

Longitudinal Results of a School-Based Obesity Prevention Program Targeting Ethnically Diverse, Early Childhood Students

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Abstract

The purpose of this study was to determine whether early childhood students who participated in the teacher-implemented Healthy for Life/PE4ME Program experienced significant changes in their age-adjusted body mass index (BMI) percentiles, obesity-related lifestyle behaviors, and knowledge of healthy foods and physical activities. A total of 356 children and their parents were recruited from 17 Southern California schools serving a high percentage of ethnically diverse, early childhood students of low socioeconomic status. Parents completed a survey assessing their children's demographics; family medical history; and obesity-related lifestyle behaviors; at pre-test and post-test. The early childhood students completed a picture scale activity designed to assess their knowledge of healthy/unhealthy food and physical activities. According to Calfas, Sallis and Nader (1991), the knowledge results of the picture scale activity may be used to study precursors of health-related behaviors in early childhood.

BMI percentiles significantly decreased among children who were overweight or obese at pre-test; they also significantly decreased their junk food (such as cookies, candy, soda, Cheetos®, Doritos®, etc.) consumption. Furthermore, children who were obese at pre-test significantly decreased their consumption of whole milk and increased their consumption of low-fat milk. Lastly, normal weight children significantly increased their consumption of milk as well as their physical activity. These findings provide preliminary evidence that the Healthy for Life/PE4ME program maybe effective in improving the nutrition choices and increased physical activity depending upon the

student's initial weight category. A clinical trial is needed to determine the effectiveness of this program.

Introduction

Approximately 155 million school-aged children worldwide are overweight or obese, and 20 million children younger than five years are overweight (Kraak & Story, 2010; Stroup, Johnson, Proctor, & Han, 2009). In the United States, the prevalence of obesity in children ages two through five was 10.4% (NHANES) 2007-2008 (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). Children from ethnic minority, socioeconomically disadvantaged families are at an increased risk of overweight and obesity. For instance, 15% to 25% of children are overweight or obese at Head Start preschools, which are U.S.-funded early childhood education programs (Whitaker, Gooze, Hughes, & Finkelstein, 2009). In Orange County, Latino/Hispanic children had a 13.9% rate of overweight among birth to four-year-olds, and 22.9% among five to eleven-year olds (Children's Services Coordination Committee, 2009). It was estimated that by 2010, 46% of American school children will be overweight and at greater risk for type 2 diabetes and cardiovascular disease even prior to adulthood (Kraak & Story, 2010; Stroup et al., 2009).

Multiple factors including the increased consumption of fast food, low-nutrient-density snack foods, and sweetened beverages, as well as increased screen time (which includes television, computer, video games, hand-held play station, and cell phone use), and decreased physical activity have contributed to the rise in childhood overweight and obesity (U.S. Department of Health and Human Services, 2010). Much of obesity among

Hispanic/Latino children is attributed to food insecurity, low socioeconomic status and acculturation to the U.S. diet and lifestyle (Wilson, Adolph, & Butt, 2009).

Up to 60% of children six years or younger spend at least 29 hours per week in childcare or preschools (Iruka & Carver P, 2006). Hence, a preschool intervention program has the potential of positively impacting obesity trends (Dunn, Thomas, Ward, Pegram, Webber, & Cullitan, 2006; Eliakim, Nemet, Balakirski, & Epstein, 2007). Those who are overweight or obese during the preschool years are 26%-41% more likely to be obese as adults (Crawford, Mitchell, & Ikeda, 2002). The literature demonstrates the need to provide nutrition education/resources for preschool teachers and parents (Dunn, et al, 2006; Eliakim, et al., 2007; Whitaker, et al., 2009). Lastly, relatively few obesity prevention/intervention school-based studies have targeted such a young population, who are ethnic minorities and reside in underserved communities

The purpose of this study was to determine whether early childhood students who participated in the school-based Healthy for Life/PE4ME program significantly (1) increased their physical activity, (2) decreased their screen time, (3) improved their nutritional knowledge, and (4) decreased their rates of overweight/obesity over a nine-month period. This program provides teachers with the resources and training to achieve these outcomes.

