Original Research

Journal of Behavioral Health
www.scopemed.org
DOI: 10.5455/jbh.20140726034114

GESDAV

Nutrition education intervention for low-income human immunodeficiency virus-infected adults

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Received: February 18, 2014
Accepted: July 26, 2014
Published August 24, 2014

ABSTRACT

Nutritional status during human immunodeficiency virus (HIV) infection is related to disease outcome and health status. While HIV disease continues to put infected individuals at nutritional risk, nutritional issues have shifted from undernutrition and weight loss to obesity and metabolic imbalances even though inadequacy in nutrient intake persists. Nutrition education targeted at improving dietary habits through improvements in nutrition knowledge, self-efficacy, and readiness to change are critical to reduce nutritional risks in HIV-infected patients. This pilot study, conducted between January 2012 and September 2012, evaluated the effect of nutrition education on nutrition knowledge and behavior, dietary intake, and nutritional status of HIV-infected adults. Forty-five individuals were randomized into intervention (30 participants) and control (15 participants) groups. They completed pretest, post-test, and 3 months follow-up assessments and surveys administered before and after the intervention program. Although there were no significant differences in some of the outcome measures between the groups, we observed a trend toward improved nutrition knowledge and self-efficacy scores in the intervention group compared to the control group. In addition, fewer individuals in the control group progressed in the stage of change continuum compared to the intervention group for all dietary habits assessed. This study serves as a platform for developing nutrition education tools to address the nutritional and health needs of this population.

KEY WORDS: Nutrition education, nutrition knowledge, nutrition status, self-efficacy, stages-of-change

INTRODUCTION

Nutritional status during human immunodeficiency virus (HIV) infection is related to disease outcome and health status [1]. As such, the maintenance of optimal nutritional status is essential for health and immune system support in persons living with HIV (PLHIV), making nutrition management an integral part of HIV care [2]. Nutrition education and counseling can be effective in improving health outcomes in HIV-infected individuals [3]. Research supporting this evidence comes from studies conducted among HIV-infected individuals experiencing undernutrition and weight loss, and most studies combined oral nutrient supplementation with counseling [3-8]. Some of these nutrition interventions led to increases in weight and lean body mass, greater adherence to treatment medication, and improved dietary patterns even though immunologic parameters did not improve [4-7].

While HIV disease continues to put infected individuals at nutritional risk, nutritional issues have shifted from undernutrition and weight loss to obesity and metabolic imbalances [9,10], even though inadequacy in nutrient intake persists. Before the advent of antiretroviral therapy (ART), overweight and obesity seemed to have been protective of HIV disease progression [11,12]. For patients receiving ART, however, obesity is now a disadvantage as it is associated with increased risk of liver fibrosis and coronary heart disease, the two major causes of non-AIDS-related deaths in this population [13,14]. This is especially true in resource adequate settings where there is widespread use of ART [15]. Regardless of the use of ART, however, the trend toward obesity observed among PLHIV mirrors that observed in the general public, making them also susceptible to comorbidities [9,10,16]. The consequences of obesity include a higher cardiovascular disease risk, dyslipidemia, atherosclerosis, advanced liver fibrosis, and risk for Type 2 diabetes [17]. Among PLHIV, earlier studies showed increased body mass index (BMI) to be associated with slower disease progression [11,12]. Newer studies show obesity to be associated with lower levels of immune cell counts [18,19]. In addition, a recent study reported that the obesity increases the adverse effects of HIV infection on functional impairment, especially as related to balance and gait [20].

Lifestyle modification, including consuming a healthy diet, is the number one approach to the reduction and management

of obesity observed in PLHIV [2,21,22]. Nutrition education, focusing on healthy dietary intake and patterns, while emphasizing nutrition requirement for disease management, is one of the appropriate ways of confronting the current nutritional issues related to HIV infection. Several factors affect dietary intake. Individuals who are economically disadvantaged are likely to have poor diet quality and are less likely to adhere to dietary guidelines [23-25]. An obesity paradox has been documented in many conditions including HIV, where those in poverty and who lack access to healthy and nutritious food (food insecurity) are at higher risk of becoming obese [26]. Such individuals tend to consume caloric laden foods which contribute to increased obesity. In addition, dietary habits are affected by knowledge and beliefs about nutrition and health, and by patient's self-efficacy in implementing dietary changes [24,27]. Taking such variables into consideration, when planning and implementing nutrition education interventions, have been shown to improve behavior outcomes [24]. In light of this, this pilot study was designed with the objective of determining the effect of nutrition education intervention on nutrition knowledge, stage of change, self-efficacy, dietary intake, and nutritional status among low-income HIV-infected adults.

