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High 5 for Kids: The Impact of a Home Visiting Program on Fruit and Vegetable Intake of Parents and Their Preschool Children

Debra Haire-Joshu, PhD[1,§], **Michael B. Elliott, PhD**[1], **Nicole M. Caito, MPH, RD**[1], **Kimberly Hessler, MPH**[1], **M. S. Nanney, PhD, RD**[2], **Nancy Hale, MA**[3], **Tegan K. Boehmer, PhD**[1], **Matthew Kreuter, PhD**[1], and **Ross C. Brownson, PhD**[1]

[1]Department of Community Health, School of Public Health, Saint Louis University, St. Louis, Missouri

[2]University of Minnesota, School of Medicine, Minneapolis, MN

[3]Parents As Teachers, Inc.

Abstract

Objective—The High 5 for Preschool Kids (*H5-KIDS*) program tested the effectiveness of a home based intervention to teach parents how to ensure a positive fruit-vegetable (FV) environment for their preschool child, and to examine whether changes in parent behavior were associated with improvements in child intake.

Methods—A group randomized nested cohort design was conducted (2001 to 2006) in rural, southeast Missouri with 1306 parents and their children participating in Parents As Teachers, a national parent education program.

Results—When compared to control parents, *H5-KIDS* parents reported an increase in FV servings (MN=.20, p=.05), knowledge and availability of FV within the home (p=.01), and decreased their use of noncoercive feeding practices (p=.02). Among preschoolers, FV servings increased in normal weight (MN=.35, p=.02) but not overweight children (MN=-.10, p=.48), relative to controls. Parent's change in FV servings was a significant predictor of child's change in FV in the *H5-KIDS* group (p=.001).

Conclusion—*H5-KIDS* suggests the need for, and promise of, early home intervention for childhood obesity prevention. It demonstrates the importance of participatory approaches in developing externally valid interventions, with the potential for dissemination across national parent education programs as a means for improving the intake of parents and young children.

Keywords

Fruit and vegetable intake; Home based program; Noncoercive parenting practices; Obesity prevention; Preschool children; Randomized control trial

[§]Corresponding Author: Saint Louis University School of Public Health, 3545 Lafayette Avenue, Salus Center, Suite 300, St. Louis, MO 63104, Phone: 314) 977-3280, Fax: 314) 977-3234, joshud@slu.edu.

Introduction

Diets high in fruits and vegetables (FV) are associated with reduced risk of obesity (Vioque, et al., 2008). There is substantial evidence that FV preference and intake patterns are learned by children at very young ages, with parents being a primary influence on pattern development (Benton, 2004). Parents are responsible for what young children are offered to eat and thus have tremendous influence over shaping their food preferences (Birch, 2006, Faith, 2005, Spruijt-Metz, et al., 2002). The food experiences to which young children are exposed are crucial to the early development of patterns of FV acceptance and intake. These childhood dietary patterns in turn, track into adulthood and may be critical in the development of obesity (Savage, et al., 2007).

There are several ways in which parents can influence the development of a child's patterns of FV intake. Parents who understand the importance of FV intake on health and model its consumption in the presence of their child may influence positive intake patterns (Haire-Joshu, et al., 2003, Haire-Joshu and Nanney, 2002). Parents who make FV available in the home (e.g., clean and cut-up FV) can also increase consumption of those foods by their child (Galloway, et al., 2006). Coercive child feeding practices, including frequent commands (e.g. clean your plate) and punishment prompts (e.g. no dessert), can negatively affect the child's long-term preference for FV and ability to regulate intake, leading to obesity (Faith, 2005). In contrast, noncoercive styles of parenting create an eating experience that allows children to regulate their own intake of a variety of foods (Birch, 2006).

Home based education programs may provide a means for teaching parents how to provide a positive food environment for their young children. Nonetheless, few studies have addressed the effectiveness of home based approaches and their influence on parent to child intake (LaRowe, et al., 2007). The High 5, Low Fat Program was a home based intervention that significantly improved the dietary intake of African American parents by encouraging modeling of positive eating behaviors to their children (Haire-Joshu, et al., 2003, Nanney, et al., 2007). However due to the young age of the child (0 to 24 months), there was limited ability to assess whether changes in parent intake directly influenced child intake. The High 5 for Preschool Kids (*H5-KIDS*) program extended this prior work and tested the effectiveness of a home based intervention focused on teaching parents to ensure a positive FV environment for their preschool children (ages 2 to 5 years), and to examine whether changes in parent behavior were associated with improvements in child intake.

