Article

Incorporating an Increase in Plant-Based Food Choices into a model of Culturally Responsive Care for Obesity in Hispanic/Latino Adults and Children

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Abstract: The national rate of obesity in US Hispanic/Latinos exceeds all other major ethnic subgroups and represents an important health disparity. Plant-based diet interventions that emphasize whole plant foods with minimal processing and less refined grains and sugar have shown have shown great promise in control of obesity, but there is a paucity of data translating this treatment effect to disparity populations. The objective of our study was to evaluate the efficacy and scalability of the Healthy Eating Lifestyle Program (HELP) – a hospital-based, family centered, culturally tailored, plant-based diet intervention for Hispanic/Latino pediatric obesity patients and their families. Our evaluation methods included: 1) a quasi-experimental, one group, longitudinal study to measures changes in BMI at 0, 6, and 18 weeks of follow-up, and 2) A stakeholder analysis consisting of six key informant interviews of HELP program staff. We found a significant decrease in body mass index across all adults (-0.2 kg/m^2 p=0.0047), that was much stronger in men. For children ages 5-12 years, there was also a significant decrease in BMI Z score from pre- to post-intervention (p=0.04). Program strengths were the cultural tailoring of the plant-based diet choices, and allowing a tiered approached that did not require adherence to strict vegetarianism. Our pilot study findings from HELP raise the possibility that incorporating plant-based diet choices into the treatment of pediatric obesity patients and their families can be an effective addition to a culturally responsive care model.

Keywords: diabetes; vegetarian diet; nutrition; metabolic syndrome; obesity; disparity

1. Introduction

The 2016 National Health and Nutrition Examination Survey of the US reported that the prevalence of obesity in Hispanic/Latino adults ages 20 years and older (47%) was higher than their Asian (12.7%), Black (46.8%), or white (37.9%) peers[1 2]. For Hispanic/Latino children, a similar disparity in the obesity trend was also found in the national data (25.8% Hispanic/Latino; 11% Asian;

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22% Black; 14.1% white)[1 2]. Dr. Eduardo Sanchez, Chief Medical Officer for Prevention at the American Heart Association issued a statement on the disparity in obesity rates highlighting the need to link the public with "affordable, healthy, and nutritious foods, and fewer sugary drinks"[3].

Plant-based diet interventions that emphasize whole plant foods with minimal processing and less refined grains and sugar have shown have shown great promise in control of obesity and type 2 diabetes (T2DM). In a meta-analysis of 15 plant-based diet randomized controlled trials, Barnard et al found that adherence to the diet for at least four weeks was associated with a mean weight loss of -3.4 kg[4]. For T2DM patients, a systematic review of 9 plant-based diet randomized controlled trials, Toumpanikis et al[5] reported that: 1) 8 out of 9 found a clinically important decrease in HbA_{1c} levels, and 2) 6 out of 9 reported reduction or discontinuation of diabetes medication. Taken together, we find convincing data from randomized controls trials in the explanatory setting that plant-based diet interventions can improve self-management of both obesity and T2DM. The limitation of these interventions is in the translation of plant-based diet treatment effects to high risk disparity populations in the US such as Hispanic/Latinos.

For the purpose of systematically adapting a plant-based diet intervention for high risk Hispanic/Latino patients, our group at Loma Linda University undertook a series of pilot studies[6-9] to study plant-based diet practices in Hispanic/Latino Adventists and further test whether such plant-based diet patterns could be applied to Hispanic/Latino adults receiving health care in a federally designated medically underserved region of Southern California. The rationale for studying Adventists is that due to faith-based recommendations of the Seventh-day Adventist Church (Protestant Christian Denomination), about 50% of the members are vegetarian, and are further encouraged to consume certain plant foods (i.e. legumes, nuts, whole grains) in place of animal products[10 11]. The NIH has funded cohort studies that provide convincing evidence that a range of plant-based diet patterns (from semi-vegetarian to vegan) practiced by Adventists are associated with lower incidence of obesity and diabetes[12-16], and a longer life expectancy[17 18]. For example, in a national sample of 3,475 US Hispanic/Latino Adventists[7], in NCI-funded Adventist Health Study-2 (AHS-2), plant-based diet patterns were associated with significant percent decreases in BMI relative to patterns of frequently eating animal products: semi-vegetarians (-4.89 %, $p = 0.011$), pesco-vegetarians (-5.34%, $p < 0.0001$), vegetarians (-8.92%, $p < 0.0001$), vegan (-15.07%, $p < 0.0001$). In a Southern California sample of Mexican Adventists[6], the Adventist Multi-ethnic Nutrition Study (AMEN) study found that plant-based diet patterns were associated with: 1)maintaining BMI in the recommended range (24.5 kg/m^2 vs. 27.9 kg/m^2, $p = 0.006$), and 2)significant decreases in waist circumference (34.8 in vs. 37.5 in, $p = 0.01$), and fat mass (18.3 kg vs. 23.9 kg, $p = 0.007$). Lastly, LLU faculty adapted Adventist Health Study findings to the design of a pilot plant-based diet intervention trial that enrolled 32 Mexican T2DM patients from community clinics in a federally designated medically underserved area of Southern California (San Bernardino County)[8 9]. The intervention increased plant-based diet choices (without requiring strict vegetarianism) through a culturally tailored set of cookbooks, recipes, and cooking instruction designed by a Hispanic/Latino nutritionist[8 9]. After 6 months of follow-up, the investigators found a plant-based diet treatment effect (decrease in HbA_{1C} of 1.2%)[8] from the LLU pilot study that translates to a 21% decrease in diabetes-related deaths, 37% decrease in microvascular complications, and 14% decrease in risk of myocardial infarction[19].

