



# Increasing Vegetable Intake in Preschoolers: Evaluation of the Captain 5 A Day Program

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## Abstract

Previously we reported short-term improvements in preschoolers' intake of vegetables with an intensive 5-wk nutrition and physical activity curriculum. We aimed to assess the impact on vegetable intake of a less intensive dose of education over 16-wks. The Captain 5 A Day Program was implemented in preschool programs and addressed multiple Social Cognitive Theory concepts. Year 1 involved pilot testing in 850 preschoolers with subsequent improve-ments in curricular messages and parental outreach. Year 2 involved 1050 intervention/250 control preschoolers. The impact on lunchtime vegetable intake was assessed via teacher weekly reports and intake of target vegetables (broccoli and carrots) via plate waste in select intervention sites. Classroom teachers implemented the Program with high fidelity under circumstances normal to preschool. Preschoolers in the intervention classrooms were significantly more likely to be categorized as "more than usual" vegetable intake across the Program than were control preschoolers ( $\chi^2=23.273, p<.01$ ). Teachers' reports of change in intake mirrored those derived from plate waste. In repeated measures ANOVA, consumption of carrots and broccoli increased in intervention classrooms from baseline to intervention ( $p<.005$ ) and baseline to post-intervention ( $p<.001$ ). Parent survey and interviews with teachers suggested success in reaching parents via take-home activities, parent letters with child-friendly recipes, newsletters, parent workshops, and website. In conclusion, a less intensive dose of nutrition education can improve preschoolers' vegetable intake at school. An enriched parental component has the potential to expand curricular messages to the home. (USDA FSNE & Am Diab Assoc funded).

## Year 1—Pilot Study

**Aim:** To evaluate and improve usability of a 16-wk school-based nutrition and physical activity curriculum focused on increasing f/v intake  
**Design:** Pre-post test design. Preschool sites were secured during Summer 2005. September involved teacher training. Including 4 weeks baseline and post-intervention data collection, the intervention ran for 16 wks (Oct-April 05).  
**Participants:** 852 preschoolers participated (Table below). Parents provided written consent for their children to participate in the IRB-approved procedures.

Ethnicity	Intervention (n=868)	
	# of Children	% of Children
African American	108	12
Asian	20	2
Caucasian	311	36
Hispanic	187	22
Other	242	28

The demographics of preschoolers in the Pilot Study

### Intervention:

- School-based—Delivered by classroom teachers, the curriculum focused on increasing preschooler's f/v intake and structured physical activities, while conforming to preschool educational standards. Teachers were free to incorporate the daily lessons into their schedules (table 2).
- Outreach—Parents were reached via direct and indirect nutrition education opportunities: take-home activities encouraging parent/child interactions; workshops; 2 newsletters; website (www.captain5aday.org).

Teacher Weekly Reporting Sheet	Baseline	Intervention	Post-Intervention
	Two nutrition activities		
Two physical activities			
Nutrition activity reporting sheet			
Physical activity reporting sheet			
Take-home activities			

Teacher responsibilities for program implementation

**Process Evaluation:** Minutes of nutrition and physical activity delivered. Based on post-intervention interviews with 29 head teachers:  
• 23 felt they could incorporate 2 nutrition lessons/wk  
• 25 felt they could incorporate 2 structured physical activities/wk

### Outcome Evaluation:

**Preschooler's Vegetable Intake**  
• Nearly 60% had an increase (pre-post intervention sign test:  $z=2.81, p<.01$ ). Post intervention, intake was significantly greater than during baseline (Wilcoxon matched pairs;  $z=1.94, p=0.05$ )

Teacher Weekly Report  
For each child, please note if he/she ate less, the same, or more of the vegetables served that week during lunchtime.

Child's Name	ATE LESS than usual	ATE THE SAME as usual	ATE MORE than usual	Comments

### Preschool Outcomes by Teacher Interviews:

- 24 believed that the Program worked to increase vegetable consumption
- 26 felt that the program worked to increase structured physical activity
- 26 stated that they offered more nutrition education during the intervention
- 23 stated completing more physical activity lessons than normal

### Parental Outreach Outcomes

- 18 teachers reported the team did a good job reaching parents; 16 felt parents valued the information in the newsletters.
- Homework activities were evaluated by how many were returned for inclusion in a raffle. Return rate ranged from 10 to 30%; higher rates seen in those programs who sent more of these activities home to parents.

