

Short Term outcomes of a Faith-based Obesity Attenuation and Prevention Program for Low Income African American Children: CHHIL Feasibility and Efficacy Study

Dodani S*, Sealey PC, Arora S, Khosla N, Lynch S, James DS and Kraemer DF

University of Florida, College of Medicine, Jacksonville, Florida, USA.

*Corresponding author: Dodani S, Associate Professor of Medicine, University of Florida, College of Medicine, Jacksonville, Florida, USA, Tel: 904-244-9859; Fax: 904-244-9234; E-mail: soni.dodani@gmail.com

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Abstract

Background: The CHHIL is a faith-based, culturally tailored and multi-level obesity attenuation and prevention program for African American (AA) children and adolescents in low-income church community. The study objective is to test the feasibility and efficacy of 8 weeks CHHIL intervention.

Methods: This is a sequential mixed methods study design, examining the feasibility and efficacy of 8 weeks CHHIL intervention conducted at a low income neighborhood AA church. All sessions were conducted at the AA church, after Sunday services. Parents and children separately attended seven weekly group sessions focused on lifestyle modification. Participants: 1) an AA church member; 2) age 8-17 years; 3) Child BMI of 85%-95% or parent with BMI ≥ 25 or family history of type 2 diabetes. Eleven families (child and at least one parent/guardian) were recruited. At the baseline and then every week for 7 weeks children's nutrition, physical activity (PA) and anthropometric information was obtained. Primary outcomes were changes in dietary intake/patterns and BMI at the end of 8-weeks CHHIL program. Changes in outcome measures were assessed using paired samples t-tests, ANOVA and non-parametric tests.

Results: Of the 11 children and adolescents who enrolled, seven (63%) completed the 8-weeks program. Overall there was a trend among the children and adolescents to decrease total calories (kcal), protein, and carbohydrates consumed overtime. Participants consumed significantly lower levels of sodium from baseline to end of the program ($P < 0.001$). At the end of 8 sessions (7 weeks), no significant change in BMI and other anthropometric parameters was seen at the end of the program.

Conclusion: The CHHIL program may be a promising option for health behaviors changes and thus changes in weight for church-based ethnic minorities. However trend towards improvements in dietary behaviors were observed, no impact on anthropometric measures were seen requiring further research with longer program duration. With increasing burden of health disparities, childhood obesity prevention research must now move towards identifying how effective intervention components can be embedded within health, education and care systems and achieve long term sustainable impacts.

Keywords: African American; Childhood obesity; Health disparities; Behavioral lifestyle; Churches.

Introduction

Obesity is a major public health problem for adults and children worldwide. Poor nutrition and physical inactivity are major contributors and should be considered the most urgent indicators to address in pediatrics and child health [1]. Around 75% of the younger age-groups in the US do not consume the recommended servings of 5 or more fruits and vegetables per day and about 60% of children ages 6-11 years do not get the recommended 60 minutes per day of physical activity (PA) [1]. With this increasing obesity burden, the incidence of type 2 diabetes (henceforth diabetes) in young children is also increasing [1]. This trend is especially pronounced in minority populations, including African Americans (AAs) and Hispanic groups [2-4]. The obesity epidemic occurs disproportionately in AA children, especially between the ages of 6-11 years; therefore AA children are a

logical target for childhood obesity (CO) research with the aim of preventing diabetes. Thus, there is an important need to focus intervention on minority children, however very few intervention studies have focused on ethnic minorities [5-9].

The AA church has been a community resource that can help address areas of health disparity for its members [10,11]. Given the strong identification with religion as a social support mechanism, and its importance in the everyday lives of AAs, it follows that health interventions incorporating spiritual and cultural contextualization have been effective [10-12]. Health promotion interventions conducted in faith communities provide a promising opportunity to enhance emotional, physical and spiritual health. The spirituality and its relationship to overall well-being are highly correlated and research suggests a positive relationship between the two [13].

For several years, there has been a trend to have lay health leaders, rather than healthcare professionals, successfully deliver health promotion community-based participatory research (CBPR) programs

in hard-to-reach communities [14,15]. There are several strengths to using lay health advisors (supported by experts and church pastors) in delivering CBPR programs: i) they are acceptable to hard-to-reach community residents, ii) they provide a ready support network, iii) they serve as efficacious peer models, iv) they promote community ownership, and v) they are cost-effective.

CHHIL-Children's Healthy Habits Integrated for Life is a multi-level, faith-based obesity attenuation intervention for AA children and

their families. CHHIL was modified by integrating the NIH-funded lifestyle arm of the diabetes prevention program (DPP) [15,16] and work from Dr. Epstein's Family Based Intervention called the Traffic Light Diet (TLD) [17,18] curriculum (Table 1). The objective of this pilot study was to test the feasibility and efficacy of the CHHIL obesity Attenuation program in AA children in a faith-based setting.