For the scalability of interventions in disparity populations, the National Institute of Minority Health and Health Disparities proposes a conceptual framework that involves engaging multiple domains of influence over the lifespan (biological, behavioral, physical/built environment [i.e. household], sociocultural, and health care system[i.e. patient-provider])[20]. For the present study, Loma Linda University partnered with Adventist Health-White Memorial (AHWM) Medical Center – a health care organization operating in a medically underserved, East Los Angeles catchment area that is 90% Hispanic-Latino (85% Mexican). AHWM has developed a successful model of culturally responsive care for their patient population[21 22], and this care model has been recently used to adapt and pilot test culturally tailored plant-based diet and physical activity interventions for Hispanic/Latino Patients. Specifically, the AHWM Diabetes Education Office adapted a hospital-

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based, family centered intervention - the Healthy Eating Lifestyle Program (HELP)[23,24] – for use as a plant-based diet intervention for Hispanic/Latino pediatric obesity patients and their families.

The overall aim of our mixed methods evaluation of the adapted HELP program was to assess programmatic efficacy and sustainability in reducing pediatric obesity by educating children ages 5-12 and their families about plant-based eating habits and physical activity (6 week educational phase followed by a 3 month maintenance phase). The specific aims are as follows: 1) To examine whether the HELP intervention prevented an increase in adiposity levels in children, 2) To examine whether the HELP intervention decreased adiposity in obese/overweight parents, 3) To determine strengths, weaknesses, opportunities, and threats to the HELP program efficacy and viability through a stakeholder analysis of program staff.

2. Methods

The Health Eating and Lifestyle Program (HELP)[23,24] was created by the Hospital Association of Southern California as a nutrition and exercise intervention for pediatric obesity patients and their parents. During 2005-2007, 1,135 children and 991 parents were enrolled in HELP through the Los Angeles Chronic Disease Management Consortium (California Hospital Medical Center (CHMC), Good Samaritan Hospital, Huntington Hospital). HELP participants decreased their BMI z-scores ($p < 0.001$)[23].

In 2010, the Department of Family Medicine and Diabetes Education of Adventist Health White Memorial (AHWM) Medical Center adapted and implemented HELP to be a culturally tailored plant-based diet and physical activity intervention for pediatric obesity in Hispanic/Latino families. At AHWM HELP was delivered through a highly successful model of culturally responsive care that was developed, implemented, and disseminated by AHWM in 2008[21,22]. We will describe the HELP Program, qualitative evaluation methods of HELP, and quantitative evaluation methods. Our program evaluation methods of the adapted HELP program received ethics approval from the Institutional Review Board of Adventist Health White Memorial Medical Center (#20191016) and the Institutional Review Board of Loma Linda University (#5190401).

2.1. HELP Program

2.1.1. HELP Implemented in the Context of a Culturally Competent Care Model developed at White Memorial Medical Center

AH-WMMC created an innovative modular curriculum for training of providers[21], medical residents, and medical students in cultural competence that draws from the domains of cultural competence training from the AAMC[21]: 1) Introduction/Key Concepts, 2) Bias Stereotyping, Culture, and Clinical Decision Making, 3) Health and Healthcare Disparities, 4) Cultural Competence in Patient Care, and 5) Cultural Competence and Community Action. The curriculum draws from theory-driven frameworks built upon cultural awareness, knowledge, skill, encounters, and proficiency[21]. A 2016 HRSA-funded effort further disseminated AHWM's model for an East Los Angeles catchment area (90% Hispanic/Latino; 85% Mexican) to hospitals serving the South Los Angeles[22] catchment area that was also predominantly Hispanic/Latino. For the HELP program, this framework empowered the delivery of culturally tailored plant-based diet material through a multidisciplinary provider staff (family medicine, nursing, educator, patient navigator) in family medicine and diabetes education who were all working through a common culturally responsive framework.