METHODS

Study Design and Setting

This study was approved by Florida International University's Institutional Review Board. Participants included in the study were recruited from the Borinquen Healthcare Center, which provides healthcare services to low-income HIV-infected individuals in Miami-Dade County. Recruitment was done using flyers, referrals from case managers, and by word of mouth. Participants were considered eligible if they were (1) HIV positive, (2) 18 years or older, and (3) low-income (defined as eligibility to participate or participating in the supplemental nutrition assistance program [SNAP]; the largest food assistant program in the US). SNAP eligibility was ascertained using the state of ACCESS Florida's pre-screening eligibility tool [28]. Ninety-three individuals were eligible to participate in this study. After signing informed consent, they completed an initial needs assessment survey that evaluated nutrition education interests and needs. Possible interest and needs, used in the development of this survey were identified from the literature and from one-to-one interviews the researchers conducted with nutrition professionals serving this population. Participants were randomized into intervention and control groups using simple randomization from computer-generated random numbers. Thirty participants were randomly assigned to the intervention group and 15 to the control group. Forty-nine participants were excluded from the study for reasons including not wanting to participate, inability to be contacted, being incarcerated, etc. [Figure 1]. A study visit was then scheduled to complete baseline data collection. Survey and assessment data collected during the baseline visit were repeated immediately following the intervention (post-test) and again at 3 months post-

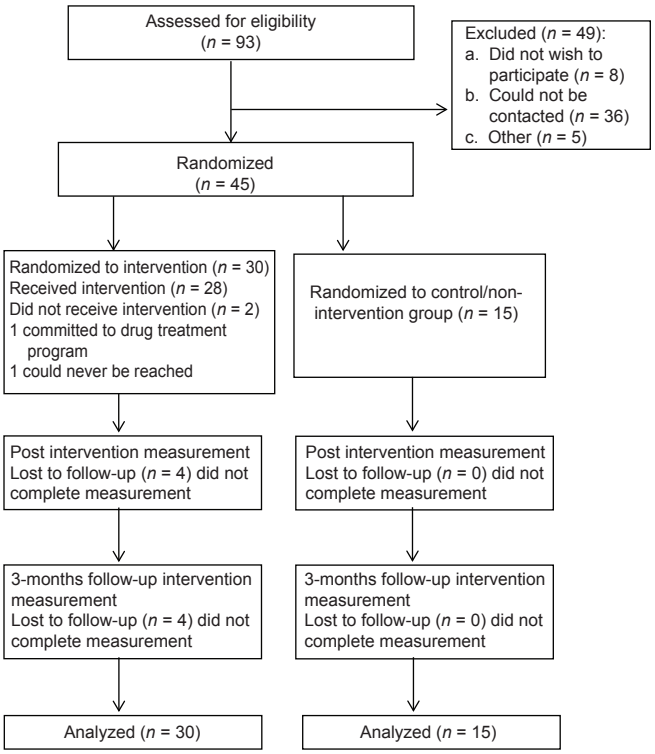

Figure 1: Randomization flowchart

intervention (follow-up). All surveys were self-administered. The entire duration of the study was 9 months, conducted between January 2012 and September 2012. Study visits lasted approximately 45 min. Individuals in the control group did not receive any intervention during the follow-up period. They were, however, provided with intervention education materials after the follow-up visit.

Variables Measured

Demographic characteristics

Structured questions were used to assess participant characteristics. Variables assessed included gender, age, ethnicity, education, employment status, monthly income, marital status, drug use, alcohol use, smoking status, and use of antiretroviral treatment.