Wk	Major Theme	***Group Session Objectives (Expert-led CHA's)	Tailored Intervention with each family (led by CHA's)	Church-level support (Pastors)
1	Welcome to CHHIL Kick-off! (Making a Commitment)	(a) Overview of CHHIL program;	(a) Build Individual commitment; (b) Record/reinforce reasons for joining;	(a) Kickoff event at least 1 week prior to program start; &
		(b) Benefits of a healthy lifestyle;		
		(c) Introduction to the Food Pyramid; (d) Assess your own PA habits;	(c)Review benefits; reinforce self-monitoring of food intake; &	
		(e) Introduce self-monitoring;		
		(f) Set family goal to engage in PA; (g) Building groups commitment; &	(d) Endorse visit to YMCA for family PA.	
		(h) Setting SMART goals.		
2	New eating style, environment it's all around you!	(a) Meaning and important of environment;	(a) Introduce home self-monitoring of weight;	(a) Pastor endorsement of weekly session objectives during weekly sermon.
		(b) Planning healthy meals and snacks;	(b) Assess success in decreasing calories;	
		(c) Recognize patterns in family environment;	(c) Problem solving, endorsing habit changes; &	
		(d) Set goals regarding home environment; &		
		(e) Using positive reinforcement with your children.	(d) Endorse visits to YMCA for family PA.	
3	Size Up your servings! Seeing is believing	(a) Review the concept of moderation	(a) Practice self-monitoring skills (i.e. measuring foods, estimating food portion size);	(a) Pastor endorsement of healthy eating and improving PA during weekly sermon; &
		(b) Recognize feeling of hunger and satiety;		
		(c) Important of estimating serving sizes;	(b) Problem solving;	
		(d) Set family goals to estimate portion sizes at meals;		
		(e) Introduce three ways to eat less; (f) Identify CV exercise and its benefits;	(c) Endorsing habit changes; &	
		(g) Take your pulse and calculating target heart rates;		
		(h) Set family goals to engage in aerobic exercise; &		(d) Endorse visits to YMCA for family PA activity for at least one hour.
		(I) Family rules.		
4	Go, Grow, Glow! Empty Calories	(a) Identify major nutrient in each food group;	(a) Emphasize important of regular meals and eating slowly;	(a) Pastor endorsement of healthy eating and improving PA during weekly sermon; &
		(b) Recognize fat and sugar content in snacks and soda;	(b) Review self-report and cooking/ eating activities in past week;	
		(c) Identify low fat substitutes for high fat foods;	(c) Identify exercise that improves flexibility;	

		(d) Recognize importance of warm-ups and cool downs;		(b) Church activities may include cooking demos and taste tests.
		(e) Set family goal to decrease empty calories;	(d) Review family goals and mapping your day for eating and PA; &	
		(f) Teach reading food calorie labels; &		
		(g) Use of rewards and incentives with children.	(e) Endorse visits to YMCA for family PA activity for at least one hour	
5	Mix up Recipes. Tip the Calorie Balance	(a) Modify receipt to contain lower-fat ingredients;	(a) Begin self-reports of food intake and PA;	(a) Pastor endorsement of weekly session objectives during weekly sermon; &
		(b) Plan a balanced meal;		
		(c) Set family goals to plan and prepare a balanced meal;		
		(d) Prepare a common recipe using a low fat ingredients;	(b) Reinforce positive behaviors;	(b) One policy change in the church (e.g., setting guidelines about the types of food to be served at church function and/or changing snacks served to children in church).
		(e) Keep a watch on eating healthy outside;		
		(f) Self-monitoring;		
		(g) Recognize major muscle groups in the body;	(c) Assist in problem solving as needed (i.e., addressing personal likes and dislikes about PA).	
		(h) Recognize importance of muscle strength;		
		(i) Set family goal to muscle strengthening activities;	(d) Endorse visits to YMCA for family PA activity for at least one hour	
(j) Self-esteem.				
6	Taking Charge of what's around you	(a) Assist participants to find time to include PA short bouts (10-15minutes) and healthy lifestyle activities;	(a) Review self-reports of food intake and PA;	(a) Pastor endorsement of weekly session objectives during weekly sermon; &
		(b) Teach basic principles of exercising safely; &	(b) Reinforce positive behaviors;	
		(c) Encourage everyone in the family to meet their goals successfully.	(c) Develop action plans;	(b) Pastor to promote project through announcements on display boards, newsletters, church bulletin (etc.)
	(d) Maintain food and fitness diaries; &			
			(e) Endorse visits to YMCA for family PA activity for at least one hour.	
7	Stop and Shop Healthy Shopping	(a) Planning a healthy shopping list; (b) Reading and comparing labels;	(a) Review self-reports;	(a) Pastor endorsement of weekly session objectives during weekly sermon; &
		(c) Set family goals to plan and prepare balanced meals;	(b) Provide a reduced calorie, structured meal plan that is tailored for family;	
		(d) Practice shopping at the Coop; (e) Take stock of progress and consolidate gains;	(c) Plan field trips to PA such as roller skating at the park; &	(b) Ongoing activity, policy, promotion (as described above).
		(f) Set family goals to continue weekly PA; &		
		(g) Teach the fundamentals of energy balance and goals to lose weight.	(d) Endorse visits to YMCA for family PA activity for at least one hour.	
8	Party on! Introduction to monthly follow-up sessions	(a) Resisting social pressure and eating out;	(a) Review self-reports;	(a) Pastor endorsement of weekly session objectives during weekly sermon; &
		(b) Environmental cues that encourage eating;		