Methods

Study Design and Participants

A non-experimental, pre-test, post-test design was used for this study. In the 2008-2009 school year, a convenience sample of 356 early childhood students were recruited. The 17 participating schools serve low-income, ethnically-diverse Orange

County, California populations, and included Head Start preschools, state-funded and Title 1 schools with associated preschools. The program manager recruited the Orange County of California preschools by attending Title 1 school district principal meetings, Orange County School Readiness Nurse meetings, Head Start Directors' meetings and individual school district and preschool meetings.

The Healthy for Life/PE4ME program provided the participating schools with equipment, physical education curricula, teacher training, nutrition education curricula, student screening assessments, and parent nutrition presentations. These program components were meant to enhance the already-existing physical activity and nutrition education at the schools. The SPARK (Sports, Play, and Active Recreation for Kids) curriculum and equipment were provided to the teachers. SPARK activities focus on active physical activity that promoted gross motor development, creativity and fun, and are relatively easy for teachers to implement in the classroom or on the playground. During the school day, the amount of physical activity time for the students provided by the teacher varied from one school to another. The Color Me Healthy nutrition and physical activity curriculum was designed to be used during circle time. The goal of the lessons was to creatively teach children about healthy eating and physical activity, by stimulating the touch, smell, sight, sound, and taste senses of the early childhood student, with the use of color, music, and exploration of the senses. The Healthy for Life/PE4ME program was in its first year of a four-year grant sponsored by a health system consisting of three hospitals. (Prosper, Moczulski, Qureshi, Weiss, & Bryars, 2009).

Procedures and Measures.

The IRB of the first author's affiliation approved study procedures prior to the program implementation. The early childhood student's parents were provided with an information letter, student participation consent form, and a photo consent form at the beginning of the school year prior to the scheduled initial student assessments. Early childhood students provided verbal assent to participate in the program at the time of the initial assessment, and each participating student was assigned a student identification number. Participants and their parents were not compensated for consenting to enroll in the Healthy for Life/PE4ME class. All data was collected in the preschool classrooms, at the beginning and end of the school year during one classroom period. Parents of the early childhood students completed a pre-test and post-test self-report questionnaire containing demographic, family medical history, and 10 lifestyle questions regarding their children at the beginning of the school year and then at the end of the nine-month program. This parent questionnaire was developed by a program steering committee, which was comprised of a board certified pediatrician, a registered dietitian/certified diabetes educator, registered nurses, public health professionals, and academia/research professionals. The 10 lifestyle questions focused on children's behaviors that have been identified as contributing to the childhood obesity epidemic (Beckman, Hawley, & Bishop, 2006; California Center for Public Health Advocacy, PolicyLink, & UCLA Center for Healthy Policy Research, 2008; Covic et al., 2007; Dunn et al., 2006; Eliakim et al., 2007; Freedman & Alvarez, 2010; Laurson, Eisenmann, Welk, Wickel, Gentile, & Walsh, 2008; Maher, Carter, & Johnson, 2008).

See Appendix A.

The early childhood students completed a validated picture scale activity (Calfas et al., 1991). This data was collected during a one-on-one structured interview format. The program Assessment Team Members (ATM) were trained to use a structured interview guide to ask the students which food is a healthier choice (e.g., Fruit Loops vs. Cheerios) and which physical activity is a healthier choice between two options (e.g., sitting and rolling the ball vs. running and kicking the ball; Calfas et al., 1991). Students completed a total of 12 picture scale pairs. See Appendix B. The ATMs also obtained the children's anthropometric measurements at pre-test and post-test (nine months later), and included height and weight (to calculate BMI), and waist circumference. Height was measured using a portable stadiometer with students not wearing shoes. Weight was obtained using a digital calibrated portable scale. The students were weighed without their shoes and sweat shirts/sweaters/jackets. The waist circumference was obtained using a gulick tape. The measurement was obtained measuring above the child's bare iliac crest (Katzmarzyk, Srinivasan, Chen, Malina, Bouchard & Berenson, 2004). A board-certified pediatrician completed a screening physical for each student at pre-test. Students identified as obese (BMI \geq 95th percentile), with abnormal cardiac issues, and/or acanthosis nigricans (a physical sign of insulin resistance), were referred for further medical assessment by their primary care physician or a local clinic health care professional. The data obtained was recorded on medical assessment forms that were scanned into the St Joseph Health System Teleforms program. The anthropometric, demographic, lifestyle questionnaire and the picture scale activity data was then entered into an SPSS database for analyses.