Methods

Participatory Development of *H5-KIDS*

H5-KIDS was developed in partnership with Parent As Teachers (PAT), a parenting and child development program with over 3000 sites across all 50 states and 8 U.S. territories. The premise of PAT is that positive child development outcomes will result from a program that empowers parents as their child's first and most influential teachers by encouraging positive parent-child communication and increasing parents' knowledge of ways to stimulate childrens' social and physical development. Methods of recruiting to PAT occur via schools, clinics, day care settings, and word of mouth from other parents. Parent educators deliver a standardized curriculum via at least five home visits, on-site group activities, and newsletters. All services are provided free of charge on an annual basis to parents at the time of pregnancy until the youngest child in the home is 3 years of age. However, PAT extends services until the *youngest* child is 5 years of age in the case of underserved families, defined as single or minority parent homes, those living in poverty, or low parent education. In addition, underserved families may receive additional home visits as a means of ensuring complete delivery of the PAT curriculum. PAT has been thoroughly evaluated and shown to

be effective in achieving positive parenting and child outcomes (Wagner and Clayton, 1999).

H5-KIDS was specifically designed for dissemination, thus ensuring the content was consistent with the mission and format of the national PAT program. *H5-KIDS* used a combination of theoretical models to guide development including social cognitive theory and an ecological framework. A key model construct was reciprocal determinism, suggesting characteristics of the person, the person's behavior, and the environment are in constant interaction with paths of influence operating in multiple directions (Bandura, 1989, Pakenham, et al., 2002, Reddan, et al., 2002). Intervention strategies targeted the intrapersonal environment of the parent (e.g., knowledge, FV servings), interpersonal interactions between the parent and child (e.g., child-feeding practices, FV modeling), and the physical environment (e.g., FV availability in the home).

Participatory methods were used to focus the intervention on select cancer preventive FV (tomatoes, broccoli, etc.) (Nanney, et al., 2007, Nanney, et al., 2005, Nanney, et al., 2007, Nanney, et al., 2007). Focus groups were conducted with parents and children to identify relevance of content, materials, and survey measures. This approach ensured *H5-KIDS* met state criteria for reimbursement of PAT activities, critical to sustaining the program. *H5-KIDS* was comprised of three components: a tailored newsletter, a series of home visits, and materials for the parent and child, including storybooks.

Computer tailored nutrition newsletter

Tailored communication presents information intended to reach one specific person, based on characteristics that are unique to that person, derived from an individual assessment related to a specific behavior or outcome (Kreuter, et al., 2003).To develop the tailored newsletter, parents were first formally enrolled in *H5-KIDS* and completed a pretest interview. Relevant data was then imported into an in-house computer based tailoring program. Scores were calculated based on FV knowledge and intake, frequency of parental modeling, style of parenting (coercive or noncoercive), and quality of the home food environment (FV availability). Each newsletter began with a bulleted tailored statement that included the self reported servings of FVs the parent and the child consumed per day. Additional parent data (e.g. FV knowledge, parental role modeling, noncoercive parenting skills, FV availability) were each uniquely used to individualize messages and describe the themes of each of the four storybook sets the family would receive at their home visits. For example, if participant data indicated a parent did not eat FV in front of their child very often (<7/week), the tailored messages would emphasize the importance of modeling FV intake in front of the child as a means of improving consumption, and provide relevant examples of how this could be accomplished. The parent was then referred to *H5-KIDS* storybooks that provided examples of modeling for the child. In contrast, parents who scored appropriately in each individual area received messages of praise encouraging them to continue their behaviors. Newsletters were mailed to the parent's home at the beginning of the program.

Home visits

Parent educators delivered four *H5-KIDS* home visits, each of which addressed the core program areas (knowledge, parental modeling of FV intake, noncoercive feeding practices, FV availability). Parent educators then reinforced the core content in subsequent visits. Consistent with the philosophy of the PAT program, each visit provided examples of parent-child activities designed around healthy nutrition, that the parent could use to promote the child's language and cognitive ability, and fine and gross motor skill development (e.g. having the child learn the names and colors of various FV; child assists with selecting a

variety of FV for breakfast). As part of each visit, parents also received materials and informational handouts with suggestions for improving feeding practices and the food environment in the home. Consistent with the standard PAT program, each home visit was designed to allow for 60 minutes of contact.