Nutrition knowledge

Participant's nutrition knowledge was assessed using a 20-item self-administered instrument, previously used among a low-income adult population [29]. Eleven of the items assessed knowledge on the nutrient content of food, two assessed recommendation for fruit and vegetable intake and seven, the link between diet and chronic disease prevention. All the statements in the nutrition knowledge survey provided multiple choice answers, allowing the participant to choose the correct answer. Items on chronic disease prevention included options for "True," "False," and "I don't know" [29]. A score of one was given for the correct answer and a score of 0, for the wrong or "I don't know" answer. Possible range

for the knowledge score was 0-20 for summed items (or 0-100 for percent of correct answers).

Stages of change

Staging algorithms validated for measuring readiness to make changes in intakes of fruits and vegetables, dietary fiber as well as dietary fat [30] were used to categorize participants into one of the five stages of the transtheoretical framework described by Prochaska and DiClemente [31]. First, the algorithms determined if the recommendation regarding intake for a particular food was being met. Participants who met the recommendations were classified into the action or maintenance stage depending on how long they had been meeting recommendations (i.e., < or ≥6 months). Depending on their intention to change behavior, participants who were not meeting the recommendation were categorized into pre-contemplation (no intention of changing behavior in the next 6 months), contemplation (intend to change behavior in the next 6 months), and preparation (intend to change behavior in the next 30 days). Strong evidence of validity has been reported for all the three-staging measures [30].

Self-efficacy

Participants' ability to confidently make changes in their dietary intake were assessed using a validated survey [30]. The self-efficacy scale for fruit and vegetable intake was made up of six items with a coefficient alpha of 0.83. The dietary fiber and dietary fat intake measures had eight and five items, respectively. They both had a coefficient alpha of 0.89 [30]. The items were measured using a five-point scale with 1 being "not confident at all" and 5 being "extremely confident." The ability to buy healthy food options when grocery shopping was also measured using a validated measure made up of 7 statements. Each statement started with "How confident are you in your ability to?" [29]. The scale used was 1 = not confident at all, 2 = not confident, 3 = somewhat confident, and 4 = very confident. The Cronbach's alpha coefficient for this measure was 0.936.

Dietary intake and nutritional status

Nutrient and caloric intake was measured using a 24 h recall questionnaire. Participants were asked at each study visit about foods consumed in the last 24 h prior to visit. Food models were used during the dietary recall interviews in order to achieve accuracy with estimates of the amount of food consumed. These data were later analyzed using the NutriBase Professional Nutrition Software Version 9 (Cybersoft Inc., Phoenix, AZ, 2011). Participants' hemoglobin, hematocrit, and albumin levels were also evaluated as part of nutritional status. These were obtained from participants' recent (within 3 months of the study visit) medical records from visits with their primary care physician. In addition, each participant's height and weight were measured; height to the nearest 0.5 inch using a stadiometer and weight to the nearest 0.1 lbs using a standard calibrated scale. These were used to determine their BMI, which was calculated as weight in kg divided by height in m^2.

Intervention

The conceptual model used in this intervention was developed based on the stampsmart model by Campbell *et al.* [32] This model is rooted in the social cognitive theory and the transtheoretical model of stages of change. Our model differs from the stampsmart model in that multimedia was not used in delivering the nutrition message. In addition, the educational messages were not individualized, but delivered in group settings, that took place within the healthcare services offered to PLHIV. However, the interviews to assess the nutritional needs of this cohort were conducted individually to identify nutrition education interest and concerns of participants. Major nutritional needs and areas of interest identified were associated with food acquisition, preparation, and food safety. Over 60% of participants were interested in learning how to shop for healthy foods, 54.8% in how to shop on a limited budget, 54.2% in healthy cooking habits, 49.7% in food safety, and 48% in making healthy food choices when eating out.

Other nutrition-related education interest such as dealing with side effects of medication, learning how to read food labels, physical activity, fatigue, and stress management were included. However, very few study participants indicated these as areas of concern. Intervention materials were, therefore, developed to address the major topics of interest, making the education intervention targeted specifically to the interests of this study sample.