	(c) How to select and adhere to healthy choices when eating away from home;	(b) Identify cues in individual's environment and develop action plan	(b) Ongoing activity, policy, promotion (as described above)
	(d) Review progress and consolidate gains;		
	(e) Set long-term goals to make healthy changes and permanent part of lifestyle	(c) Mapping your day for eating and PA	
	(f) Overview of monthly follow up sessions.		

Table 1: Conceptual Faith-based CHHIL Program Curriculum (adapted and modified from DPP and TLD). *2 hr sessions every week for 8 weeks (one hour for group session and remaining hr for group PA ***separate sessions will be conducted for parents & children simultaneously. DPP=Diabetes prevention program; TLD=Traffic Light Diet; PA=Physical Activity; CV=Cardiovascular. Diet and PA, along with frequent weighing were part of the DPP and TLD projects and will be strongly encouraged in this project.

Methods

The procedures followed in this study are in accordance with ethical standards for human research and were approved by the institutional review board (IRB) of University of Florida, College of Medicine, Jacksonville (UF COM-JAX), Florida (FL).

This study used a sequential, mixed methods design with a qualitative phase followed by a quantitative phase. During the quantitative study phase, a quasi-experimental single group pre-post intervention feasibility and efficacy community-based study on high risk AA children was implemented through an urban AA church in JAX, FL. The entire study period included several program components, some of them were described in detail elsewhere [19,20]. Briefly, the following activities were completed before the implementation of 8-weeks CHHIL program.

Establishment of community advisory board (CAB)

The 14-member Community Advisory Board (CAB) was established at the UF COM-JAX to strengthen partnerships between UF COM-JAX and local AA communities and help in planning and implementing health promotion programs in AA churches. The CAB consist of more than 90% representation from AA communities including local public/private/government organizations serving low-income ethnic minority groups, leaders from health education institutions, churches, and non-profit organizations. The CAB provided significant input and oversight in the development and implementation of CHHIL program [18-20].

Development of 8-weeks group-based CHHIL program

Guided by the social-ecological model (Figure 1) and CBPR principles, team with the help of DPP and TLD program experts and input from CAB developed CHHIL program from DPP and TLD interventions (Table 1) [21]. The Socio-Ecological Model is a theoretical framework for understanding the multiple factors that influence health behavior. The five levels of influence are (1) individual factors such as awareness, knowledge, attitudes, beliefs, values, and preferences; (2) interpersonal factors such as family, friends, and peers that provide social identity and support; (3) organization factors such as social networks and norms which exist formally or informally

among individual groups, and organizations (4) community factors such as rules, policies, procedures, environment, and informal structure within an organization; and (5) social factors such as state and federal government policies and laws that regulate or support healthy actions and practices for disease prevention, early detection, control, and management.

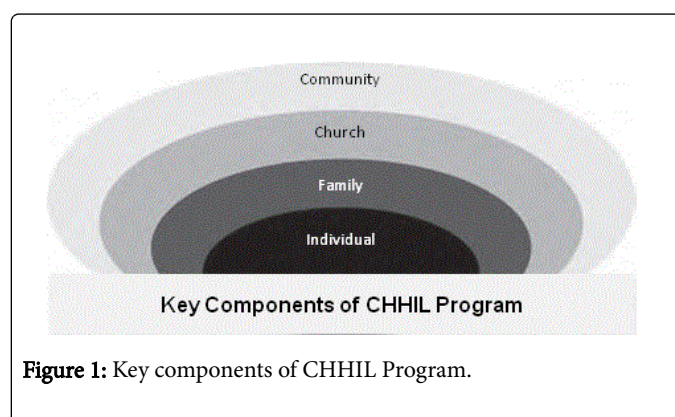


Figure 1: Key components of CHHIL Program.