Sing-A-Long Storybooks with Audio Cassette

PAT emphasizes literacy and parent child interaction through reading. Consistent with this approach, at each home visit children received a *H5-KIDS* sing-a-long storybook with audio cassette tape and a coloring book. Each storybook reinforced one of the core areas of the *H5-KIDS* program through the use of child friendly characters and appealing storylines presented through songs.

H5-KIDS Training

Parent educator training protocols were developed in partnership with the PAT National Training Center and included 4 hours of training on nutrition content and overview of materials. Twenty-seven parent educators eligible to participate in *H5-KIDS* successfully completed the training. In accordance with PAT criterion, parent educators who successfully completed this training received continuing education credit, an annual requirement to maintain parent educator certification.

Sample recruitment and randomization

H5-KIDS used a group randomized, nested cohort design and was implemented from 2001 to 2006. Sample size calculations for .90 statistical power were based on methods specifically focused on nested cohort designs (Koepsell T, 1998, Murray and Hannan, 1990). Based on these calculations, 16 PAT programs from rural, southeast Missouri were identified and recruited into the study. PAT sites were paired based on the percentage of children living below poverty. A computer generated numbers table was used for random assignment to intervention or control within pairs by the study team. Sites were not blinded to assignment. Within these sites, 2012 families enrolled in PAT were assessed for eligibility and willingness to participate by parent educators. Of these, 444 families were excluded due to refusal to participate or other reasons. The remaining 1658 families with a preschool-aged child (ages 2 to 5 years old) participated in the *H5-KIDS* study. Control families received the standard PAT program (n=899); intervention families received the standard PAT program plus the H5-KIDS protocol (n=759).

A telephone survey was conducted with the same parent before and after the intervention to assess change in the dietary patterns and behaviors of both preschool children and the parents. The average time between the pretest and the posttest survey was 7 months (range = 6 to 11 months). Interviewers were trained to conduct the survey. Participants were given a $20 gift card for completing the pretest and posttest survey. The Institutional Review Board of Saint Louis University approved this study, and informed consent was obtained from all participants.

The telephone survey assessed demographic and lifestyle characteristics. Body mass index was calculated from height (test retest ICC=.64) and weight (test retest ICC=.94) reported by the parent for themselves and their child. Weight status of children and parents was determined in accordance with Centers for Disease Control and Prevention recommendations (Centers for Disease Control and Prevention, 2006b, Centers for Disease Control and Prevention, 2006a).

Child and parent FV intake was assessed with the Saint Louis University for Kids Food Frequency Questionnaire (SLU4Kids FFQ). The SLU4Kids FFQ was developed by

selecting specific cancer preventive FV that were available to and more likely to be consumed by members of the target demographic (rural Midwest, children ages 2–5 and parents ages 20–59). This approach allowed us to reduce respondent burden by eliminating foods this population was unlikely to consume due to unavailability. The resulting measure showed good concordance with observed intake ranging from 92% to 100% agreement for the parents (kappa .50 to 1.0) and 77% to 93% (kappa .17 to .81) for the parent's report of the child's intake. The development and validation of the FFQ are discussed in more detail elsewhere (Linneman, et al., 2004). Additionally, a sub-sample of respondents was re-interviewed shortly after the initial baseline interview to establish test-retest reliability for the measures in this population.

The SLU4Kids FFQ examined child and parent intake of 27 FV during the past seven days, as well as the child's preference for specific FV. FV intake over the seven days was converted into the number of times consumed per day for each individual food item and summed to obtain the total number of fruits (excluding juice), vegetables (excluding fried potatoes), and FV combined. The test-retest reliability for the measures of fruit and vegetable preference were excellent with ICCs of .78 and .84 respectively. The measure of FV intake showed excellent reliability with a test-retest ICC of .82. Each SLU4Kids FFQ food item was linked to one or more similar foods from the Consumer Survey of Food Intake in Individuals (CSFII). Using CSFII data from the Midwest region, intake was converted from times per day into grams per day based on the median serving size reported for each age group (2–5 years for children and 20–59 years old females for parents).