2.1.2. HELP Study Lifestyle Intervention

Study Population. Subjects were enrolled in the HELP program using the following inclusion criteria: 1) a child ages 5-12 years, with body mass index (BMI)>80% for age and gender, 2) one parent/guardian must attend and participate in the workshop with the child participant, 3) no provider restriction for both child and parent to participate in the HELP diet and physical activity intervention. The primary method for recruitment was pediatric referral from the AHWM service

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area – an East Los Angeles Catchment Area that is 90% Hispanic/Latino and 85% Mexican. In addition, flyers in the AH-WMMC system and news media (English and Spanish Language television and print media) were used, in addition to the hospital magazine. Word of mouth and patient referrals were also accepted.

During 2010-2018, children and their family members were encouraged to participate in the program together. No family members were excluded. From 2010-2018, three hundred forty eight children participated in the program along with an additional 194 non-referred children (i.e. family members of referred children) from 2010-2018. Curriculum and data collection methods changed post 2015; hence, only participants enrolled in the HELP program from 2016-2018 are reported (52 referred children and 98 adults).

HELP Intervention. The 5 month intervention includes an intensive 6 week educational phase (6 lifestyle change modules) followed by a 3 months maintenance phase and program graduation. The **dietary intervention** consisted of cooking instruction and supermarket tours to implement a four tiered (gold, silver, bronze, brick) food guide to plant-based eating (Figure 1). The food guide is depicted in figure 1, and shows that the highest tier (gold) involved eating whole plant foods with minimal processing (battered, deep fried, heavily sauced, fast food processing), and allowed a pesco-vegetarian pattern. Subjects were coached on this tiered continuum and there were no strict vegetarian categories enforced (transitioning to gold-silver-bronze are all a "success") – a method resonating with AHS-2 findings from Hispanic/Latinos that semi-vegetarian and pesco-vegetarian patterns have significant protective effects against obesity[7]. The physical activity intervention included a physical activity pyramid to achieve pedometers goals of 10,000 steps per day for the adult, and 13,000 steps per day for the child. From each parent-child dyad BMI was measured six times during the 5 month follow-up, and a food and activity diary recorded.

Adventist Health White Memorial

OLYMPIC FOOD GUIDE

h.e.l.p

	VEGETABLES -Fresh or frozen-	FRUITS -Fresh or frozen-	DAIRY	PROTEIN	GRAINS Whole wheat or whole grain- oats, rye, corn, etc.:	FATS	BEVERAGE	MISCELLANEOUS
GOLD	Artichokes, Asparagus, Bamboo shoots, Broccoli, Brussel sprouts, Carrots, Cabbage, Cauliflower, Celery, Cucumbers, Eggplant, Greens, Green beans, Green onions, Garlic, Jicama, Lettuce, Mushrooms, Nopales, Onion, Peppers, Radishes, Spinach, Squash, Sweet potatoes, Tomatoes, Water chestnuts, Zucchini, Winter squash	Apples, Strawberries, Apricots, Tangerines, Blackberries, Cherries, Blueberries, Cantaloupe, Grapefruit, Lemons/Limes, Nectarines, Oranges, Papaya, Pineapple, Peaches, Plums, Raspberries	Cottage cheese, non-fat or fat-free Milk, non-fat or fat-free, skim Powdered milk, non-fat Yogurt, non-fat or fat-free	Beans-kidney, black, pinto, etc. Lentils Egg whites Fish Peas-split, black-eyed Refried beans, fat-free Tofu, low fat Veggie burgers	Barley Bran Bread Bulgur English muffins Hominy grits Oatmeal Pastas-Whole grain Popcorn, plain Quinoa Rice, brown Rice cakes Tortillas, Whole wheat 6"		Carbonated Water Mineral water Water	Cinnamon Flavorings/extracts-e.g. vanilla Herbs Horseradish Mustard Salsa, home-made Spices Tabasco sauce Vinegar
SILVER	Corn Peas Potatoes	Applesauce-no sugar added Bananas Dried fruits Fruit, canned in its own juice Grapes Raisins Watermelon Pear	Cheese, made from non-fat, fat-free, or skim milk Cottage cheese-low-fat Milk, 1% low-fat Sour cream, non-fat Soy Milk Yogurt, plain, low-fat	Chicken, white meat, no skin Chili, home-prepared Eggs Egg substitutes Red meat, lean, all fat removed Seafood-shrimp, crab, etc. Tofu Tuna, packed in water Turkey, white meat, no skin Vegetarian refried beans	**All products must have 3g or more of fiber per serving:** Bagel/Biscuits, Pretzels Bread, white Cereal, no sugar added Crackers, low fat English muffins, white Hamburger/hot dog buns Pasta/spaghetti Rice, white, boiled Tortillas, corn 6"	Avocado-¼ No more than ¼ cup of nuts	Coffee Tea Vegetable juice-½ cup	Broth, low sodium Clear soup, low sodium Other salsa Vegetable soups, low sodium
BRONZE	Baked potato chips Pickles Potato salad Sauerkraut	Applesauce, sweetened Fruit juice-100%, ½ cup or 4 oz a day only Fruit canned in light syrup Minute-Maid, light	Cheese-low-fat Cream soups Frozen yogurt, low- fat Milk, 2% low-fat Milk, choc., low-fat Pudding, low-fat or regular Soy milk, flavored Yogurt, low-fat or regular w/fruit	Canadian bacon Chili, canned Chicken or turkey, with skin Chicken or turkey, dark meat Lunch meats, low fat Peanut butter Red meat, hamburger Refried beans Tuna, packed in oil	Corn bread muffins Crackers French toast Granola bar, low-fat Macaroni & cheese Macaroni salad Pancakes Pizza, Veggie Popcorn, buttered Rice, fried Stuffing Waffles	Guacamole Margarine, soft Mayonnaise, light or low-fat Nuts-almonds, cashews, pecans, walnuts, etc. Oils-canola, olive, peanut Salad dressings, light or low-fat Seeds, sunflower	Crystal Light Diet Soda Fruit$_2$O Fruit juice 100%- ½ cup Minute-Maid, light Propel V-8 Splash, diet	Gelatin, diet Honey Ketchup/catsup Molasses Soy sauce, Light
BRICK	Battered & deep fried vegetables French fries Hash browns Potato chips Vegetables with sauces MOST FAST FOODS	Coconut milk Fruit bars Fruit in heavy syrup Fruit drinks Fruit fillings Fruit rollups Fruit smoothies Jamba Juice Nectars	Cheese, Sherbet Cream cheese Cream sauce Half & half Ice cream Milk, whole Milk, chocolate Shakes Sour cream Whipped cream	Bacon, Bologna Corned Beef, Corn dogs Fish Sticks, Fried fish Fried Chicken, Pastrami Hot dogs, Sausage Liver sausage, Spam Pizza snacks-pepperoni Salami Salt pork MOST FAST FOODS	Cakes, Chips, Cookies Candied or sweetened cereals Croissants Cup of noodles/Top Ramen Doughnuts- all kinds Granola bars Pastries Pies Taco shells MOST FAST FOODS	Butter Gravy Lard Margarine Mayonnaise Oil Salad dressing Tartar sauce	Blended coffee drinks Fruit drinks-Fruit Punch, Lemonade, Tampico, Sunny Delight, Tang, etc. Gatorade, Kool-Aid Jamba Juice, Sodas Milkshakes, Horchata, PowerAde, w/ sugar Smoothies, Jamaica, Yogurt drinks, w/sugar	BBQ sauce Candy Chocolate topping Gelatin Jam Jelly Marmalade Popsicles Sugar Syrup