### Areas to improve—usability, curriculum, reporting sheet, parent outreach

Teacher Interview Questions	Responses (Pilot Study)	Changes (Evaluation Study)	Responses (Evaluation Study)
Do you feel the program was well-organized? What improvements could be made?	17/29 (58%) felt the program was well-organized. <b>Suggestions:</b> • Improve training • Set realistic expectations. • Add more options to quantify.	• <i>Balanced training sessions by going over the intervention binder in detail.</i> • <i>Individualized calendar.</i> • <i>Expanded categories to quantify child's vegetable intake.</i>	42/50 (84%) felt the program was well-organized
How accurately could you assess child's vegetable intake over the week; what would improve your accuracy?	11/29 (38%) felt they could assess vegetable intake. <b>Suggestions:</b> • add more options to quantify.	• <i>Revised nutrition and physical activity lessons based on teacher feedback.</i>	32/50 (64%) felt accurate in assessing child's lunchtime vegetable intake
Were the nutrition & physical activity lesson plans easy to use and appropriate?	11/29 (45%) reported the lessons were age appropriate.	• <i>Added mini-letters that corresponded to class activities with recipes and nutrition facts.</i>	39/50 (78%) voiced the nutrition and physical activity lessons were age-appropriate.
How did we do in reaching parents and what works best for you in reaching parents?	14/29 (48%) felt they reached many parents. Newsletters and personal contact works best.	• <i>Added mini-letters that corresponded to class activities with recipes and nutrition facts.</i>	25/43 (58%) felt we had a high-level parent contact.

## Year 2—Evaluation Study

**Aim:** To evaluate the ability of the 16-wk school-based nutrition and physical activity curriculum to improve vegetable intake.  
**Design:** Pre-post test and involving an intervention and control (no program offering) groups, not assigned randomly but based on site feasibility.

Ethnicity	Intervention		Control	
	# of Children	% of Children	# of Children	% of Children
African American	141	15%	91	47%
Asian	19	2%	1	1%
Caucasian	254	26%	7	4%
Hispanic	338	37%	81	42%
Other	166	18%	13	7%

**Intervention:** As previous. Intervention teachers attended a training workshop, reviewing the lessons, individualized activity calendar, and reporting sheets. The research team provided support and materials to the intervention teachers to assure quality offering. The intervention was offered with high fidelity—30+/50 classrooms offered 2 nutrition & 2 phys activity lessons/wk, the remaining, 1 of each/wk. Control classrooms received orientation on the weekly reporting sheets and an individualized calendar of activities.

### Captain 5 A Program Components by Social Cognitive Theory Concepts

Concepts	Captain 5 A Day Program
Environment	The lunch menu offered a variety of vegetables. The program increased opportunities for nutrition education and structured physical activities. Take home activities reinforced in-class nutrition and physical activity messages. Parents were involved in the Program through take-home activities, newsletters, the website, and parent workshops.
Behavioral Capability	Nutrition and physical activity lessons promote achieving developmental benchmarks, increasing familiarity with eating veg. and being active.
Expectations	Preschoolers develop positive health behaviors from connections between role models, the Captain 5 A Day hero and classroom teachers. The take-home activities support positive connections with parents and healthy eating.
Expectancies	The program promotes that health and increased level of energy results from consuming more vegetables and being physically active.
Self-Control	Preschoolers choose the amount of vegetables to consume at lunch meals as well as whether or not to participate in structured physical activities.
Observational Learning	Family style meals and lesson plans promote preschoolers to model diet and health behaviors after teachers, parents, Captain 5 A Day hero, and classmates.
Reinforcements	Recognition of preschooler accomplishments from the nutrition and physical activity lessons (eg, displaying drawings, wearing vegetable taster badges). Incentives are offered to parents who return completed take home activities.
Self-efficacy	Preschooler's success in eating more vegetables and increasing physical activity is promoted by repeated exposure and small steps toward achieving the behavior (eg, tasting vegetables, then increasing the serving size).

### Preschooler's vegetable intake

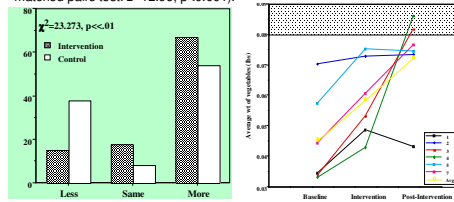
Lunchtime vegetable intake was evaluated by the revised teacher weekly reporting sheet (below). Plate waste method in 7 classrooms evaluate change in broccoli and carrot intakes.

### Teacher Weekly Report

For each child, please note if he/she ate less, the same, or more of the vegetables served this week during lunchtime compared to last week.

Child's First Name	ATE LESS than usual	ATE THE SAME as usual	ATE MORE than usual	Other	
				Absent	WD from program
1					
2					
3					

• From teacher weekly reporting sheets, nearly 67% of intervention children had increase in lunchtime vegetable intake from baseline across the intervention (sign test:  $z=12.48, p<.001$ ) and the increase was significant (Wilcoxon matched pairs test:  $z=12.96, p<.001$ ).



