</td>
<td>76</td>
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before, the impact of the program at 6 and 12 months is described below.

**Findings after 6-month follow-up**

In children of IG who had not performed MPA or MVPA any day of the week at the beginning of the study, 60% ($P = 0.004$) and 58% ($P = 0.003$) reported MPA and MVPA more than 3 days a week, respectively, after 6 months of follow-up. Whereas among CG children who had not previously reported any MPA or MVPA prior to the study, 33% ($P = NS$) and 20% ($P = NS$) performed MPA and MVPA, respectively.

No significant changes were observed in the number of hours the children spent watching television, playing video games or using a computer in either of the study groups.

**Findings after 12-month follow-up**

No significant changes from baseline to 12 months in performance of MVPA were observed in either of the two groups. The impact of the program on MPA at 6 months remained after 12 months since of the children in IG who had not performed MPA at baseline any day of the week, 40% ($P = 0.04$) reported performing MPA more than 3 days a week compared with 8% in the CG ($P = NS$).

Consistent with the 6-month evaluation, at the end of the study no significant changes were observed in the number of hours that children spent watching television or using computers. However, the IG showed a significant reduction in the number of hours playing video games, among children who spent more than 3 hours a day in this activity at baseline, but the CG did not (Fig. 3).

**Discussion**

Even though the multiple benefits of regular exercise are known [20, 28–31], its practice remains rare among young people [7, 32], as was observed in the present study, where the baseline results showed a high proportion of overall children had not practiced MVPA or MPA any day of the week. This situation gets worse if we consider the time spent by children in sedentary activities as watching television and playing video games.

Also, results of this study showed that, at the beginning, more than a third of overall children spent more than 3 hours a day watching television. In this matter, it is important to emphasize that a positive correlation between the amount of hours that children and adolescents spend watching television and overweight had been reported previously [32]. Thus, the need to use strategies to increase the physical activity and reduce sedentary activities in children and adolescents is indisputable.
A number of studies have been launched to test the effectiveness of interventions designed to promote physical activity in children and adolescents, but the results have not been definitive.

A systematic review of recent clinical studies indicate that while multilevel interventions to promote physical activity in adolescents were effective, in children the evidence was not conclusive, and in some cases, such as those involving lower socioeconomic groups, was limited [33]. However, it is important to mention that only 10 of the 57 studies included had follow-ups of 6 months or more. RESCATE was an effort to demonstrate the effects of a program on the physical activity patterns in children at longer term.

As well as, it seems that school-based intervention that include a family-based component is more effective than those with only a school-based component, as was described by Salmon et al. [21]. RESCATE, an intervention program focused on students from lower socioeconomic groups that involved a family component with a 12-month follow-up period, was able to demonstrate a significant improvement in self-reported MPA but not in MVPA.

After 6 months of follow-up, a significant proportion of the children in the IG had begun to practice MVPA and MPA more than 3 days a week, while the CG reported no significant changes. At the end of the follow-up period, the impact of the program on MPA was maintained; however, no significant change occurred in the practice of MVPA in either group at the end of the follow-up with respect to the baseline measure. This emphasizes the important to strengthen this component of the program so that the effect lasts longer and contributes to reducing cardiovascular risk in schoolchildren.

The CATCH [23], one of the largest school-based health promotion field trial including a family-based component in half of the intervention schools, found that even when after a 3-year study period intervention students reported significantly more daily vigorous activity than controls (58.6 versus 46.5 min, \( P < 0.003 \)), there were no additional effects among children in the CATCH plus family-based intervention compared with the CATCH-only intervention children.

However, there are some other school- and family-based interventions [18, 34–36] that have been shown to be effective in promoting children’s physical activity, as was also observed in the RESCATE study. However, it remains unclear if these interventions are able to modify positively the overall children’s physical activity, besides the effects on physical activity into the school, measured by objective methods.

Even though physical activity outside the school was not measured in the RESCATE study, sedentary activities were evaluated, and a 10% reduction in the proportion of children playing video games for more than 3 hours a day was found. However, television viewing, one of the most prevalent sedentary activities in our environment with a great impact on children’s eating habits, was not significantly modified. Consequently, it is essential to develop more effective strategies for reducing the time children devote to watching it.

Finally, with the findings reported in the present study, it is possible to conclude that the RESCATE program, which includes components of physical activity at individual, school and family levels, is an effective tool to increase MPA and reduce time spent on such sedentary activities as video games among those at highest risk students (who reporting no physical activity or more than 3 hours a day in sedentary activities at baseline) in 8- to 10-year-old Mexican children from lower socioeconomic status.

At the same time, the program activities with similar objectives should be reinforced periodically so that part of the children’s daily activities are dedicated to exercise, and they remain physically active on a long-term basis.

**Study limitations**

The RESCATE study had four important limitations. The first was that the effect of the program was evaluated only in the subgroup of highest risk children, those reporting no physical activity or those who spent more than 3 hours a day in the studied sedentary activities at baseline. The second
was the vacation period. The students had 2-month summer vacations, during which they were not reached and recidivism, that was not assessed, could occur. The third was that the collected data were ‘self-reported data’. Some authors [37, 38] suggest that this method could overestimate the physical activity levels, as a result of an exaggerated perception of time and effort. And the fourth was the fact that this was a nonrandom and non-representative sample. Thus, these results may not be applicable to other populations.

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