The 8-sessions were developed and modified based on pilot work and CAB suggestions those 8 sessions were sufficient time to cover the concepts of the intervention and maintain the interest of children. Briefly, the content areas of the CHHIL program includes; (1) improving diet by decreasing saturated fat intake, increasing fruit and vegetables, and including low-fat dairy products; (2) Increasing PA to ≥ 60 mins of moderate exercise/day for at least 5 days/week; and (3) behavior modification to achieve and maintain these goals (Table 2). All CHHIL sessions focused on nutrition, exercise, behavior change, and setting family health goals. The intervention was formed within a spiritual framework, and faith-based strategies of Fit Body and Soul [22,24] were used to add faith components to the program. CAB members selected the spiritual themes and scripture to frame the three concepts of the program-nutrition, PA, and behavior change. Spirituality was seen as a source of emotional support, a positive influence on health, and contributing to life satisfaction. Further minor modifications of CHHIL program may be done as per church needs to suit congregation.

Activity	Recommendation	Intervention Emphasis & Self-Monitoring	Outcome Assessment
Weight*	5% of body weight at the start of the program	Yes	Weight measurement at the end of 8 weeks
Physical activity	150 mins/week	Yes	PAQ-C
Total Calories**	1600-2000/day	Yes	MCNQ and weekly food logs
Sodium intake	<2,300mg	Yes	MCNQ and weekly food logs
Protein % calories	10-30%	Yes	MCNQ and weekly food logs
Carbohydrate % calories	45-65%	Yes	MCNQ and weekly food logs
Total Fat %	25-35%	Yes	MCNQ and weekly food logs
Saturated Fat %	<10%	Yes	MCNQ and weekly food logs
Fruits and vegetables	9-12 servings/day	Yes	MCNQ and weekly food logs
Dairy (Calcium)	1300 mg/day	Yes	MCNQ and weekly food logs

Table 2: CHHIL Goals at 3 levels: Church, Group, and Individual. *Weight loss recommended only for those with BMI-z scores \geq 85th percentile. ** Varies by age. The range is based on Physical activity and age. Each child was deemed to be moderately active, because they are in school. PAQ-C=Physical Activity Questionnaire for children; MCNQ=Modified Child Nutrition Questionnaire.

Focus groups

Two focus groups were conducted in the AA community (churches and other AA community engaged programs) during the study's qualitative phase and before implementing the CHHIL program. A purposive sample of AA community members (adults, adolescents and children 6-11 yrs) were taken based on the suggestions of CAB. Two focus groups (consisting of 42 member's total) were conducted in the community. Each focus group was recruited with a minimum of 8 members, which was a figure that was deemed optimal as per literature [25]. The objective was to gain a baseline understanding of the needs, perceptions and attitudes of the community as it pertains to the health of AAs in general and childhood obesity issues in particular. Further, focus groups also gathered information and recommendations on the feasibility and implementation of CHHIL in churches from the socio-cultural aspect. This information was gathered using a structured focus group questionnaire. Focus groups were digitally recorded and a semi-transcript was made from the recordings. The transcripts were coded using a grounded theory approach [26].

CHHIL Need assessment survey

Dr. Dodani and her team with the support of CAB conducted need assessment survey in order to understand the need for CHHIL program in AA churches. IRB approved CHHIL surveys were mailed to pastors in more than 60 AA churches within the JAX, FL with stamped return envelopes. Thirty five survey forms were received, of those thirty four were complete and therefore included in the descriptive analysis (n=34 surveys).

Training of church health advisors (CHAs)

After the IRB approval and on the recommendation of CAB (based on need), Mount Olive Primitive Baptist Church in the urban core of JAX, was selected from the 30 partnership AA churches for this study. Four church members, hand-picked by the Pastor were selected to be the program leaders called church health advisors-CHAs [23]. There

were no requirements for prior training in health education or health care, but the importance of CHAs being viewed as role models among program participants was emphasized. The CHAs are heavily involved within the church community and well-respected by church congregation.

A 10-hr training workshop for CHAs on CHHIL and HEALS (parents' lifestyle program) was conducted by the research team experts [24]. The training was also attended by the Pastor. Key objectives were to familiarize CHAs with the interventions. In light of the required commitment and training, CHAs were provided with a small stipend for attending training workshop.