Results

Demographic Characteristics of the Sample.

Table 1 presents the descriptive statistics that were conducted on the variables of interest. Out of 356 participating early childhood students, 177 of them (49.9%) were male and 178 of them (50.1%) were female. Three fourths of the early childhood students were between 5 and 6 years of age (5 years $n = 135$ and 6 years $n = 133$). Almost three quarters of the participants (70.5%) were Latino ($n = 251$) and 49.2% of the parents ($n = 175$) indicated that Spanish was their primary language.

BMI Percentile/Acanthosis Nigricans

Of the 356 participants, 15.8% ($n = 56$) were identified as overweight (BMI= 85th - 94th percentile) and 18.6% ($n = 66$) were obese (BMI \geq 95th percentile). The BMI percentile mean was 62.1 (SD = 29.0). Seventeen participating students (4.8%) were identified as having Acanthosis Nigricans by the program physician during the initial screening physical assessment.

Table 1. Baseline Characteristics of the Sample

	f	%
Gender		
Male	177	49.9
Female	178	50.1
Ethnicity		
Latino	251	70.5
Non-Latino	105	29.5
Language		
Other	13	3.6
Spanish	175	49.2
English	168	47.2
Age in Years		
3	2	.6
4	14	4.7
5	135	39.6
6	133	39.0
7+	57	16.7
Acanthosis Nigricans	17	4.8
<u>Body Mass Index Percentile</u>		
Children with normal BMI percentile	234	65.6
Children BMI 85 th - 94 th percentile	56	15.8
Children BMI \geq 95 th percentile	66	18.6

Anthropometric Changes

Table 2 displays paired sample *t-test* results for mean BMI percentiles for normal weight, overweight, and obese participants separately. At pre-test, the mean BMI percentile for overweight students was 92.7 (SD=4.5); their BMI percentile significantly decreased to 89.4 (SD= 11.8) at post-test ($t = 3.36, p=.001$). The mean BMI percentile for obese participants at pre-test was 96.6 (SD=.8); their BMI percentile significantly decreased to 94.6 at post-test ($t = 2.03, p =.05$). Finally, at pre-test, the mean BMI percentile of normal weight students was 43.4 (SD=19.9). Their BMI percentile

significantly increased to 50.1 at post-test ($t=-5.66$, $p=.000$), which is still well within the normal weight range.

Table 2. Changes in Body Mass Index Percentiles

<u>Dependent Variables</u>	<u>M</u> at Pretest	<u>M</u> at Posttest	<i>t-score</i>	<i>p-value</i>
<i>BMI Percentile</i>				
BMI < 85 th (n=169)	43.4(SD=19.9)	50.1(SD=24.2)	-5.66	.000*
BMI 85 th - 94 th (n=56)	92.7(SD=4.5)	89.4(SD=11.8)	3.36	.001*
BMI ≥ 95 th (n=54)	96.6(SD=.8)	94.6(SD=7.3)	2.03	.05*

**P=statistically significant*

Lifestyle Variables

The Wilcoxon-signed-ranks tests were calculated to assess changes, from pre-test to post-test, on parent-reported lifestyle variables for normal weight, overweight and obese preschoolers separately. For normal weight children, parent reports of their children's duration of physical activity significantly increased from pretest to posttest ($z = -3.65$, $p = .001$). Findings were not statistically significant among overweight and obese children. The frequency of junk food (such as cookies, candy, soda, Cheetos®, Doritos®, etc.) consumption significantly decreased among overweight children ($z = -1.98$, $p = .05$) and obese children ($z = -2.55$, $p = .001$), but not for normal weight children. Parents' reports of their preschoolers' milk consumption also changed. Specifically, normal weight children increased their frequency of drinking 2-3 8 oz cups of milk in a day from pre-test to post-test ($z = -3.12$, $p = .01$). There were no significant findings for milk consumption frequency among overweight and obese preschoolers. However, obese

preschoolers drank significantly less whole milk from pre-test to post-test ($z = -1.97, p = .05$); such findings were not present among normal weight and overweight participants.

