Increasing Physical Activity In Inner City Youth Using Novel Interactive Gaming

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Objective

To assess the feasibility of participation in an after-school physical activity program incorporating novel exercise technologies on changing physical activity level and physical fitness, compared to a nutrition education intervention alone. A second objective was to assess whether this type of intervention could modify cardiovascular risk factors and anthropometrics.

Target Population

Children enrolled in 3rd - 5th grade at an inner-city public elementary school in Boston, MA.

Project Description

Children were randomly assigned to either nutrition education sessions only ("Advice Only"), or nutrition education plus supervised physical activity ("GoKids") for 10 weeks. Physical activity sessions were conducted three afternoons per week at GoKids, UMass Boston, a center designed to provide children with supervised physical activity incorporating novel gaming and interactive physical activities as well as traditional cardio and strength training equipment. Nutrition education, held at the school one afternoon per week for all participants, covered a broad range of topics consistent with the Dietary Guidelines for Healthy Americans, and incorporated games, worksheets and exposure to new and healthy foods.

Methods

All assessments were conducted at baseline (1-wk prior to start) and at the end of the intervention. Children were instructed to wear an ActiGraph accelerometer for 7 consecutive days to measure physical activity at both assessments. Time in sedentary behaviors, light activity, and moderate and vigorous physical activity (MVPA) was calculated using the Freedson child specific equation. Fitness (predicted VO^2max) was estimated using a 15 meter shuttle run. We obtained non-fasting fingerstick total cholesterol (TC), triglyceride (TG) and glucose levels, and measured height, weight, waist circumference (WC); we auscultated SBP and DBP. BMI and BMI percentile were calculated from the measured height and weight, and percent body fat (BF%) was estimated using bioelectrical impedance. Attendance was recorded daily.

Results

- Of 42 consented, 36 participants completed the study (14% attrition, see Figure 1). Overall session attendance was >80%. Average age of participants was 9.7 ± 0.9 years; 53% were male, 50% African-American, 56% Hispanic, 81% received free/reduced school lunch.
- There were no between group baseline differences in time spent in MVPA, predicted VO^2max, non-fasting TC, TG, glucose, and the anthropometrics WC and BMI and percent body fat. At study end, neither group showed significant changes in TC, BP, WC, percent body fat, BMI percentile, or fitness (p>0.05).
- MVPA increased in the GoKids group (Intervention) from baseline to final visit and decreased in the Advice Only group (Control), neither change was significant when wear time and other design factors were taken into account (adjusted p=0.35 and p=0.13 respectively). The between group difference in change from baseline also did not reach statistical significance (p=0.09).
- Light physical activity increased in the GoKids group (Intervention) and decreased in the Advice Only group (Control), and comparing the between-groups difference revealed significant differences (p=0.02). Sedentary activity declined in the GoKids group (Intervention) and increased in the Advice Only group (Control); again, the change differed significantly between groups (p=0.05).

Study Participant Flowchart

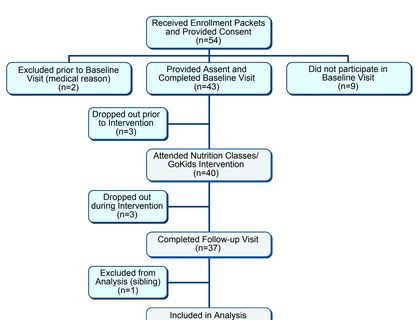


Table 1: Sociodemographic Characteristics (N=36)