In addition to child preference, intermediate outcomes included child-feeding practices, parent modeling of FV intake, nutritional knowledge, and FV availability in the home. Following an extensive literature review and based on feedback from focus groups, we modified our measures to ensure appropriate literacy level, ordering and types of foods, and survey length. Parental use of coercive child-feeding practices (e.g. using food as a reward) was evaluated by four items that summed the number of "rarely" or "never" responses (range, 0–4; test-retest ICC = .66). Modeling of FV intake was assessed by asking parents the number of times in the prior week in which they assured their child had observed them eating FV (test-retest ICC = .50). Nutrition knowledge was assessed by asking the number of times a child should eat fruits and vegetables for good health, and number of times a child needed to be exposed to a food before developing preference (test-retest ICC = .65 and .74 respectively). FV availability in the home was assessed as the number of specific food items (fruit cocktail, broccoli, tomatoes, mixed vegetables, cantaloupe, strawberries, carrots, and green beans) present in the home during the past week (range, 0–8; test-retest reliability ICC = .71).

Statistical Analyses

Baseline demographic and lifestyle characteristics were compared between intervention and control participants using chi-square statistics. Difference scores were calculated for the outcomes of interest by subtracting the pretest response from the posttest response. Thus, a positive difference score represents change in the expected direction for all outcomes. The effect of the intervention on difference scores was evaluated using linear regression models with the difference score as the dependent variable and intervention/control group as the primary independent variable. Demographic characteristics that differed between groups at baseline were evaluated as potential confounders; parent's age and education status were retained in the final models. To control for potential floor and ceiling effects, the baseline value of the outcome of interest was also included as a control variable in the regression models. There was minimal impact of grouping by site on the principle measures of impact in this study (ICC child fruit and vegetable servings=.00095 and ICC parent fruit and vegetable servings=.01). Therefore, the analyses did not adjust for group.

Regression models with change in parent FV servings added as a covariate were run to determine the extent to which child FV was influenced by change in their parent's behavior. Change in the intermediate outcomes was also examined (one at a time and in combination) to assess their mediating effect on child FV change.

Results

The *H5-KIDS* program was delivered in its entirety to 78% of intervention families. Parent educators reported a high degree of acceptance for all four *H5-KIDS* modules, as indicated by the proportion who responded "strongly agree" or "agree" to the following items: content was relevant to parent's current situation (90%), parent actively participated in discussions (91%), parent and child responded positively to materials (94%), and materials/activities reinforced *H5-KIDS* content (95%). Parent survey responses verified this positive assessment. Eighty-three percent of parents felt that they could set reasonable limits for their children after participating in the program and 97% of parents felt that their parent educator knew a lot about nutrition.

Among participating families, 84% (N=1387) completed the posttest survey (Figure 1). For analysis purposes, participants were excluded from the posttest if there was missing or inconsistent data (n=81) leaving a sample of 1,306 families (605 intervention group and 701 control group). Overall, 95% of participants were mothers, and intervention group parents were more likely to be white, younger, less educated, and have lower income than control group parents (Table 1).

When compared to control parents, *H5-KIDS* parents significantly improved intake of fruit alone (mean servings=.14, p=.04) and combined FV (mean servings=.20, p=.05; see table 2). *H5-KIDS* parents also reported an increase in FV knowledge and availability of FV within the home (p=.01). Contrary to expectations, parents in the intervention group decreased their use of non-coercive child-feeding practices compared to those in the control group (p=.02). Vegetable preference decreased in both control and intervention groups but to a significantly lower degree among *H5-KIDS* children. The effectiveness of the intervention for *H5-KIDS* children differed by the child's weight status at baseline (see table 2). Fruit servings, vegetable servings, and combined FV servings increased in normal weight, but not overweight children relative to controls (mean servings=.35, p=.02 compared to mean servings=.10 p=0.48). Logistic regression controlling for age and parental education indicated that normal weight intervention children were 1.49 times more likely than controls to increase their intake of fruits and vegetables by half a serving per day or more (O.R. 1.01–2.20).

Parent's change in FV servings was a significant predictor of child's change in FV in the *H5-KIDS* group. An increase of one FV per day among parents was associated with an increase of 0.50 FV per day among children (see Table 3). The intermediate outcomes of FV availability and knowledge also predicted positive change in child's FV servings. Self reported parent weight, improvements in modeling, and non-coercive child-feeding practices did not explain change in child FV servings.