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Figure 1. Tiered food guide to guide family-based intervention for overweight/obese Hispanic/Latino children ages 5-12 years (Healthy Eating and Lifestyle Program).

HELP Outcome Measures. The goal of the HELP program is lifestyle change. We track BMI by taking each child and each adult participant's weight and height. HELP is a 6 consecutive week program with a 3 month break between week 6 (module 5) and graduation (module 6). We take their weight and height at either Orientation or module 1 (week 1 or 2), at module 5 and at module 6. We

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also track self-reported nutrition and activity habits of both the qualifying child and adult guardian using food frequency questionnaires and physical activity diaries.

2.2. Qualitative Measures and Analysis

Subjects. During May, 2018 semi-structured interviews were conducted with six key informants who possessed valuable insight on the HELP Program at White Memorial Medical Center (WMMC). This six key informants consisted of an interdisciplinary team (Diabetes Program Manager, Certified Diabetes Educator, Dual Role Health Educator-Office Coordinator, Dual Role Health Educator-Patient Navigator, Endocrinologist, Executive Chef). Four of the team members (Diabetes Program Manager, Certified Diabetes Educator, Dual Role Health Educator-Office Coordinator, Dual Role Health Educator-Patient Navigator) had specifically designed, culturally tailored, implemented, and modified the intervention during 2010 to the present. Two of the remaining team members (Endocrinology, Executive Chef for AHWM) were chosen for their technical knowledge of diet and diabetes in patients in the catchment area. Education (obesity knowledge, cooking instruction, and supermarket tours) was the major component of this intervention and was conducted by the Diabetes Program Manager, Certified Diabetes Educator, Dual Role Health Educator-Office Coordinator, Dual Role Health Educator-Patient Navigator, who were all bilingual and Hispanic/Latino.

Interviews. All subjects provided written informed consent. The following four interview questions were developed by the Center for Health Research at School of Public Health, Loma Linda University to evaluate the efficacy and sustainability of the HELP Program: 1) What are the strengths of the programs to introduce more plant-based eating into the diets of Hispanic/Latino obesity or T2DM patients being treated at WMMC? We would like you to refer to cooking classes, supermarket tours, and diet counseling if possible, 2) What are the weaknesses of the programs to introduce more plant-based eating into the diets of Hispanic/Latino obesity or T2DM patients being treated at WMMC?, 3) What opportunities are present and need further development in the programs to introduce more plant-based eating into the diets Hispanic/Latino obesity or T2DM patients being treated at WMMC? 4) What are the threats that exist to the continuation of development of the program to introduce more plant-based eating into the diets of Hispanic/Latino obesity or T2DM patients being treated at WMMC? The interviews with consented participants were held over the telephone during business hours and lasted 20-40 minutes. All interviews were digitally recorded (with participants' consent) and transcribed verbatim. The interviewer reviewed the transcripts to ensure no content was lost during the transcription and to clarify any questions.