Table 3. *Changes in Lifestyle Variables (Parents' report on their preschool child)*

	BMI < 85 th (n=194)			BMI 85 th – 94 th (n=56)			BMI ≥ 95 th (n=66)		
	Baseline%	Follow-up%	z	Baseline%	Follow-up%	z	Baseline%	Follow-up%	z
PA 60 minutes/day			-3.65***			-.65			-.69
0-2 days/week	17.8	4.1		10.7	2.3		8.2	2.2	
3-5 days/week	45.6	49.3		47.3	59.8		54.1	58.7	
6+ days/week	36.7	46.6		42.0	37.9		37.7	39.1	
Eats Junk Food			-.37			-1.98*			-2.55***
0-2 days/week	59.9	59.3		52.8	62.1		55.0	67.4	
3-5 days/week	33.9	36.7		37.7	34.5		35.0	28.3	
6+ days/week	6.2	4.0		9.4	3.4		10.0	4.3	
Drink 2-3 8 oz milk/day			-3.12**			-1.30			-1.45
0-2 days/week	10.7	4.7		18.5	11.6		9.8	4.4	
3-5 days/week	34.8	30.0		32.4	26.7		42.5	24.4	
6+ days/week	54.5	65.3		49.1	61.6		47.5	71.1	
Milk type			-1.7			-5.7			-1.97*
Whole	28.7	22.4		24.3	25.3		23.0	19.6	
2% Low-fat	57.3	58.5		52.3	52.9		57.4	54.3	
Non-fat	1.7	3.4		8.4	4.6		9.8	6.5	
1% Low-fat	8.4	13.6		9.3	13.8		9.8	19.6	
Soy milk	1.7	0		3.7	2.3		0	0	
None	2.2	2.0		1.9	1.1		0	0	

* $p = .05$, ** $p = .01$, *** $p = .001$ PA = Physical Activity

Table 4 displays mean scores for the 12 picture scale activities. Possible scores on the healthy food items ranged from 0-6, as was the case for physical activity items. Paired samples *t*-test results indicated that scores on the physical activity items significantly increased from pre-test to post-test among normal weight children, ($t = -2.2, p = .03$), but this was not the case for overweight or obese children. There were no significant findings for the remaining lifestyle variables: screen time, consumption of fast food, breakfast, fruits, vegetables and healthy snacks.

Table 4 *Children's Knowledge of and Preference for Healthy Food and Physical Activity*

	BMI < 85 th (n=194)					BMI 85 th – 94 th (n=56)					BMI ≥ 95 th (n=66)					
	Baseline		Follow-up			Baseline		Follow-up			Baseline		Follow-up			
	M	SD	M	SD	z	M	SD	M	SD	z	M	SD	M	SD	z	
Healthy_Food																
Scores	3.2	1.57	3.42	1.36	-1.7	3.1	1.62	3.3	1.37	-1.43	2.9	1.66	3.2	1.39	-1.03	
Physical Activity																
Scores	3.4	1.62	3.74	1.27	-2.2*	3.3	1.55	3.4	1.29	-0.91	3.3	1.35	3.6	1.31	-1.05	

* $p=.05$

Discussion

The purpose of this study was to determine whether early childhood students who participated in the nine-month Healthy for Life/PE4ME program experienced significant changes in their BMI percentile, parental reports of obesity-related lifestyle behaviors, and children's self-reported knowledge of healthy food and physical activity choices. We found that: (1) normal weight children increased their consumption of milk and time spent engaging in physical activity, as well as knowledge about physical activity choices; (2) overweight and obese children decreased their junk food consumption; and (3) obese children significantly decreased their consumption of whole milk and increased their consumption of lower fat milk. Relatively few obesity prevention/intervention school-based studies have targeted such a young population, who are ethnic minorities and reside in underserved communities.

