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Short-Term Efficacy and Correlates of Change in Health Weight Management Program for Chinese American Children

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Introduction

Childhood obesity is one of the most prevalent public health concerns facing health care providers today, especially among minority immigrants such as Chinese Americans, which are the largest and fastest growing Asian subgroup in the United States (US). Approximately 25% of Chinese American children are overweight or obese. [1] Although the prevalence of childhood obesity in Chinese Americans is not higher than Whites, Chinese Americans have a higher percentage of body fat and a higher risk of developing cardiovascular disease (CVD) than non-Hispanic whites at the same body mass index (BMI).[2,3]

Childhood obesity increases the risk for adverse physical health including type 2 diabetes mellitus (T2DM) and CVD risk factors. [4,5] A recent systematic review of literature on 378 studies on the prevalence of metabolic syndrome in children found that overweight or obese children are three to nine times more likely to have metabolic syndrome (i.e., glucose intolerance, obesity, and hypertension) than normal weight children.[6] An even higher prevalence of metabolic syndrome is found among overweight or obese Chinese children in mainland China (56%).[7] In obese children, a reduction of BMI of only 5% is associated with improvements in insulin sensitivity and lipid profiles [8]. Because many obese children will become obese adults [9] with increased susceptibility to type 2 diabetes mellitus (T2DM) and CVD [10], healthy weight management in overweight and obese children, especially among Chinese Americans, is critical.

Primary care clinics present a great opportunity for the development of feasible and effective strategies to promote healthy weight because most children receive their health care in primary care settings. Primary care clinics also provide unique opportunity to combine medical management with community outreach and improve access to health programs, especially underserved, low-income, and new immigrant populations. [11] [12] Partnership with community centers or other settings where children can gain access to recreational opportunities is another important step towards developing a successful program, especially for low-income families with less available resources [12]. However, few studies have been conducted in primary care settings in collaboration with local community centers for underserved low-income immigrant children [12,13]. Therefore, we developed a culturally appropriate and evidenced-based healthy weight management program (*iStart Smart*) targeting low-income Chinese immigrant children co-located at a community-based center and a primary care clinic. The purpose of the study was to explore the short-term efficacy of the *iStart Smart* program for overweight and/or obese Chinese American children and to identify factors associated with BMI changes.

Study Methodology

This study utilized a pre-test and post-test quasi-experimental study design to test a healthy weight management intervention with overweight and/or obese Chinese American children. Children who met the following inclusion criteria were invited to participate in the study: (1) between 7 and 12 years old; (2) self-identified as Chinese and/or Chinese immigrants; (3) identified as overweight and/or obese defined by having a body mass index (BMI) percentile above the 85th percentile, as defined by the Centers for Disease Control [14]; (4) lived with at least one parent in the same household; and (5) were able to speak and read English. In addition, the child's parents had to be able to speak English, Mandarin, or Cantonese and to read in English or Chinese. Exclusion criteria included children with chronic health problems that lead to any dietary modifications or activity limitations (e.g., diabetes). Committee on Human Research approved this study.

Study Procedure

A trained research assistant worked with primary care providers in a primary care clinic on identifying and recruiting study participants. Study flyers also were also posted in the clinic. Potential eligible participants received an introduction letter sent out by the research team explaining the study. Parents who were interested in the study provided their names and contact information to the research team via mail or phone.

After parents gave informed consent and children provided verbal assent, baseline data were collected. Children in the study had their weight, height, blood pressure (BP), waist and hip circumference measured. Fast lipid data were also collected at the clinic at baseline and at six-month post intervention. Additionally, children completed questionnaires regarding food choices, self-efficacy, and knowledge regarding nutrition and physical activity at baseline (T_0), two months (T_1) and six months (T_2) post-baseline. Several questionnaires regarding demographic data, acculturation level and child's activity level were completed by parents.

iStart Smart Program Overview

The description of the program has been reported elsewhere. [15] In summary, intervention was also based on Social Cognitive Theory aimed to increase children's self-efficacy through setting realistic and achievable goals and providing necessary skills to achieve mastery. The program was intended to improve self-efficacy in maintaining a healthy weight and a healthy lifestyle.

In this study, children attended 8-weekly, 2-hour small group sessions while parents attended a single 2-hour parent workshop. The children's program included 60 minutes of interactive health curriculum and 60 minutes of physical activity each week. The program was led by a trained research assistant. A parent workshop conducted in Cantonese and English was used to discuss both Chinese and Western diets and ways to increase physical activity in urban, under-resourced communities. The parent workshops aimed to increase parents' knowledge and skills regarding healthy food preparation, active lifestyle and maintaining a healthy weight tailored to the needs of each family. The program also included a field trip to a local grocery store to reinforce messages about healthy food choices.