Qualitative Analysis. Grounded theory was used to guide the data analysis. The interview transcripts were entered into QSR International's NVivo 11 qualitative data analysis software. Open and axial coding was used to analyze the data and identify emerging themes.

2.3. Quantitative Evaluation of the HELP Study

Outcomes. To assess the effect of the intervention on adiposity in the child and adult we conducted a quasi-experimental, one group, longitudinal study to measures changes in BMI from baseline to week 6 (final week of education phase) to 3 months after the end of the education phase. Outcomes were child body mass index (kg/m^2) and adult body mass index (kg/m^2).

Analysis. Linear mixed models with main effects of time, gender, age, year cohorts, gender by time interactions, and subject-level random intercepts were used to model the longitudinal trajectories of BMI in adults and BMI z-scores in children. All analyses were done using SAS Software (version 9.4) and R version 3.1.1 (http://cran.r-project.org/).

3.Results

3.1. Qualitative Study of HELP Study Providers

The six key informants provided insight into the strengths and weaknesses of the current programs as well as the opportunities for future development. Five key emerging themes were identified.

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Theme #1: The surrounding community stands to benefit from nutrition programs at AHWM.

One of the main emerging themes identified was that the surrounding community members stand to benefit from nutrition programs at AHWM. This theme was evident across all six of the interviews. Participants referred to the socio-economic status and disease prevalence in the area, the prevalence of unhealthy nutritional habits, the positive response from the community members to the current program offering, and the openness of the community members to learn. As one of the key informants stated: "I feel, with experiences with other programs is that they really want to live healthier lives, they want healthy changes…we do have a community wanting and hungry to learn."

Subtheme #1a: The patients served are largely a non-vegetarian community.

Half (six) of the participants highlighted that a plant-based diet is not common in this community. This presents challenges and opportunities of getting the community members to accept the plant-based diabetes education and to buy into a plant-based diet program considering how presently the community residents are not inclined to the vegetarian diet. Despite this, the key informants felt that the past experience with the program being well tailored to the community resulted in positive response from community members: *"they were able to hear this is good for me, it's easy to make, and not only it was good for me and it's easy to make, but it doesn't taste bad."*

Subtheme #1b: Positive community response to the current program.

Four of the participants referred to the positive response from community members to the program being offered. One of them who is involved in coordinating the program shared positive feedback she received from the program participants, expressing gratitude: *"I get families telling us how thankful they are and how they benefited, how they didn't know that what they were giving to their children was bad. How kids are now telling the parents how to eat better or not to buy certain products because that's what they learned in class… Children are at a time in their life where the changes are going to be more permanent if we reach them, because they are more willing to learn."*

Theme #2: Lack of awareness among community members about the program offered

Four of the interviewees shared that one of the challenges of the program was that the community members were not well informed on the availability of classes or on what diabetes education entails. Patient education on diabetes and obesity, while available on a one-on-one basis, may not reach every patient. Two participants stated that not all patients have the access to get a referral to take the diabetes education classes, and may simply not know about the program.

"Anybody can get that [diabetes education] as long as they have some sort of insurance coverage…Whichever patients have access to the educators, they will get the … education."

One key informant who is among chief instructors for the programs expressed that classes have room to grow so more of the population would be able to benefit from them: *"I think maybe the only struggle would be to get the word out there, [get] people informed so we get bigger classes, a bigger population coming to get educated".*

Theme #3: Lack of teen-focused programs

One of the key informants expressed a concern that there is not a next level of the child obesity program for this community, so that as the children transition in age, they could remain in the chronic disease prevention program and continue getting this support: *"I wish I had a teen program because ours [program] only runs from five to twelve…. I am a true believer of children's programs because I think children are at a time in their life, for their changes are going to be more permanent if we reach them because they're more willing to learn. The adults aren't but children are more open and teens because there is a really, really great need that's when a lot of the social the environment comes in and they really, really need that help."*

Theme #4: Culturally Tailored Interactive Program Conducted by Competent Staff

Another emerging theme resulting from the data analysis is that culturally tailored interactive programs conducted by competent staff, as is done at WMMC, will results in greater acceptance by the community.