Feasibility and efficacy of 8-weeks CHHIL program

Following the qualitative phase of the study a quantitative phase was implemented. This phase included a quasi-experimental single group pre-post intervention feasibility and efficacy community-based study conducted at a low income neighborhood AA church. With the help of pastor support and after several announcement prior to the start of CHHIL, a health fair was arranged and study team with the help of CHAs, recruited eligible families (eligible child with at least one parent/guardian) at the church, who provided 8-weeks commitment to participation. Eligibility criteria included; (1) an AA church member; (2) age 8-17 years; (3) Child BMI of 85%-95% or parent with BMI \geq 25 or family history of type 2 diabetes. Study exclusion criteria included; (1) unable or unwilling to give informed consent/assent; (2) current pregnancy/planned pregnancy during study period; (3) major psychiatric disorder which may impede conduct of the program. The recruitment process did not overtly identify the children as being overweight/obese so as not to stigmatize the children participating in the program. On a data collection questionnaire, focused screening history for child and parent was obtained. This included; birth weight, gestational age, breast feeding history, presence of maternal gestational type 2 diabetes, obesity, hypertension, dyslipidemia, other serious cardiovascular disease, musculoskeletal disease that limits activity, smoking history, alcohol or substance abuse, serious psychiatric

disease, reproductive history, and menstrual history. In addition, school grade level for children; and education, marital status, occupation and income level for adults were also included.

Nutrition history was collected on the Modified Child Nutrition Questionnaire (MCNQ) [27]. It is a validated standardized 24-hr food recall developed by the US Department of Agriculture for use in national dietary surveillance. Data was collected the baseline (0 week) and at the end of the program by trained nutrition students under the supervision of study nutritionist. Additionally, weekly food logs were also provided to children and information gathered was analyzed.

Regarding PA assessment in children, recent, extensive review of the literature on PA assessment in children found objective techniques such as pedometers and accelerometers much more accurate and reliable than subjective methods including surveys and recall instruments [28]. Therefore, pedometer readings were used as the primary method for assessing PA in children. Five days' worth of pedometer step counts were recorded every week and data collected on baseline and 8 weeks was analyzed. A validated PA questionnaire for children (PAQ-C) [28-30] was also completed at baseline and at the end of the program as a secondary measure to assess PA and compared with pedometer results for convergence. Anthropometric measurements using standard techniques were performed by the trained study staff on children and included; (a) weight and height measurement; (b) waist circumference (at the level of 2 cm above the umbilicus); and (c) blood pressure (BP) measurements using appropriate cuff size at baseline (0 weeks) and then every week till the end of the program. At every visit, two BP readings were taken, 5-minutes apart and the average was used to represent BP. Body mass index (BMI) was calculated (weight in kilograms/height in meters squared).

Weekly sessions were delivered by the CHAs on every Sunday after church service under team supervision, every week. Separate sessions were conducted simultaneously for children and their parents at the same time. Sessions were also repeated by the CHAs for participants who could not attend. Prior to the start of every session, pastor offered special prayers pertinent to the main theme of every session followed by anthropometric examination. MCNQ and PAQ-C were completed at baseline and at the end of the program. Families were provided incentives such as free program booklets, bags, food measurement devices, portion control rings etc. CHAs were provided \$20 for every session they delivered.

Study sample and data analysis

This was a pilot feasibility and efficacy study, therefore a convenience sample of 11 families, who provided consent, was enrolled in the study. The family is defined as at least one child and one parent fulfilling the eligibility criteria. Presence of both parents was preferred. Results obtained from this study will help develop a statistically powered, randomized controlled intervention trial. Descriptive summaries were generated for numeric variables (mean standard deviation, minimum, median, and maximum) and for categorical variable (frequency and proportion). All outcomes (improved nutrition, and change in BMI) were evaluated at baseline (0 weeks), and 8 weeks. The changes of BMI and waist circumference at 8 weeks post-intervention from baseline were analyzed by the repeated measure ANOVA and Wilcoxon signed-rank test (non-parametric test) using SAS Version 9.4 for Windows. MCNQ and food logs were analyzed on nutrition software. The weekly food intake logs were analyzed using the USDA Myplate Nutrient Analysis software for individual intake

and the data was transferred to SPSS Version 10 for further analyses. T-test and repeated measure ANOVA were used for comparison of nutritional components from the baseline to the end of CHHIL program (8 weeks). Focus group findings were analyzed qualitatively using Atlas Ti Software.

Results

Focus group findings

Focus group participants indicated that health for them meant being "free of disease" or "absent of sickness." Participants believed that the main health issues that community members faced included "diabetes," "high blood pressure," and "obesity." When asked about what eating healthily meant, participants suggested items like "smaller portion size," "moderation," and "balance." An important factor in this discussion of eating healthily was cost. Focus group members indicated that "cost=price or cost=we will not pay now but later." Also inactivity was a challenge that participants suggested may prevent some community members from eating healthily.