The education program consisted of four sessions delivered twice a month over a period of 2 months. Each session was delivered on the same day to two groups, each with approximately 15 participants per group. The sessions were taught from a manual that was developed based on results from the needs assessment and recognized theories of change. Each session was taught by the same nutritionist. Table 1 describes the topics covered in each session. The sessions lasted about 45-60 min; each was comprised of both information delivery and activity sessions. All the sessions ended by providing take-home re-enforcers to participants, reminding them of the concepts discussed in the session. To re-enforce healthy eating habits, participants were provided healthy snacks at each session. In addition, participation in discussions was encouraged by giving the most involved participant a token at the end of each session. This was usually vouchers of $10.00 for use in the neighborhood grocery store.

The program's content and implementation strategies were designed to target the various stages of change for dietary behavior change, focusing on the processes involved in each. Examples of some of these include providing knowledge and information to raise consciousness about behavior, using discussions with peer role models to promote self-evaluation, [33] and reinforcement management (giving praise and recognition) to promote self-efficacy [34].

Statistical Analysis

All randomized participants were included in the analyses and had at least one study and/or intervention visit. To minimize

Table 1: Topics discussed during education sessions

Session 1: What happens between HIV and nutrition
Information about HIV effect on the body
Discussion about the importance of nutrition during HIV infection
Discussion on how to obtain and maintain adequate nutrition
Session 2: The green effect: Eating on a shoestring budget
Discussion on how to navigate the grocery store (product placement relative to the food item being healthy or not
Tips for saving money and price conscious grocery shopping
Discussion and practice on how to read food labels
Discussion of participants current shopping practices (acknowledgement of good practices and suggestions on what could be done differently during the next shopping trip for the "not so good practices")
Session 3: Take charge of your diet
Practice knowledge on which food belongs with which food group
Information on recommended servings from each food group and illustrations of adequate portion sizes
Discussion and tips on healthy cooking methods
Re-enforcement activity on making healthy changes to
Session 4: Keep the bugs out
Discussion and activity on how to practice food safety when grocery shopping
Discussion and activity on how to store food safely (Temperature and environment)
Discussion and activity on food safety during meal preparation

HIV: Human immunodeficiency virus

the effects of loss of subjects to follow-up, the Last outcome measure carried forward technique was used in the analyses. Data from baseline were imputed for missed follow-up visits for 4 participants in the intervention group. Analysis to determine differences between groups from the baseline demographic data was carried out using student's *t*-test for continuous variables and Chi-square test for categorical variables. For non-normally distributed variables, the Mann–Whitney U test was used. The results were reported as mean ± standard deviation or as percentages. The Mann–Whitney U test was also used to test the difference in changes along the stages of change continuum between the two groups. The programs' impact on outcome variables (knowledge, self-efficacy, dietary intake, and nutritional status) over time was analyzed using repeated measures analysis of variance, with group (intervention and control), and time (baseline, post-test, and follow-up) as independent variables. *P* value of <0.05 was termed as statistically significant for all analyses. SPSS version 21 software (SPSS, Inc., Chicago, IL, 2011) was used in analyzing group comparisons at various stages of the study.

RESULTS

Participant Characteristics

This pilot study had a sample of 45 participants with an average age of 47.4 years. The majority of the individuals were male (60%), African-American (77.8%), and single (73.3%). Two-thirds (67%) of the participants had at least a high school education. Only 8.9% were employed; most were either on disability (46.7 %) or unemployed (44.4%). The two groups were comparable in baseline characteristics as shown in Table 2. About 18% of the population used illicit drugs, while 44% drank alcohol, and 64% smoked cigarettes [Table 3].