Parental Measures

Family information. Parents completed a 12-item demographic questionnaire about parent(s)' and children's ages, parents' weights and heights, parents' occupation(s), family income, and parents' levels of education.

Acculturation: Suinn-Lew Asian Self-Identity Acculturation Scale (SL-ASIA). SL-ASIA is a 21-item multiple-choice questionnaire that contains questions related to language, identity, friendships, behaviors, general and geographic background, and attitudes. The SL-ASIA has moderate to satisfactory validity and reliability for Chinese Americans [16].

Family Eating and Activity Habits Questionnaire (FEAHQ). The FEAHQ was used to monitor the environmental factors and family behaviors[17]. This questionnaire was completed by the parents. It assesses the behaviors of parent, spouse and child. It contains 29 items and has four subscales: *activity and inactivity level subscale*; *stimulus exposure*; *eating related to hunger subscale*; *eating styles subscale*. Scores were calculated separately for each member of the family, with higher scores reflecting poor eating and activity/inactive behaviors. The FEAHQ has an established validity and internal consistency.[17] Activity and inactivity level subscale was used to estimate the activity change in children.

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Children's Measures

Body Mass Index (BMI). BMI was calculated by dividing body mass in kilograms by height in meters squared (kg/m^2) [18]. In this study, children's weight and height were measured while the children wore light-weight clothes and no shoes. The 214 Road Rod portable stadiometer, which has graduations of 1/8 inch (0.1 cm), were used to measure stature.

Waist and hip ratio. The waist-to-hip ratio was derived from the waist and hip circumferences. Waist circumference was measured midway between the lowest rib and the superior border of the iliac crest. Hip circumference was measured at the maximal protrusion of the buttocks. The circumferences were given as the mean of two measurements to the nearest 0.1 cm [19].

Blood Pressure (BP). Blood pressure including systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured by using a mercury sphygmomanometer with specific cuff size appropriate for children (Baumanometer, W. A. Baum Co, Copiague, New York) to the nearest 2 mm Hg. BP was measured twice in the child's right arm, with the child seated after 10 minutes of rest.

Lipids profile. Fasting sample measures included high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, triglyceride, total cholesterol, insulin, and fasting glucose and were obtained at the clinic laboratory.[20,21] Children were asked to fast for 12 hours before samples were obtained. Blood samples were collected at baseline and at 6-month follow up assessment.

Usual Food Choices. This 14-item survey was part of the Health Behavior Questionnaire developed for the Child and Adolescent Trial for Cardiovascular Health (CATCH) study. This survey asked about usual food choices (behavior) in a forced-choice

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format that focuses on low-fat and low-sodium foods. It measured usual food selections and what types of food a child eats most of the time. Children were given a choice between two foods and asked which one they eat more often. Sample questions are: “Which foods do you eat most of the time: hot dog or chicken? Frozen yogurt or ice cream?” A higher score indicated more healthy food choices. Adequate validity and internal consistency were reported [22]

Physical Activity Knowledge. The research team developed this five-item questionnaire to assess children’s knowledge about physical activity. Items were adapted from recommendations from the US Department of Agriculture[23] and the American Heart Association [24] regarding dietary guideline, MyPlate, and children’s health. Sample questions included the following: “How many minutes of activity are required for a healthy heart for a child? How many hours a day should a child watch television or play video games?” The score ranged from 0 to 5. A higher score indicated more accurate knowledge about physical activity needs.

Dietary Knowledge. This 14-item questionnaire was part of the Health Behavior Questionnaire developed for the CATCH study [22]. It measured children’s knowledge about healthy food choices. Children were asked to identify the food that was “better for your health.” Samples of two choices included: “whole wheat or white bread” and “frozen corn or canned corn.” This survey had a reported internal consistency ranging from 0.76 to 0.78 [22]. The possible score ranged from 0 to 14. A higher score indicated more accurate dietary knowledge.

Child Dietary Self-efficacy. This 15-item self-report questionnaire measured children’s self-confidence in their ability to choose foods low in fat and sugar [22]. The questionnaire contained 15-item stems beginning with “How sure are you…?” Items were scored on a Likert scale, with options of “not sure,” “a little sure,” or “very sure.” The possible score ranged from

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1 to 3. Higher scores indicated higher self-efficacy. Adequate reliability has been reported for children [25].

Physical Activity Self-efficacy. This five-item subscale of the Health Behavior Questionnaire was used to measure the children's self-confidence in their ability to participate in various age-appropriate physical activities [25]. The possible scores ranged from 1 to 3. Children were asked if they were "not sure," "a little sure," or "very sure" that they could complete activities such as "keeping up a steady pace without stopping for 15 to 20 minutes." Higher scores indicated higher self-efficacy. Adequate internal consistency has been reported for children [25].