A further adaptation of the program consisted of interactive hands-on cooking classes conducted by expert staff (three registered dietitians/certified diabetes educators) for the local community. The programs focused on teaching culturally tailored plant-based nutrition: how to eat a healthy diet and how to cook plant-based healthy recipes. The interactive cooking classes allowed the participants

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from the community not only to learn about healthy eating, but experience it by participating in the cooking process, touring the supermarkets, and tasting the samples as part of the education. As one of the participants stated: *It's not only good for me, it's easy to cook, it tastes good, and I am able to purchase the items at my local market."*

Subtheme #4a: Cultural Tailoring

Five of the key informants discussed in detail the cultural tailoring of the program and this appeared to be one of the largest reported strengths of the program. All of the program educational materials were specifically developed for the targeted community with language considerations. As the community being serviced was largely Hispanic, all of the educators were bilingual.

Furthermore, all cooking demonstrations were designed with target population in mind, where recipes were carefully aligned with the traditional fare of this community. This means they could continue to enjoy familiar foods but now made with healthier ingredients: *"I did a lot of recipes that were familiar; they were Latin recipes they would bring to me, and I would turn them into healthier versions of their favorite recipe…I believe, that was well accepted."*

The educators took special care to ensure that the recipes taught in the program included only those ingredients that were easily accessible in the local neighborhood markets, making the program recommendations easily attainable. This means participants did not have to alter their shopping habits and go out of their community to go grocery shopping. This is of particular importance as many in this community do not own a car, therefore having to drive or take a bus to a whole foods store would create an additional burden for this community. Instead, they could shop in the same neighborhood markets. The resources for healthier meals were easily available in their own community.

Subtheme #4b: Tailored Educational Materials

In addition to cultural sensitivity, the educational materials developed for these programs reflected the low literacy level of the targeted population and included pictures, and as one of the participants stated: *"they are easy to follow".*

Subtheme #4c: Competent personnel

Two of the key informants felt that having competent experienced staff (three bilingual registered dietitians, who are also certified diabetes educators, with prior experience in offering cooking classes and interactive health education) conducting the programs contributes greatly to the overall strengths of the HELP program.

Theme #5: Administrative and Financial Support is Necessary for the Success of Community Programs

Another important emerging theme that has the potential of becoming a barrier or the advantage to the diabetes prevention programs at AHWM is related to the administrative and financial support of the programs.

Subtheme #5a: Leadership Support

Two of the respondents specifically noted the more recent support the hospital administration has offered for the nutrition programs. On the other hand, another participant expressed that there is a level of uncertainty of whether the hospital will remain committed to these programs. This individual emphasized the importance of getting the corporate executives on board and to recognize the importance of lifestyle interventions as the current perception is that the corporate leadership does not understand the local community members' needs, and they would not recognize the value of educating the population who are largely Spanish monolingual and many of whom have low literacy level or are illiterate: *"…They [corporate] do not understand our community, they do not understand the needs here, they do not understand, even with their marketing department that's been handled now away from here, they don't understand what it takes to educate a population that is mainly monolingual Spanish… We are having a struggle… so now that we won over the hospital, now we have to win over corporates…"*

Subtheme #5b: Financial Support

All six responded reported that a lack of consistent funding to the programs was a key weakness/threat to the programs. As community health programs do not bring in revenue, all the key informants expressed concern about their sustainability. Lack of funding for space rental and

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materials as well as inability to expand programs for this reason was among some of the reported concerns. One of the interviewees was encouraged about the hospital providing the program funding for the first time during this year, as in the past traditional grant funding resulted in lay-offs once the funding ran out. More diabetes educators are needed to sustain and expand quality programs, but the current staff's concern is whether they will be able to keep who is there now: *"Can we have more diabetes educators, can we even keep the ones that we already have and then the ancillary staff that we need to run these types of programs"*.

Given the type of programs offered, two of the key informants referenced the use of grants for past funding and felt that there are multiple grants that could be sought after to sustain these programs in the future. The concern however, expressed at the same time, is that when the programs are funded by grants, it means the funding is limited to a time-period, and once it runs out, the programs may have to stop.

3.2. Quantitative Study of Adiposity Outcomes in HELP Participants

Ninety-eight adults (87% females and 13% males) and 52 children (58% females and 42% males) entered the HELP study from 2016 to 2018 (Table 1). Ninety-three adults (98%) and 39 (58%) children are overweight or obese (BMI≥25) at baseline.

Table 1. Participant characteristics.

Adult Characteristics	**Overall (N=98)**	**2016 (n=20)**	**2017 (n=68)**	**2018 (n=10)**
Age	41.24 (7.52)	41.50 (7.09)	41.58 (7.55)	38.80 (8.44)
Gender: n (%)				
Female	85 (87%)	18 (90%)	58 (85%)	9 (90%)
Male	13 (13%)	2 (10%)	10 (15%)	1 (10%)
BMI				
Baseline	33.31 (6.08)	33.77 (7.76)	33.35 (5.82)	32.10 (4.18)
Post-Intervention	33.26 (6.19)	33.66 (7.78)	33.36 (5.97)	31.84 (4.05)
Follow-up	33.71 (7.07)	32.79 (8.31)	34.00 (6.73)	
Child Characteristics	Overall (N=52)	2016 (n=13)	2017 (n=35)	2018 (n=4)
Age	9.35 (2.09)	8.77 (2.17)	9.71 (2.05)	8.00 (1.63)
Gender: n (%)				
Female	30 (58%)	7 (54%)	21 (60%)	2 (50%)
Male	22 (42%)	6 (46%)	14 (40%)	2 (50%)
BMI				
Baseline	28.55 (6.01)	28.18 (4.84)	29.00 (6.64)	25.80 (2.74)
Post-Intervention	28.20 (6.09)	27.39 (4.70)	28.86 (6.69)	24.95 (3.25)
Follow-up	27.91 (4.81	28.08 (5.23)	27.83 (4.74)	-