	Control (N=19)		Intervention (N=17)		P Value
Age years mean ± SD	***9.89±0.95***		***9.43±0.91***		***0.14***
	N	***%***	***N***	***%***	
Gender					
Male	9	47%	10	59%	0.53
Grade					
Third	5	26%	10	59%	0.16
Fourth	9	47%	6	35%	
Fifth	5	26%	2	12%	
Race					
White/Caucasian	6	31%	5	29%	1.0
Black/African American	9	47%	9	53%	
Asian	2	11%	1	6%	
Not specified	2	11%	2	12%	
Ethnicity					
Hispanic	9	47%	11	65%	0.34
Family					
Two parent	4	21%	7	41%	0.16
Single parent	13	68%	9	53%	
Other	2	11%	1	6%	
Medical Conditions					
Asthma	4	21%	3	18%	1.00
Allergies	4	21%	2	12%	0.66
Healthcare					
Doctor's Office	3	16%	0	0%	0.34
Hospital	3	16%	4	24%	
Community Health Center	13	68%	13	76%	
Parental Employment					
Employed (≥35 hours)	6	32%	6	35%	0.54
Employed (<35 hours)	1	5%	3	18%	
Student/not employed/other	11	58%	8	47%	
Parental Education					
Some high school	4	21%	4	24%	0.61
High school/GED	5	26%	5	29%	
1-4 years of college	9	47%	3	18%	
Other	1	5%	3	18%	
Free/Reduced School Lunch	14	74%	15	88%	1.0

Table 2: Anthropometric and Lab Values at Baseline and Follow-up (N=36)

Group Characteristic	Baseline	Follow-up	Mean Change	P Value
***Height**, cm*				
Intervention	135.5 ± 9.2	136.7 ± 9.2	1.2 ± 0.7	0.11
Control	138.9 ± 11.5	140.4 ± 11.5	1.5 ± 0.4	
***Weight**, kg*				
Intervention	40.4 ± 15.6	41.2 ± 16.0	0.8 ± 1.3	0.54
Control	40.8 ± 12.6	41.3 ± 12.6	0.5 ± 1.3	
***Waist circumference**, cm*				
Intervention	69.4 ± 13.9	68.9 ± 14.3	-0.5 ± 2.7	0.87
Control	68.0 ± 10.9	67.4 ± 10.2	-0.7 ± 2.3	
***BMI**, kg/m^2*				
Intervention	21.7 ± 7.1	21.8 ± 7.2	0.02 ± 0.66	0.36
Control	20.7 ± 3.6	20.5 ± 3.6	-0.19 ± 0.71	
BMI percentile				
Intervention	77.7 ± 24.5	75.5 ± 25.4	-2.3 ± 5.1	0.67
Control	77.5 ± 27.4	75.9 ± 27.0	-1.6 ± 3.8	
BIA Percent Body Fat*				
Intervention	26.9 ± 7.9	27.0 ± 8.1	0.09 ± 1.58	0.53
Control	29.5 ± 5.9	29.2 ± 6.3	-0.27 ± 1.66	
Systolic Blood pressure**, mmHg				
Intervention	95.5 ± 14.5	94.2 ± 14.7	-1.3 ± 8.4	0.32
Control	95.8 ± 8.6	97.5 ± 11.8	1.8 ± 9.5	
Diastolic Blood Pressure**, mmHg				
Intervention	58.2 ± 7.5	58.4 ± 8.3	0.2 ± 6.9	0.80
Control	59.6 ± 5.9	60.5 ± 2.3	0.9 ± 9.2	
***Total Cholesterol**, mg/dL†*				
Intervention	165.9 ± 15.4	168.6 ± 25.0	5.7 ± 24.2	0.83
Control	158.2 ± 19.4	163.9 ± 21.5	3.9 ± 22.3	
***Glucose**, mg/dL†*				
Intervention	82.7 ± 8.6	92.5 ± 14.0	11.2 ± 15.8	0.36
Control	84.5 ± 11.2	90.4 ± 13.8	5.6 ± 17.1	
***Triglycerides**, mg/dL†*				
Intervention	105.2 ± 50.9	110.5 ± 83.1	1.3 ± 80.6	0.59
Control	83.8 ± 35.1	92.6 ± 50.4	12.6 ± 48.5	

** BIA: Control n=16; intervention n=17*
*** Blood pressure: Control n=18; intervention n=18*
† Labs: Control n=16; intervention n=16