Data Analysis

Descriptive statistics were calculated for demographic characteristics and all major study variables. To assess the potential efficacy of the intervention, mixed-effect models were used to estimate average pre and post changes in BMI, usual food choices, child's health behaviors, health knowledge, and self-efficacy. Outcomes from baseline, two month and six month post-baseline visits were included as repeated measures, using a random effect for each child to account for within-subject correlation of the outcomes. Age and gender were included as covariates in all models. Pair t test was used to examine the change of lipid profile at baseline and at 6-month follow up assessment.

To examine factors associated with change of child's BMI, stepwise linear regression with stepwise was used. Variables included in the model were child's usual food choice, child's activity, family stimulus environment, child's eating related to hunger, child's eating style, child's nutrition knowledge, physical activity knowledge, self-efficacy related to nutrition and

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physical activity. All analyses were performed in SPSS 22.0, with $p<0.05$ set as the required level of significance.

Results

One hundred and fifteen children participated in the program. Children had a mean age of 9.5 years (SD = 1.53), average BMI of 23.7 (SD = 3.56) and average BMI percentile is 94 percent (SD = 8.06). Approximately 70% of children in the *iStart Smart* program were boys (n = 81). The average education level for mothers in the study is 10.5 years (SD = 3.5 years) and father is 10.7 years (SD = 2.91 years). The mean Acculturation score was 2.05 (SD =.56), indicating a low acculturation population. About 80% of families in the study reported annual household income less than $40,000. The attendance rate was at 90% with a retention rate of 95% at the 6 month follow up. Data on outcome variables are presented in Table 1.

iStart Smart efficacy outcomes

We found significant reduction of BMI (t = -3.20, p =.002), waist/hip ratio (t = -4.29, p=.001), systolic blood pressure (t = -2.52, p =.013) and improvement of child's eating style (t=-.-3.30, p = .01), physical activity knowledge (t=2.01, p=.04), physical activity self-efficacy (t = 2.57, p =.011), child's dietary self-efficacy (t-3.91, p =.001), and children's quality of life (t=3.44, p=.001) at 6-month post baseline assessment (Table 2). In addition, significant improvement of high-density lipoprotein (HDL) cholesterol (t = -2.94, p = .006) and decreased in triglyceride (t = 3.41, p =.002) were found at 6-month post baseline assessment.

Factors associated with BMI change

Regression analysis revealed improvement of nutrition self-efficacy and decreased stimulus environment were associated with decreased BMI in overweight and obese Chinese American children in the study (F = 6.06, p=.01, See table 3).

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Discussion

The study found that a culturally appropriate and evidence-based health weight management program co-located at a community-based center and a primary care clinic demonstrated short term efficacy. At 6-month follow-up, children in the program decreased their BMI and SBP, triglyceride and increase HDL. In addition, improvement of child's eating style, physical activity knowledge, physical activity self-efficacy, and children's quality of life was also found at 6-month follow up. Improvement of child's dietary self-efficacy and decreased stimulus for unhealthy food at home were associated with decreased child's BMI.

The lifestyle intervention we employed while partnered with community organizations in primary care settings revealed significant reduction in BMI and improvement in lipids at 6 month follow up among overweight and/or obese Chinese American children. Our intervention focuses on healthy lifestyle behavior change and the program is tailored to low-income Chinese American immigrants. Results of our study were consistent with systematic review articles suggest behavioral lifestyle interventions (i.e., improved health diet, increased physical activity, decreased sedentary activity and less sugar-sweetened beverages) can lead to improvements in weight and metabolic outcomes in children. [26,27]

Comprehensive group lifestyle programs have both been found to be effective in primary care settings as many children receive health care in primary care clinics. [28] In addition, a recent systematic review on the effects of primary care intervention on childhood overweight and obesity found that 47% of studies (eight out of 17) reported significant anthropometric changes immediately after the intervention, and these all maintained some significant effect at subsequent follow-up (between 4 months and 4 years after intervention). [29] Our study supports

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the notion that lifestyle intervention can lead to behavior and weight change, and the primary care clinic is a feasible setting at least in short term.