The finding that knowledge of healthy foods and physical activity suggests that the early childhood school environment provides an excellent opportunity to encourage healthy nutrition and physical activity learning experiences and behaviors (Dunn et al., 2006; Eliakim et al., 2007; Maher et al., 2008; Whitaker et al., 2009). Therefore, it is possible that the establishment of federal and state regulations for age-appropriate

nutrition education, and nutritious meals and snacks for children in the early childhood school/daycare environment would provide them with a foundation for developing healthy nutrition and physical activity knowledge and behaviors. Establishing healthy lifestyle behaviors before an operational level of cognitive development (7 to 8 year olds) is necessary before children can fully understand the relationships between their food choices and their health consequences (Calfas et al., 1991). Hence, more research is needed to justify setting physical activity and nutrition federal standards in the early childhood school/child care setting (U.S. Department of Health and Human Services, 2010).

Parents of normal weight children reported that their children increased their physical activity during the 9-month study period. The increased amount of physical activity reported by the parents may have occurred as a result of teacher SPARK training, SPARK and Color Me Healthy curricula, and SPARK equipment resources provided to the teachers. The nutrition, physical activity and health information Tip of the Week provided to the school teachers and administrators to distribute to the student's parents may have also increased the parents knowledge of healthy lifestyles and improved their behaviors. Unfortunately, parents of overweight/obese children did not report increased physical activity at post-test. This finding points to the need to better understand how the early childhood school/child care environment may promote increased physical activity with children at risk for overweight-obesity (Maher, et al., 2008; Kraak & Story, 2010). Currently, specific physical activity standards for the early childhood students and child care settings are not clearly defined or consistently followed (San Diego State University, 2007).

It has been suggested that federal and state-level standards should be developed and enforced for this age group. (Whitaker et al., 2009).

Parents of both overweight and obese children reported a decrease in the consumption of junk food. More than seventy percent of the preschool children were Latino and almost fifty percent of the families' primary language spoken was Spanish. The findings from the Viva la Familia Study conducted by Wilson et al. (2009) with low SES Latino families are consistent with the results from this study. The decreased consumption of junk food observed in this study may be a result of the parent nutrition presentations provided by the program's registered dietitians and the Tip of the Week sent to the teachers and shared with the student's parents. Healthy food choices, label reading, portion control and increased physical activity education was emphasized during the nutrition talks and in the Tip of the Week fact sheets. As discussed earlier, teaching a young child healthy nutrition choices and encouraging physical activity has become the responsibility of both the family and the child's caregivers (Freedom & Alvarez, 2010). The parent-reported decreased junk food consumption among early childhood students may also be linked to their lowered BMI percentile from pre-test to post-test.

The frequency of parent-reported milk consumption increased for normal-weight children. The program encouraged parents and students to participate in a local campaign, "Rethink Your Drink," to achieve the 2005 Dietary Guidelines of drinking 2-3 8 oz servings of milk per day for this age group, and drinking water instead of sweetened beverages (Crawford, Woodward-Lopez, Ritchie, & Webb, 2008). Parent's of the early childhood students were encouraged to sign a "Rethink Your Drink" commitment form at the beginning of the school year for themselves and their children. Also, parents of obese

early childhood students reported a decreased consumption of whole milk and an increased consumption of 1% low fat milk. Consuming the 2005 Dietary Guidelines suggested amount of lower fat milk may have contributed to improvements in obese children's BMI percentiles. To ensure that parents understand the American Academy of Pediatrics and the American Dietetic Association guidelines of transitioning children from whole milk to 1% low-fat milk at age 2, it is suggested that pediatricians educate parents at the 2-year well child visit (Gee, Rogers, Liu, & McGarth, 2008).

Limitations

Limitations of this study included information bias among the parent participants and teachers' attitudes toward the program. Preschool parents may not have accurately reported their child's screen time, dietary behaviors and physical activity, either due to pressures of social desirability or misperceptions of actual behavior. Furthermore, the dose of the intervention may have varied among classrooms, depending upon the extent to which the preschool teacher was supportive of the program and was motivated to utilize the program-related resources and training provided to them. It was therefore not possible to assess the relationship of the increased dose of physical activity with the study results.