There was a significant decrease in BMI across all adults (p=0.0047) from pre- to post-intervention of 0.2 kg/m^2 (p=0.0047). The effect was much stronger in Men and this is depicted in Figure 2. For children ages 5-12, there was also a significant decrease in BMI Z score from pre- to post- intervention (p=0.04) that attenuated with age and is depicted in Figure 3.

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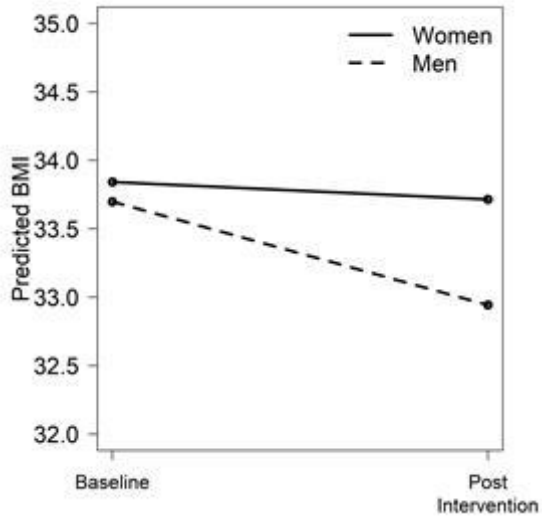

Figure 2. Pre- to Post- intervention decrease in BMI by gender among Hispanic/Latino Parent/Guardians in the Healthy Eating and Lifestyle Program indicating a significantly stronger effect in men as compared to women (p=0.04).

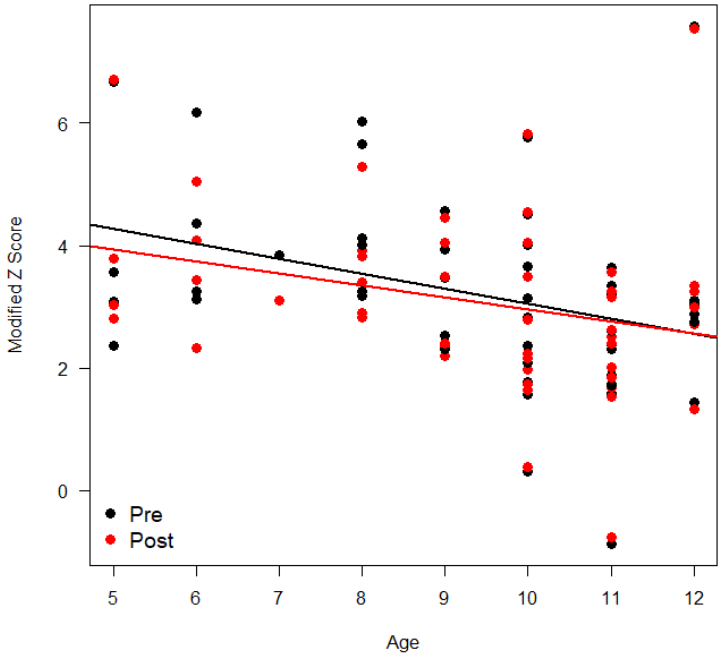

Figure 3. Change in Z-score by Age is given Pre- and Post- HELP intervention for Children ages 5-12 years.

4. Discussion

Our findings from the HELP program, indicate that for pediatric obesity in a Hispanic/Latino children living in a medically underserved region of East Los Angeles, a culture-specific, family-tailored plant-based diet intervention significantly reduced adiposity for the child and the caregiver. Several aspects of HELP program efficacy reported here are noteworthy: 1) The plant-based diet intervention was not binary (i.e. enforcing a strict adherence to vegetarianism) but allowed a tiered approach to following a pattern that emphasized incorporating whole plant foods with minimal processing (battered, deep fried, heavily sauced, fast food processing), 2) The plant-based

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intervention allowed a pesco-vegetarian pattern, 3) The pediatric obesity intervention improved obesity outcomes in both child and parent, 4) The plant-based diet intervention was administered by a multidisciplinary team (health educators, nurses, executive chef, physician-endocrinologist) that worked under a culturally responsive care model that made the intervention diet both culture-specific and family-tailored (i.e. subjects bringing their family's favorite recipes to the educators and being taught to prepare healthier versions of them).