Our study found improvement of child's dietary self-efficacy and decreased stimulus for unhealthy food at home were associated with BMI reduction among overweight and/or obese Chinese American children. As the study was based on Social Cognitive Theory and intervention aimed to increase children's self-efficacy through various activities related to goal setting and skill building to promote a healthy lifestyle and to maintain a healthy weight, improvement of diet self-efficacy leads to decrease BMI. This was consistent with other studies that support the notion of increased self-efficacy is associated with BMI reduction. [30-32]

In addition to improving self-efficacy for diet, we also found decreased presence of unhealthy food at home also related to decreased BMI. Family environment and parents' health behaviors are key influences on the development of children's food preferences, eating styles, and activity patterns.[33-36] Several studies have shown that childhood obesity prevention programs can be effective when they are designed to include parents in behavior change and home environments, where they can engage children to change their dietary behavior, decrease sugary drinks, increase physical activity, and reduce television viewing time.[37-40] Parents in this study learned various strategies to improve their health by promoting a healthy home environment and engage in healthy lifestyle practices with their children. Our study found that removal of unhealthy food (stimulus environment) at home helped reduce BMI in overweight and/or obese children.

Healthy People 2020 has listed reducing childhood obesity as our national health priority. Many families with overweight and/or obese children have been looking for effective healthy weight management program for their children. The partnership between primary care clinics and community centers increases access and resources for these families. Our intervention provides a first insight into a culturally appropriate and evidence-based healthy weight management intervention in overweight and obese Chinese American children in low-income families.

Despite the short-term efficacy on weight management in overweight and obese children, this study has some limitations including (1) convenience sampling, (2) non-randomization design, (3) only involved Chinese American children, and (4) follow up for only 6 months. Furthermore, we only assessed the short-term efficacy of the intervention in this study. Future studies will have better generalizability if they included larger and more diverse samples, and longer periods for follow-ups with a randomized control study design. Despite the study's limitations, the results provided new information on healthy weight management in the primary care setting in a low-income community.

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Table 1. Outcome variable descriptive data, mean (SD)

Variable	T0	T1	T2
BMI	23.7 (3.6)	23.4 (3.5)	23.4 (3.8)
BMI percentile	93.9 (8.1)	93.5 (8.3)	92.7 (8.3)
Waist/hip ratio	.95 (.09)	.94 (.09)	.92 (.05)
Systolic BP	104.0 (8.8)	99.8 (10.9)	101.1 (8.9)
Diastolic BP	62.7 (8.3)	59.1 (11.1)	61 (1.06)
HDL	47.83 (10.39)		50.94 (10.24)
LDL	101.92 (34.23)		100.69 (36.29)
Total Cholesterol	169.36 (38.38)		166.19 (41.32)
Triglyceride	97.25 (59.02)		72.92 (48.29)
Glucose	85.89 (5.24)		85.52 (6.21)
Food choice	9.02 (2.35)	9.66 (2.13)	9.38 (2.09)
Nutrition knowledge	9.37 (2.39)	9.72 (2.13)	9.61 (2.10)
PA Knowledge	3.19 (1.67)	3.68 (1.48)	3.63 (1.67)
Nutrition self-efficacy	2.37 (.48)	2.53 (.39)	2.51 (.42)
PA self-efficacy	2.25 (.47)	2.32 (.44)	2.37 (.42)
Child activity/inactivity	2.11 (7.35)	-1.11 (10.75)	-4.12 (14.20)
stimulus exposure	8.79 (3.27)	8.20 (3.64)	8.39 (4.3)
Eating related to hunger subscale: Child	6.52 (2.42)	6.15 (2.07)	6.21 (2.01)
Eating styles subscale: Child	18.52 (6.92)	17.66 (6.07)	16.46 (7.27)

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Table 2. Summary of Effects of the *iStart Smart* Intervention

Outcome	Estimate	t	p	95% CI
BMI*	-.08	-3.20	.002	-.14 , -.03
BMI percentile	-.19	-1.42	.16	-.44, .07
Waist/hip ratio*	-.008	-4.29	.0001	-.01, -.005
Systolic BP*	-.67	-2.52	.013	-1.20, -.14
Diastolic BP	-.42	-1.45	.18	-1.00, .15
FAEHQ Child Activity	-1.13	-3.39	.001	-1.78, -.47
FAEHQ Stimulus	.05	.65	.52	-.11, .29
FAEHQ Child eating-Hunger	-.04	-.10	.48	-.15, .07
FAEHQ Child eating style*	-.52	-3.30	.01	-.84, -.21
Food choice	.11	1.50	.14	-.03, .25
PA knowledge*	.07	2.01	.04	.001, .14
Nutrition self-efficacy*	.04	3.91	.001	.02, .06
Activity self-efficacy*	.03	2.57	.011	.007, .06
PQOL	1.44	3.44	.001	.61, 2.27

*Significant change

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Table 3 BMI Linear Regression Summary

Outcome	**Predictor(s)**	**R^2**	**B**	**sr^2**	**F**	**p**
BMI	Overall	.40			6.06	.01
	Nutrition self-efficacy		-2.05	.36	11.97	.003
	Stimulus		.17	.04	9.93	.045

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