Focus group participants suggested that the community needed better education in order to teach community members about healthy eating. These programs could be school-based or government-based and the teaching method should "show by example." While health education programs could be church-based too, this location should not be the only one, even though focus group members acknowledged the role of "pastor influence" to incorporate spirituality into the program, and that teaching "faith" as well as "the belief to eat healthy and exercise" would be important health promotion strategies. Regardless of program setting, "consistency" among programs was determined to be important. "Motivation" and "discipline" were deemed to be other important attributes of health education programs. On the other hand, "lack of realistic goals" was identified as a program component that would not be helpful, especially if program goals did not consider the affordability of any proposed healthy eating strategy. Consistency was also considered to be part of realistic program goals in that a program that promotes healthy eating and exercise should not also provide unhealthy foods as part of program activities.

Even though educational programs were considered to be an important strategy, community members conceded that education may not be enough to promote healthy eating because emotional factors were a consideration. Members indicated that "stress" was a factor in eating and that food was then used as a "tool for comfort or happiness." Emotional factors, in focus group members' views, also played a role in their ability to receive and then act on health education. Focus group participants indicated that "not everyone is on the same level" when it comes to knowledge about diabetes and obesity prevention, as well as their consequences. "Fear" plays a role in knowledge acquisition because "not everyone wants to know."

CHHIL need assessment survey findings

Survey findings were; a) 17/34 (50%) reported increasing childhood obesity in their church congregation as a major concern; b) 14/17 (82%) had concerns for children between 12-17 years, whereas, 9/17 (53%) had concerns for children younger than 12 years of age; c) 21/34 (62%) churches requested need for specific program; d) 9/21 (43%) churches requested need for specific program for younger children less than 12 years old, and 17/21 (81%) churches for 12-17 yr old

adolescents; and e) based on Pastors perceptions, prevalence of type 2 diabetes in adults was 17% and obesity in adults is roughly 33%.

CHHIL program feasibility and efficacy-findings

A total 11 families (child with at least one parent/guardian) who provided consent/assent were recruited in the study. Baseline characteristics of children are summarized in Table 3. Overall, mean age was 12.4 ± 3.2 years, majority were females (73%). Forty percent had BMI percentile of 95 and above.

Age, yrs (mean \pm sd), n=11	12.4 \pm 3.2
BMI %ile	N (%)
10th-25th	2 (20)
25th-90th	3 (30)
90th-95th	1 (10)
95th and above	4 (40)
Gender	
Female	8 (73)
Grade	
2nd- 5th	5 (45)
6th and above	6 (55)
Family Size	
2-3 members	2 (20)
>4 members	8 (80)
Number of children in the house	
1	3 (33)
2	3 (33)
3	3 (33)
Parental Marital Status	
Married	5 (46)
Divorced	2 (18)
Never Married	4 (36)

Table 3: Characteristics of children enrolled in CHHIL program (n=11).

Enrolled children received weekly CHHIL sessions from the CHAs under the supervision of research team. Because of the Christmas holidays and at the request of the church pastor, session 7 and 8 were combined and delivered in a 2 hour session. Seven of eleven (7/11) families (63%) attended at least 70% of the program (5 sessions or more) and were analyzed in the final post-intervention analysis for the study (Table 4). At the end of 8 sessions (7 weeks), no significant change in BMI, and weight was seen from the baseline on analysis. Similarly no significant difference was observed in systolic blood pressure (SBP) and diastolic BP (DBP) also at the end of 8-weeks CHHIL program.

Characteristics	Baseline Mean \pm SD	End of Program (8 sessions) Φ Mean \pm SD	¥P-value
Birth weight (kg), n=9	3.2 \pm 0.5		
BMI (kg/m ²), n=10	23.7 \pm 7.3	25.34 \pm 8.0	0.647
Waist circumference (in), n=11	31.0 \pm 6.3	31.75 \pm 7.8	0.686
Height (cm), n=10	148.3 \pm 13.5	148.6 \pm 18.5	
Weight (kg), n=11	54.8 \pm 22.3	56.2 \pm 16.3	
Systolic blood pressure (mmHg), n=11	109.3 \pm 15.2	109.86 \pm 23.7	0.974
Diastolic blood pressure (mmHg), n=11	61.9 \pm 9.5	61.9 \pm 9.5	0.097

Table 4: Anthropometric characteristics of recruited CHHIL participants. SD = Standard deviation; ¥ Paired sample T-test; Φ n=7 at the end of the program.

Changes in nutrition and dietary pattern

Mean weekly nutrient intakes of the participants are summarized in Table 5. Overall there was a trend among the participants to decrease overall total calories (kcal), protein, and carbohydrates consumed overtime. When intake was compared to the recommended levels (Table 2) of the nutrient for age using t-tests, overall mean for total calories and calcium, were significantly lower than recommendation levels needed for adequate growth and development (overall mean differences=-452.2; $P < 0.0005$, and -770.89; $P < 0.0005$ respectively). Similarly, significantly higher levels ($P = 0.001$) of total fat and saturated fats were consumed in excess of the recommended levels (20-35% total fat; less than 10% saturated fat). An overall mean difference of 2.6% of total fat and 3.2% of saturated fat intakes were observed in the sample at the end of CHHIL program. Analysis of the weekly logs showed that none of the participants consumed the required level of calcium intake (1000-1300 mg recommended for this group) necessary for adequate growth. Figure 2 shows the changes in nutrition consumption by week for the selected macronutrient and micronutrient of the participants.