Achieving an increase in Culture-specific Plant-based Diet Choices without using Dietary Pattern Labels ("Vegetarian")

Our findings from the HELP program indicate that increasing plant-based food choices through a four tiered (Figure 2) system of dietary improvement was an effective method for reducing excess adiposity in Hispanic/Latino families. We note that the highest tier of the HELP diet allowed fish as a protein and "success" on the tiered system was on a more continuous spectrum rather than a binary choice of a vegetarian diet versus a non-vegetarian diet. Our findings are broadly consistent with the findings from 3,475 Hispanic/Latino Seventh-day Adventists (Protestant Christian denomination encouraged to followed plant-based diet patterns) indicating that the significant decreases in adiposity for strict vegetarian and vegan patterns could also be achieved by semi-vegetarian and pesco-vegetarian diet patterns[7].

From the standpoint of translation in a high risk disparity population, we note that our findings move beyond promoting plant-based dietary pattern labels (i.e. vegetarian versus non-vegetarian) into the potentially more impactful domain of promoting culture-specific, familiar choices of whole plant foods with minimal processing from the tradition of the pre-Columbian Mesoamerican Diet[25,26]. This was reinforced by our qualitative findings (subtheme 1a) in which providers voiced concerns that a strict vegetarian intervention would be too challenging to cultural norms in Hispanic/Latino families living in medically underserved areas.

Our qualitative work from the HELP staff identified the positive effect of culturally tailoring the choice of plant foods that was implemented through culturally responsive staff and family-tailoring the recipes. This latter is concordant with findings from other interventions for Hispanic/Latinos. For example, Santiago-Torres *et al* developed a "Traditional Mexican Diet Score" (MexD) that quantified a three sisters pattern (i.e. ↑ corn-beans-vegetable, ↓ refined grains/sugars) from dietary survey data from Mexican women and found the MexD score to be inversely related to inflammation (hsCRP) and insulin resistance[26]. In their subsequent crossover trial of healthy Mexican women, a Traditional Mexican Pre-Hispanic diet (↑ corn-beans-cultural vegetable [i.e. nopales (cactus pads) and jicama]) produced significant decreases in insulin, insulin resistance, and IGFB3 as compared to a US diet[25]. In a pilot crossover trial in Baja, Mexico, Jimenez-Cruz *et al* found that a low glycemic index Meso-American diet (↑ pinto beans + whole meal bread, ↓ refined grains/sugars) significantly decreased HbA_{1c} in T2DM patients[27]. Studies from South America report that vegan and semi-vegetarian Peruvian and Brazilian subjects (following traditional cultural choices involving plant foods) do have lower rates of hypertension, dyslipidemia, and obesity as compared to omnivores[28].

Household/Family Tailoring of the Diet to affect the Household Context of the Patient: The "Familismo" Effect[29-31]

The "Familismo" Effect[29] in the Hispanic/Latino cultural context introduces the idea that "family comes first" and has been cited in the design of family-based, culturally tailored interventions. For example, an intervention that utilized a family-based diabetes intervention on behavioral and biological outcomes in Mexican adults indicated significant changes (P=0.043) over time for behaviors such as self-managements in diet, exercise and diabetes care compared to the control group (based on Diabetes Self-Care Activities Questionnaire)[31,32]. This study also found sustained self-management of general health, and a significant decrease in physician, regimen and interpersonal distress (p=0.04)[31,32].

T2DM patients who specified family participation as a motivating factor for making healthier lifestyle choices experienced a 1.4%-1.7% reduction in HbA1c ($p<0.001$) in diabetes self-management studies[29]. Additional studies indicated a 0.41% drop in HbA1c and improvements in blood pressure and diabetes knowledge among study participants of a family-based diabetes intervention conducts

on Hispanic Adults[25]. Data from this study underscored the importance of family involvement with findings that showed that BMI and diabetes knowledge also improved significantly among the non-diabetic family members that were involved in the intervention[25].

Limitations:

We note the major limitation of our pilot study is the quasi-experimental design in a small sample where we do not have an equal attention control arm to isolate the dietary treatment effect. The findings herein need investigation in a randomized controlled trial that has a sample size that allows consideration of individual and family effects. Also, we used self-report measures of diet to measure progress and that is prone to measurement error and social desirability bias.

5. Conclusions

Findings from the HELP program provide preliminary evidence that a culture-specific, family tailored plant-based diet intervention delivered in the context of culturally responsive care by a health care organization can be an effective intervention for pediatric and adult obesity in Hispanic/Latino families in a medically underserved region. The HELP program intervened on multiple domains across the life course of the NIMHD Research Framework: Biological (caregiver-child interaction), Behavioral (Family Functioning, Household Environment, Family Norms), Built Environment (Supermarket Shopping), and Health Care System (Provider-Patient). Further investigation of the efficacy of this plant-based diet intervention in a randomized control trial is the next step in this research.

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