Discussion

H5-KIDS contributes to the literature addressing interventions aimed at improving parent ability to shape the FV intake of their young children. First, *H5-KIDS* improved the fruit intake of parents, and FV knowledge and availability in the home. As importantly, when *H5-KIDS* parents increased their FV intake, their child's intake improved as well. Thus *H5-KIDS* appears to provide evidence for the importance of intervening with parents in real

world settings as important gatekeepers who control the food environment of their young child.

Second, *H5-KIDS* adds to the growing evidence for the importance of early parent intervention to prevent childhood obesity. *H5-KIDS* was more effective in improving FV intake among normal weight children, but had no significant effect among those who were overweight. These subgroup results should be considered preliminary due to the limited statistical power (beta=.70) to thoroughly test the hypotheses. However, these findings are consistent with those reported in several studies documenting that overweight children are more likely to consume high calorie snack foods or sweetened drinks which may limit intake and preference for FV (Dehghan, et al., 2005, O'Connor, et al., 2006). This contributes to the development of dietary patterns less susceptible to change and more associated with weight gain. Unlike older children with access to food in multiple settings, overweight preschoolers likely develop preferences for, and access to, high calorie foods while with their parents at home. Our results suggest the need for more intensive, home based obesity prevention programs targeting parents of overweight preschoolers as a means of reinforcing low versus high caloric dietary patterns and intake.

Notably, despite being taught to use noncoercive feeding practices with their child, *H5-KIDS* parents still tended to use coercive feeding methods to improve their child's intake. Parenting practices are often learned overtime and associated with family traditions (Blissett, et al., 2006, Spruijt-Metz, et al., 2002). It may be unrealistic to expect parents to immediately draw upon a new behavioral repertoire to facilitate dietary change. Instead it will likely require ongoing reinforcement, such as is provided through the PAT program, to change coercive parenting practices that may be ingrained overtime. However, parents did appear more able to make changes to the physical food environment first, by increasing FV availability, which can provide a basis for additional positive outcomes.

Finally, *H5-KIDS* used participatory methods to assure the program could be maintained and disseminated to applied, real world settings (Dzewaltowski, et al., 2004, Dzewaltowski, et al., 2004). This resulted in an intervention with external validity that was successfully incorporated within the PAT organization, as evidenced by the high rate of participation by parent educators and parents enrolled in PAT (Glasgow and Emmons, 2007). This suggests *H5-KIDS* will have an enhanced impact as it is delivered on an ongoing basis by parent educators located in PAT programs nationwide.

Study strengths and limitations

Strengths of this study include the randomized design which provides outcome data on a large group of understudied parents with preschool children. This population from rural Missouri also limits generalizability of our findings. Other limitations of this study include the self report nature of the survey measurement which may yield error in outcome estimates, and parent report of child intake which may result in bias. However, we assured that the parent reporting on child intake was the person who was most aware of, or controlled their food intake, and took steps to verify the psychometric quality of our measures. We are also unable to establish the clinical significance of our results. There is a lack of consensus among researchers and clinicians as to the frequency or amount of change needed to achieve both statistical and clinical significance in programs that are conducted ongoing with youth (Thomas, 2006). A final limitation to the study is the limited power to definitively assess the impact of the intervention on children within weight status subgroups. Further study relative to these findings is needed.

Conclusion

H5-KIDS suggests the need for, and promise of, early intervention within the home as a strategy for childhood obesity prevention. It also demonstrates the importance of participatory approaches in developing externally valid interventions, with the potential for dissemination across national parent education programs as a systematic means for improving the intake of the parent and, subsequently, their preschool child. Additional research into methods for promoting parent use of noncoercive feeding styles, evaluating ongoing impact of these programs, and the impact of cost on program adoption and dissemination is needed.