As clearly visible from both Figure 2 and Table 5, mean nutrient intakes showed decreasing trends from baseline to the end of the program (Table 5). Participants consumed significantly lower levels of sodium from baseline to end of the program ($P < 0.001$). No significant differences were found with other nutrient intakes shown in Figure as well as in Table 5.

Program attendance and retention

Program participation and retention were low (63%). Although tracked inconsistently by staff, the most frequently documented barriers to participation included evening programs on Sunday that made participants miss some sessions so they can go home and come back again, parents household commitments and therefore could not leave children to attend weekly sessions after Sunday services, household and family emergencies, and transportation issues.

Discussion

The CHHIL obesity attenuation program was developed in response to the urgent church community need due to increasing burden of CO

in the congregation. The key objective was to provide education about healthy nutrition, test feasibility of church lay members as program interventionists and assess program short-term efficacy. The program was developed using evidence-based elements of successful weight loss interventions (diabetes prevention program and Epstein's traffic light diet) and was implemented by trained church members under the supervision of research teams and pastor support. In this two-month

long, community-based group lifestyle intervention, significant changes (trends) in health behaviors were observed, though changes in anthropometric measures were not seen. All four anthropometric measures increased slightly after 8 weeks program, however was not statistically significant. Similarly, stabilization in waist circumference was also observed.

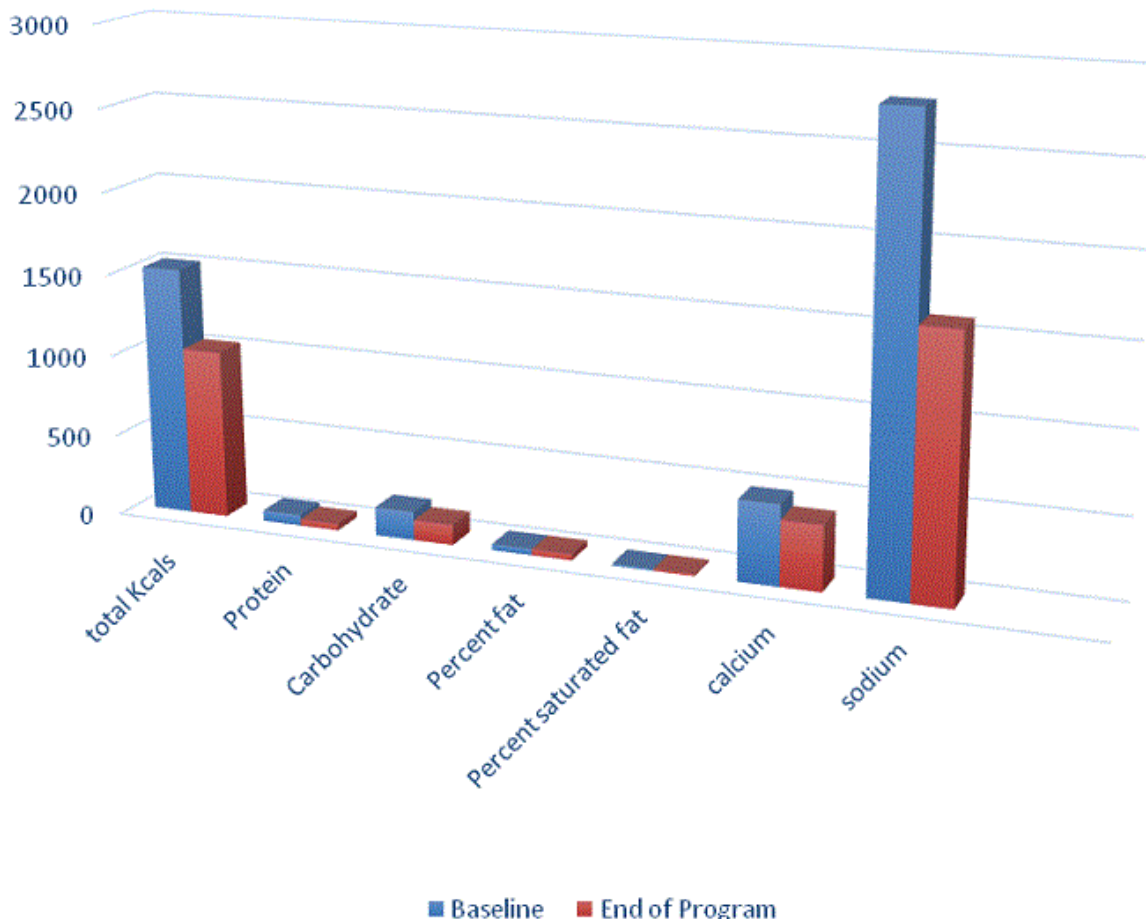


Figure 2: Changes in nutrition intake after 8 wks CHHIL program from the baseline.