After removing those absent >25% of time, teachers reported vegetable intake in 480 intervention/73 control preschoolers. Intervention children showed an increase that was a medium effect size ( $r=0.4$ , Cohen's  $d=0.88$ )

Lunchtime broccoli and carrot intake increased 34% (1/3 portion) from baseline. Intervention and, post-intervention intake was significantly greater than baseline [ $F(1,2)=11.251, p<.005$ ], a large effect size ( $r=0.908$ , Cohen's  $d=4.34$ ).

## Parent Outreach

- Same as the pilot study except sent home were Captain 5 A Day audiotope/CD and parent letters (English/Spanish) with child-friendly recipes and the Captain logo (eg, Salsa with fun dance activity; Vegetable Pizza with children involved in preparing).
- Parents who attended workshops (n=81) provided the following feedback on the outreach efforts.



### Take-home activities

Did you receive the take-home activities?	Yes	No
	4481	3781

Of those who received the take-home activities: Did you complete the take-home activities with your child?

Yes	No
3844	644

Of those who completed the take-home activities: Did you send back the take-home activities with your child?

Yes	No
2838	1038

### Parent letters with recipes

Did you receive the parent letters with recipes?	Yes	No
	4581	3681

Of those who received the parent letters with recipes: Did you find the parent letters with recipes useful?

Yes	No
4245	345

### Newsletters

Did you receive the newsletters?	Yes	No
	4781	3481

Of those who received the newsletters: Did you read the newsletters?

Yes	No
4747	047

### Internet

Do you have the internet or have access to the internet?	Yes	No
	5581	2681

## Discussion

- The 16-wk Captain 5 A Day Program was implemented by preschool teachers with high fidelity and under circumstances normal to the Head Start Program. From pre to post-intervention and in comparison to a control group, the Program produced significant increases in children's lunchtime vegetable intake. The effect size was similar to that shown by other 5 A Day interventions (Stables and Heimendinger, 2001).
- Vegetable intake improvements seen with the teacher weekly reporting sheets paralleled plate waste results, suggesting the former as a time and cost effective method to evaluate school-based interventions and track individual children across an intervention (Kneeland, 2006). This supports findings by others (eg, Cade et al, 2006).
- A menu of activities offered parents a number of opportunities to become involved in the Captain 5 A Day Program. Although teachers and a health-seeking group of parents were positive about the outreach efforts, a broader outreach and evaluation plan may be required to improve dietary quality among preschool parents and families.

### Program successes are attributed to a number of factors:

- Teachers had the freedom to choose which lessons they wanted to use and when they wanted to use them.
- The program continues to be fine-tuned to meet teachers' and overall preschoolers' developmental needs.
- The research team, comprised of graduate and undergraduate dietetics students and faculty advisors, provided support and materials to the preschool sites to allow teachers to offer quality nutrition education.

### Study limitations should be noted and include:

- Non random assignment of intervention and control classrooms
- Limited number of control classrooms because of a Head Start teacher's strike.
- Inability to determine the effect of the intervention on vegetable intake outside of the school setting.
- Convenience sampling of parents for feedback on parent outreach.
- Not all of the preschool programs supported the concept of "take-home" activities for preschoolers.

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## Background

### Reaching Children Via Comprehensive School-Based Health Curriculum

• The CDC (1996) supports coordinated school health programs to create healthy school environments that overcome barriers to obtaining healthy lifestyles.



Figure 1. Model of an integrated school-based health program (CDC, 1996)

- Head Start (HS) is a federally-funded educational program for underprivileged children. HS mandates:  
–In-class physical activity and nutrition education;  
–Meals that meet federal standards for fruit and vegetables servings;  
–Parent/caregiver involvement in child's education.

### The Adventures of Captain 5 A Day: School-Based Nutrition & Physical Activity Program

The Adventures of Captain 5 A Day was developed by the Connecticut Department of Public Health to improve fruit and vegetable intake and physical activity among preschool children. Focus groups and interviews with teachers, parent/caregivers, and physical therapists helped form a culturally, socially, and developmentally appropriate program.

### The Curriculum:

- Follows the CDC's Guidelines for School Health, Head Start Performance Standards, and the Social Learning Theory.
- Involves the entire school community.
- Significantly increases target (Frassinelli, 2002) and all (Noel, 2004) vegetable intake among the target population

### Parent/caregiver Outreach Component

- Interactions between children and their parents/caregivers within the home influence acquisition of life-long health behaviors (Ebbeling et al, 2002).
- Reaching parents/caregivers via formal workshops yield poor attendance and limited outreach according our previous efforts and verified by scientific literature (Fitzgibbon et al, 2002).
- Health messages delivered by trained peer educators are most effective and result in positive behavior changes (Buller et al, 2000).

## Aim

This community-based collaborative program aims to increase vegetable/fruit consumption of participants while concurrently offering quality supervised practice experiences for undergraduate dietetic students and building public health nutrition competence for graduate students.