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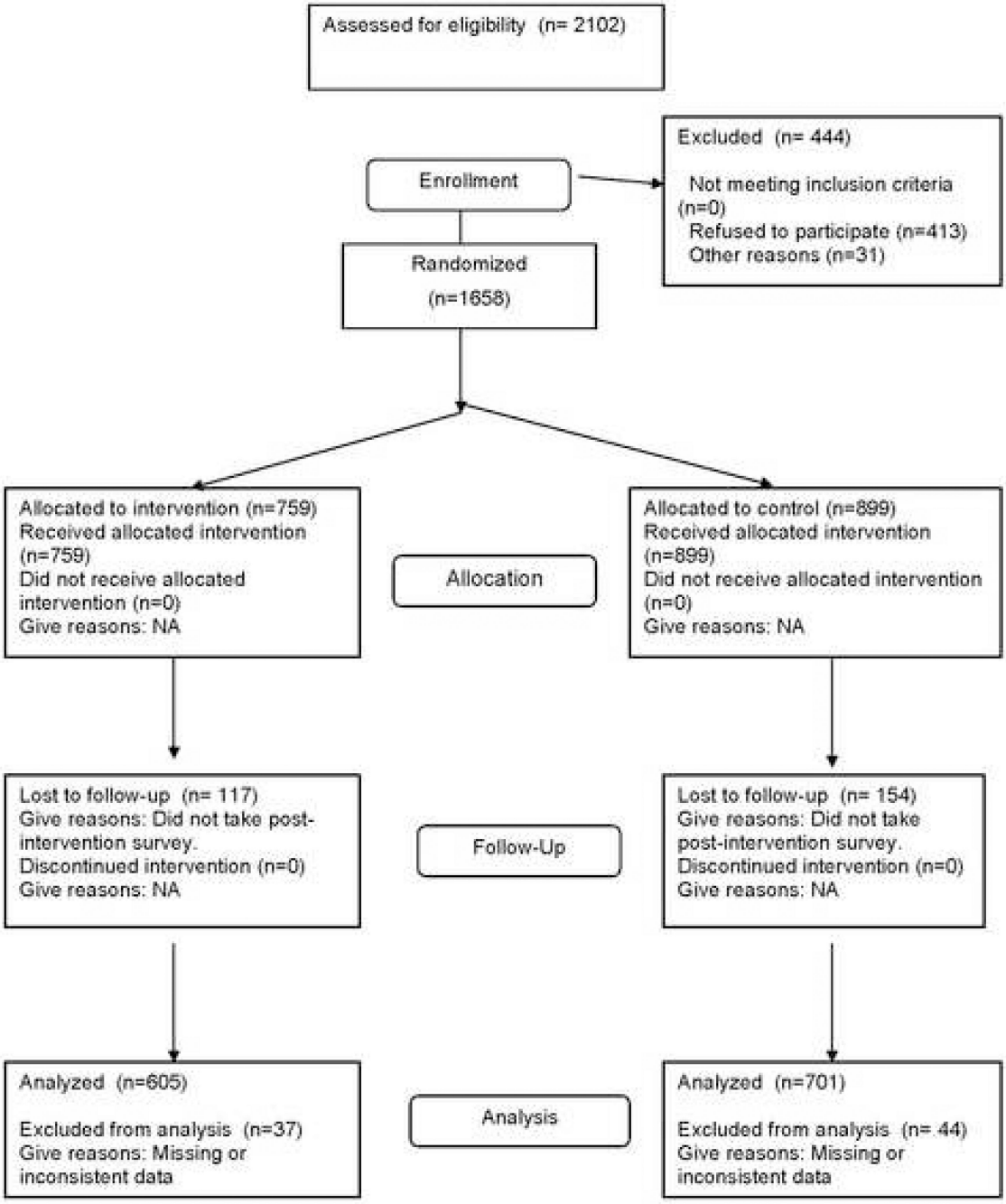

Figure 1.
CONSORT Flow Diagram
[a] This study was conducted with parents and their children in rural, southeast Missouri from 2001 to 2006

Table 1

Baseline Characteristics of Study Participants [a]

Child Characteristics	Intervention n=605	Control n=701	p-value
Male gender	52.6	51.4	0.66
Age (years)			
1–3	67.3	60.5	0.01
4–6	32.7	39.5	
Parent Characteristics			
Parent of child	96.0	96.3	0.81
Female gender	98.5	98.4	0.91
White race	86.3	79.7	0.01
Age (years)			
<25	27.8	20.7	0.01
25–29	34.7	32.7	
30–34	21.0	24.1	
35+	16.5	22.5	
Educational attainment			
Not high school graduate	15.9	11.4	0.05
High school graduate	37.7	37.7	
Some college	26.1	26.0	
College graduate	20.3	25.0	
Annual household income			
<$20,000	29.5	25.2	0.01
$20–35,000	30.0	25.0	
$35–50,000	13.1	17.9	
≥$50,000	27.5	31.9	
Employed for wages	55.9	59.3	0.21
Married or living with partner	70.4	74.6	0.09
Weight status			
Normal weight	39.7	42.9	0.13
Overweight	33.0	27.7	
Obese	27.4	29.3	