Parameters	Baseline ±SD	Mean	End of Program (8 sessions) Mean ± SD	P-value*
Total Kcals	1519.4 ± 240.5		1032.4 ± 311.7	0.199
Protein	65.2 ± 12.1		39.4 ± 12.6	0.115
Sodium	2776.4 ± 476.2		1593.8 ± 329.4	0.001 *
Carbohydrates	174.8 ± 38.0		125.6 ± 43.8	0.498
% total fat	37.6±3.4		37.4±2.1	0.96
% saturated fat	12.4 ± 2.9		12.2 ± 2.1	0.833

Calcium	490.8 ± 128.5	399.6 ± 147.1	0.806
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Table 5: Changes in consumption of nutrients at the end of the 8 week program. * ANOVA analysis.

With such a small sample, true efficacy of the program cannot be determined and larger sample studies are required. There are several explanations for not observing statistically significant anthropometric changes at the end of CHHIL program. First, not all children in the study were overweight. Second, as shown in previous studies, [31] 8 weeks program (in our study 8-weeks program was delivered in 7-weeks due to Christmas holidays) is very short period and not sufficient time to show objective weight changes. The promising findings are changes in nutritional trends towards healthier choices that in long-term will result in weight loss and other anthropometric changes. Third, not all parents of recruited children were overweight,

and though CHHIL is a family-based program, however parents did not monitor their caloric intake, which is a key strategy associated with any successful family-based CO attenuation and prevention program. Studies have suggested that targeting the family or at least one parent in such programs have the potential to improve weight loss outcomes [32,33]. And finally, small sample size of the current study was too small to show any meaningful changes in anthropometric measure in a short period of 8 weeks.

A number of published efficacy studies [34-36] describe the positive outcomes associated with pediatric weight management programs delivered in university-based settings. However, little attention has been paid to the translation and dissemination of these interventions, particularly to underserved populations [29,30,34]. To our knowledge, our study is the first church-based study examining the feasibility of lay church members delivering the CO attenuation and prevention program and testing its efficacy in a real-world, community-based setting for families in underserved low income ethnic minorities. Other potential differences in our results could be short duration, no maintenance phase, sample size, and intervention (intensity of intervention over time). The absence of a control group prevents us from concluding that the observed changes in eating behaviors actually occurred as a result of participating in CHHIL program and therefore future randomized controlled studies are warranted. It is not surprising that more than 70% of our baseline participants were women; rather, this is a common phenomenon in health research, particularly in church-based studies where majority of the congregation comprise of women [37].

The data from the National Weight Control Registry [38] have shown that self-monitoring, persistent goal setting and positive feedback from the family, and surroundings are critical components of efficacious CO attenuation and prevention interventions. Our multi-level, group based CHHIL program follows the same principles based on socio-ecological model. Some studies included the parent and child in the same group sessions, [39,40] whereas CHHIL program incorporated separate but simultaneous groups for the child and parent on the same day that is in line with the model used in the study by Epstein [17].

Conclusion

Although this study admits its limitations, our results add further understanding of baseline eating behaviors among low income church-based ethnic minorities and how eating behaviors showed changes during 8-weeks of a healthy lifestyle program implemented by church own-trained members (CHAs). However no impact on anthropometric measures was seen and this aspect of the program requires strengthening. The CHHIL program may be a promising resource for improving the health and well-being of AA children and adolescents in diverse, low-income community settings. This small feasibility and efficacy study have potential implications for church-based, culturally tailored CO attenuation programs for AA young children and adolescent groups. CHHIL program was developed with the help of community using CBPR methods and implemented by the church members under the supervision of pastor and research team, therefore will likely require fewer health professionals and related material resources than the program delivered by the health professionals. Furthermore, families living in low income neighborhoods have limited resources with limited health care services, therefore focusing on prevention strategies by involving communities in the program will be most cost-effective. Given the lack

of a trend in the clinical parameters, more proof of concept is needed, therefore the next logical step is to develop a maintenance program and pilot test the full program i.e., 2 months intervention followed by 6 months of maintenance phase. Additionally, more vigorous analytic approaches are desirable in future studies to better analyze the repeated measures collected during follow-up, to control for confounders, and to test effect modification. With a long term goal of reducing health disparities, CO prevention research must now move towards identifying how effective intervention components can be embedded within health, education and care systems and achieve long term sustainable impacts.

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