Conclusion

The study results demonstrate that more research is needed to justify setting and enforcing physical activity and nutrition standards in early childhood school/child care settings. The Healthy for Life physicians, dietitians and teachers report anecdotally that challenges still exist among families who are overworked, lack financial resources and

lack access to healthy foods and safe play areas. Physicians are respected, and parents are receptive to discussions about the importance of healthy weight, nutrition choices, physical activity, and reduced screen time guidelines for their children (Maher et al., 2008; U.S. Preventive Services Task Force, 2010). More research is needed to identify the benefit of linking physicians with overweight/obese students from the school environment. According to the California Obesity Prevention Plan, (2010) health care insurers and providers will increasingly adopt practices and policies that promote obesity prevention and early treatment by December 2015.

The Healthy for Life/PE4ME program has expanded to 57 Orange County preschools serving 1,169 preschool children. We have observed that many of the teachers involved with the program have influenced school administrators to create a healthier school environment for students, teachers and staff. With the approval of the principal, one of our elementary school teachers worked with the food service department to establish only healthy snack offerings, such as apples and string cheese, during the morning nutrition break. Through teacher observations and annual on-line program evaluations, the quality and effectiveness of the teacher training, program implementation, student assessments, and parent attendance at the nutrition presentations have improved over the past two years. We have also learned that a key factor in the overall success of the Healthy for Life/PE4ME program at our schools is selecting determined and motivated program teachers and gaining the support of school administrators. Creating healthy early childhood school/child care settings that focus on modeling and teaching good nutrition and physical activity will promote children's optimal growth, development, and weight.

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APPENDIX A

PLEASE COMPLETE THE FOLLOWING FOR YOUR CHILD		Less than 2 hrs ○¹	2 hours ○²	More than 2 hrs ○³
		0-2 Days	3-5 Days	6+ Days
1	How many hours per day does your child participate in “Screen Time” (TV, video games, or computer, etc.)?	○ ¹	○ ²	○ ³
2	How many days per week does your child eat fast food/at restaurants?	○ ¹	○ ²	○ ³
3	How many days per week does your child eat breakfast?	○ ¹	○ ²	○ ³
4.	How many days per week does your child participate for 60 minutes or more in physical activity (walking, biking, running, sports)?	○ ¹	○ ²	○ ³
5.	How many days per week does your child eat 5 or more fruits and/or vegetables in a day?	○ ¹	○ ²	○ ³
6.	How many days per week does your child eat junk food (cookies, candy, soda, Cheetos [®] , Doritos [®] , etc.)?	○ ¹	○ ²	○ ³
7.	How many days per week does your child drink 2-3 8 oz. cups of milk in a day?	○ ¹	○ ²	○ ³
8.	How many days per week does your child eat healthy snacks?	○ ¹	○ ²	○ ³
	Please indicate ONE type of milk that your child drinks most often:	○ ¹ Whole	○ ² 2% low fat	○ ³ Nonfat
		○ ⁴ 1% low fat	○ ⁵ Soymilk	○ ⁶ None
10	Does your child typically eat healthy snacks while watching TV, playing video games or on the computer?	○ ¹ Always	○ ² Sometimes	○ ³ Never

APPENDIX B

**Picture Scales for Preschool Children
Structured Interview (Script)**

Instructions and Test Procedure

At the beginning of the knowledge test, each child is asked if they know what “healthy” means. They are then provided with an age-appropriate explanation, such as, “Being healthy means that you can play outside, you don’t get sick, and you feel good. Can you tell me some things that you might do to stay healthy?” The child is then asked to point to the food/activity that will help you stay healthy and grow big and strong.

Questions asked by Assessment Team Member:

Can you tell me which food is healthier? Tuna Sandwich or Hot Dog

Please point to the healthier food item picture.

This question is asked for the following food choices:

Orange Juice or Coke

Potato Chips or Strawberry Yogurt

Froot Loops or Cheerios

Raisins or Chocolate (Hershey’s) Bar

Peanuts or French Fries

Can you tell me which activity is healthier? Walking or Running

Please point to the healthier activity.

This question is asked for the following activity choices:

Pulling the wagon or sitting in the wagon

Pushing the truck or riding a tricycle

Kicking a ball or rolling a ball

Dancing with radio or playing legos

Climbing on Monkey Bars or Going down a slide

When the child is done the Assessment Team Member thanks the student