[a] This study was conducted with parents and their children in rural, southeast Missouri from 2001 to 2006

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Table 2

H5-KIDS Pre-Post Outcomes in Parents and Children [a, b]

	Control		Intervention		Intervention Effect (Intervention mean change-Control mean change)		
	Mean Pretest	Mean Change	Mean Pretest	Mean Change	Crude	Adjusted*	p-value for intervention*
Parent Daily FV Intake							
Both overweight and normal weight							
Fruit intake	1.84	0.08	1.74	0.23	0.16	0.14	0.04
Vegetable intake	2.29	−0.02	2.30	−0.01	0.01	0.04	0.45
Fruits & vegetable intake	4.13	0.06	4.05	0.24	0.19	0.20	0.05
Parent Behavior and Knowledge							
FV availability in home	4.66	0.26	4.60	0.45	0.19	0.19	0.01
FV knowledge	3.05	0.18	3.10	0.27	0.09	0.14	0.01
FV modeling (times/week)	6.05	0.34	6.04	0.46	0.14	0.21	0.31
Non-coercive child-feeding practices	1.08	0.08	1.04	−0.04	−0.12	−0.12	0.02
Child Daily FV Intake and Preferences							
Both overweight and normal weight							
Fruit intake	3.32	−0.01	3.36	0.03	0.04	0.07	0.34
Vegetable intake	1.46	−0.04	1.55	−0.02	0.02	0.06	0.10
Fruits & vegetable intake	4.79	−0.05	4.91	0.01	0.06	0.12	0.20
Fruit preference	2.91	−0.01	2.92	0.01	0.02	0.02	0.13
Vegetable preference	2.81	−0.05	2.81	−0.02	0.04	0.04	0.01
Overweight children only							
Fruit intake	3.15	0.10	3.42	−0.02	−0.13	−0.06	0.62
Vegetable intake	1.49	−0.01	1.55	−0.05	−0.04	−0.02	0.67
Fruits & vegetable intake	4.63	0.09	4.97	−0.07	−0.17	−0.10	0.48
Fruit preference	2.89	0.00	2.90	0.02	0.02	0.02	0.30
Vegetable preference	2.81	−0.04	2.81	−0.01	0.03	0.03	0.12
Normal weight children only							

	Control		Intervention		Intervention Effect (Intervention mean change- Control mean change)		
	Mean Pretest	Mean Change	Mean Pretest	Mean Change	Crude	Adjusted*	p-value for intervention*
Fruit intake	3.31	−0.03	3.22	0.26	0.29	0.25	0.05
Vegetable intake	1.43	−0.08	1.52	−0.03	0.05	0.10	0.06
Fruit & vegetable intake	4.74	−0.11	4.74	0.23	0.34	0.35	0.02
Fruit preference	2.93	−0.02	2.94	−0.01	0.02	0.02	0.38
Vegetable preference	2.81	−0.05	2.80	−0.03	0.03	0.03	0.17

[a] This study was conducted with parents and their children in rural, southeast Missouri from 2001 to 2006

[b] Adjusted for parent's age and education, and baseline FV intake

Table 3

Effect of Change in H5-KIDS Parent FV Intake and Intermediate Outcomes on Child FV Intake [a, b]

Independent variables (parent FV intake change and intermediate outcomes)	Beta for impact on change in child's FV consumption (times per day) *	p-value beta
Parent FV intake change (times/day)	0.50	0.001
FV availability	0.10	0.01
FV knowledge	0.21	0.001
FV modeling (times/week)	0.01	0.27
Non-coercive child-feeding practices	−0.003	0.96

[a] This study was conducted with parents and their children in rural, southeast Missouri from 2001 to 2006

[b] Adjusted for parent's age and education, child's baseline FV intake, and all other variables in the model