Gender differences in physical activity patterns, & the effects of time spent in school on total daily energy expenditure in Bolivian children

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INTRODUCTION

There has been an increasing concern with the “obesity epidemic”, both in the public and research communities. Increasing obesity is no longer solely a problem in “western” nations. Poston & Foreyt noted, “Obesity is an environmental issue. Societies that are transitioning to westernized lifestyles are experiencing substantial increases in its prevalence.”

The amount of time children spend sitting in classrooms is often neglected in evaluations of activity levels typical of a western sedentary lifestyle. But as populations become more modernized, children are likely to spend increasing time in classrooms, which may lower their total energy expenditure relative to that of a more traditional lifestyle, even as traditional eating habits remain unchanged.

OBJECTIVES AND HYPOTHESES

To examine the effects of modernization on children’s activity levels and patterns, this study has two main goals:

Goal 1: School vs. other activities
Evaluate the potential effect on children’s total energy expenditure of time spent in school versus time in those activities typical of Bolivian agropastoral communities, and estimate the likely effect of this change in total energy expenditure on children’s obesity.

Goal 2: Gender differences in activity patterns
Evaluate potential gender differences in activity patterns in Bolivian schoolchildren. Specifically, we examined whether there were differences between boys and girls in time spent on:
• sports
• homework
• chores
• helping father with his job
• helping mother with her job

METHODS

In August 2003, 41 boys and 60 girls (11-14-year-olds) attending school in El Alto, Bolivia were interviewed on their engagement in sports, chores, homework, and helping parents; anthropometrics were also measured. El Alto is a peri-urban area near La Paz that provides an exceptional opportunity to evaluate the effects of transitioning from a traditional agropastoral to more modern lifestyle.

Based on these data, for each child we estimated individual total daily energy expenditure (TDEE) using predictive equations for physical activity level and basal metabolic rate (procedure described below):

1. Estimate basal metabolic rate (BMR)
   Based on predictive equations for males and females based on age and body weight:
   Females: 13.4(age) + 693 (kcal/day)
   Males: 17.7(age) + 658 (kcal/day)

2. Assign a physical activity ratio (PAR) for each 30-minute period in a week (=336 periods)

3. Define a child’s average physical activity level (PAL) as the sum of the PARs for all the week’s activities divided by 336.

4. Estimate TDEE: (TDEE) = (PAL) x (BMR)

Goal 1: School vs. other activities
For physical activity level and TDEE, compared:
1) School vs Predicted Light Work
2) School vs Predicted Moderate Work
To predict school time spent on either activity:
   Predicted Light Work: Substituted PAR = 2.0 for the 4 hours of school time (PAR=1.2)
   Predicted Moderate Work: Substituted PAR = 4.0 for the 4 hours of school time (PAR=1.2)

Goal 2: Gender differences in activity patterns
Compared time boys and girls spent on the following activities:
1) Sports
2) Helping father with his job
3) Chores

RESULTS

Goal 1: School vs. other activities
Both genders had significantly lower physical activity levels and total daily energy expenditure than they would have had if time in school had been spent in the children’s chores typical of traditional agropastoralists (p<0.001, paired t-test).

Goal 2: Gender differences in activity patterns
Results show that boys and girls did not differ in time spent on most activities, but did differ in time spent on chores (p = 0.029, Welch 2-Sample t-test).

CONCLUSIONS

• Sitting in classrooms significantly lowers physical activity levels and total daily energy expenditure.
• Both boys and girls are at risk for obesity with the “modernization” of children’s activity patterns. Assuming no reduction in food intake, 780 kcal leads to an average of 1 kg weight gain as fat, the weight gain with reduced levels of energy expenditure can be estimated:
  • reducing total daily energy expenditure by no longer engaging in light work but sitting in school:
    > Girls: 93 kcal less per day leads to ~4.4 kg weight gain over a year
    > Boys: 101 kcal less per day leads to ~4.8 kg weight gain over a year
  • reducing total daily energy expenditure by no longer engaging in moderate work but sitting in school:
    > Girls: 400 kcal less per day leads to ~19 kg weight gain within a year
    > Boys: 437 kcal less per day leads to ~21 kg weight gain within a year
  (High weight gain would likely be partially offset by reduced intake and/or metabolic changes)

• There is a significant gender difference between the amount of time children spend on chores.

• Possible solutions:
  • Reductions in energy intake
  • Incorporation of sports or similar physical activities into school curriculum
  • Implementations of standing-biased desks in classrooms

REFERENCES


ACKNOWLEDGMENTS

We would like to thank the Bolivian children for their participation, Esperanza Caceres for her invaluable assistance, and William Leonard for analytical suggestions.

Financial support from the U.S. National Science Foundation.

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