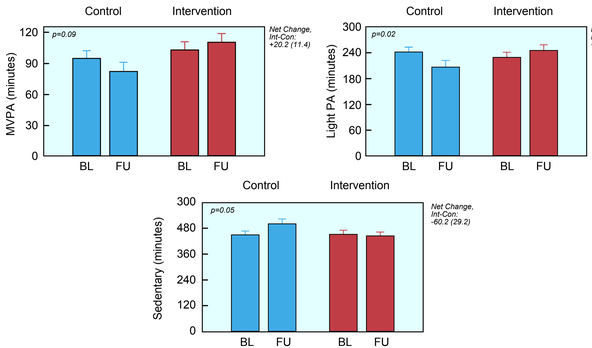
Table 3: Accelerometry And Fitness Data

Unadjusted mean ± SD baseline and follow-up values for average time spent per day in moderate to vigorous physical activity (MVPA), light physical activity, sedentary behaviors, and estimated VO^2max. Mean change during the intervention for each group are presented as adjusted mean ± SE.

Characteristic	Group	Baseline	Follow-up	Mean Change*	P Value Within Group*	P Value Between Groups†
Moderate and Vigorous Physical Activity per day (min)	Intervention	100.3 ± 67.2	110.5 ± 59.0	7.4 ± 7.8	0.35	
	Control	88.8 ± 51.0	70.9 ± 37.0	-12.9 ± 8.4	0.13	0.09
Light Physical Activity per day (min)	Intervention	234.0 ± 93.0	250.8 ± 76.9	16.1 ± 13.9	0.26	
	Control	245.4 ± 94.7	199.7 ± 99.8	-35.0 ± 14.9	0.03	0.02
Sedentary Activity per day (min)	Intervention	459.3 ± 165.0	450.4 ± 152.9	-9.1 ± 20.0	0.65	
	Control	466.5 ± 156.7	455.8 ± 156.8	51.1 ± 21.4	0.02	0.05
Estimated VO^2max*	Intervention	41.5 ± 2.8	40.9 ± 3.1	-0.5 ± 0.6	0.34	
	Control	40.2 ± 1.9	40.0 ± 3.3	-0.5 ± 0.6	0.41	0.92

**Test for zero change from Baseline to Follow-up. The estimate is adjusted for wear time, weekday vs. weekend, normal weight vs. overweight, wave (Spring or Fall).*
†Test for equal change between groups.
***Estimated from 15 meter shuttle run.*

Figure 1: Mean Minutes Per Day of Moderate and Vigorous Physical Activity (MVPA), Light Physical Activity, and Sedentary Behaviors by Group Assignment and Baseline (BL) or Follow-up (FL) Measurement



Conclusions

- In this pilot study of supervised physical activity, that included both traditional and exergaming activities, there was no significant change in MVPA, fitness, cardiovascular or anthropometric outcomes.
- However, we were able to demonstrate an increase in light physical activity and a decrease in sedentary activity over the course of the intervention in the GoKids (Intervention) group compared to Advice Only (Control)
- The lack of effect on these outcomes may indicate insufficient power related to the small sample size of this pilot and/or insufficient intensity, frequency and duration of physical activity exposure.
- We demonstrated this approach was feasible; the exercise was well-attended (>80% attendance for nutrition and exercise sessions), and well-received by both the children and school officials.
- Our data suggests that although this model may not be suitable for the treatment of obesity, such a well-attended and well-received program may help to promote weight maintenance and prevent obesity in inner-city elementary school children.

Lessons Learned

- After-school exercise programs may be more successful if they:
  - incorporate exergaming to increase enthusiasm for PA
  - engage key stakeholders (e.g., school principal)
  - provide transportation
  - have school staff accompany children to sessions
- Future studies need to determine if increasing intensity and/or volume of activity, increasing the amount of exergaming, and including parents in the nutrition and/or physical activity part of the program can better impact fitness and risk profiles.