Table 2: Baseline sociodemographic characteristics by group

Variables	Intervention (*n*=30)	Control (*n*=15)	*P* value*
Mean age (SD)	48.33 (7.06)	46.40 (9.13)	0.44
	n (%)	*n* (%)	
Gender			0.52
Male	19 (63.3)	8 (53.3)	
Female	11 (36.7)	7 (46.7)	
Ethnicity			0.53
African American	22 (73.3)	13 (68.8)	
Other[a]	8 (26.7)	2 (16.7)	
Marital status			0.27
Married	8 (26.7)	1 (6.7)	
Single	22 (73.3)	14 (93.3)	
Education			0.78
<High school	10 (33.3)	5 (33.3)	
≥High school	20 (66.6)	10 (66.7)	
Employment status			0.69
Unemployed	12 (40.0)	8 (53.3)	
Employed	3 (10.0)	1 (6.7)	
On disability	15 (50.0)	6 (40.0)	
Monthly income			0.36
<$1000	26 (86.7)	12 (80.0)	
≥$1000	4 (13.3)	3 (20.0)	

*Continuous variables analyzed using student t-test and categorical variables using the Chi-square test, [a]Other includes White, Hispanics and other ethnicities, SD: Standard deviation

Table 3: Health-related characteristics by group

Variables	Intervention (*n*=30)	Control (*n*=15)	*P* value*
Smokes cigarettes	19 (63.3)	10 (66.7)	0.83
Uses drugs	4 (13.3)	4 (26.7)	0.27
Drink alcohol	12 (40.0)	8 (53.3)	0.40
On ART[a]	28 (93.3)	15 (100.0)	0.31
Takes vitamins	15 (50.0)	9 (60.0)	0.53

*Results obtained using student *t*-test analysis, [a]ART: Antiretroviral therapy

Nutrition Knowledge

There was no difference in nutrition knowledge scores between the intervention and control groups at baseline [Table 4]. The intervention group, however, showed a consistent increase in their mean knowledge score at post-test and follow-up visits compared to the control group. There was no significant interaction by groups and time on the nutrition knowledge score, $F(2, 86) = 0.68$; $P = 0.49$.

Self-efficacy

Self-efficacy scores, as related to healthy eating and shopping were similar between the groups at baseline, with both groups reporting moderate scores for all four self-efficacy items. There was an immediate (post-test) increase in self-efficacy scores among participants in both groups for all categories except dietary fat intake. The intervention groups' confidence in the ability to increase fruit and vegetable intake continued to increase, even at the 3-month follow-up visit [Table 5]. However, no significant interaction of groups by time was found on any of the self-efficacy scores Fruit and vegetable intake $F(2, 86) = 1.167$; $P = 0.31$, dietary fiber intake $F(2, 86) = 0.47$;

Table 4: Nutrition knowledge scores across the three assessment periods by group

Study period	Nutrition knowledge score[a]			
	Mean±SD		*F**	*P* value*
	Intervention	Control		
Baseline	67.33±13.69	63.67±18.75	0.68	0.49
Post-test	68.83±15.57	70.00±17.74		
Follow-up	68.50±14.21	67.67±20.67		

*Repeated measures ANOVA group by time interaction, [a]Scores are based on the percentage of correct answers, SD: Standard deviation

Table 5: Diet and shopping self-efficacy scores across the three assessment periods by group

Study period	Self-efficacy score[a]			
	Mean±SD		*F**	*P* value*
	Intervention	Control		
Fruit and vegetable Intake			1.17	0.31
Baseline	2.81±1.22	2.65±0.77		
Post-test	2.90±0.88	3.23±0.92		
Follow-up	3.09±0.93	2.91±0.88		
Dietary fiber intake			0.47	0.60
Baseline	2.71±1.12	2.53±1.01		
Post-test	2.94±1.00	2.95±1.15		
Follow-up	2.79±0.83	2.46±1.07		
Dietary fat intake			1.13	0.32
Baseline	2.62±1.28	2.44±0.80		
Post-test	2.49±0.90	2.84±1.08		
Follow-up	2.60±1.10	2.43±0.80		
Shopping			0.20	0.82
Baseline	3.05±0.91	2.91±0.96		
Post-test	3.10±0.81	3.06±0.90		
Follow-up	2.97±0.78	2.78±0.99		

*Repeated measures ANOVA group by time interaction, [a]Scores ranged from a scale of 1-5 for dietary self-efficacy and 1-4 for shopping self-efficacy. Scores of 4 or 5=very/extremely confident, SD: Standard deviation

$P = 0.60$, dietary fat intake $F\ (2, 86) = 1.13$; $P = 0.32$, or healthy shopping $F\ (2, 86) = 0.20$, $P = 0.82$.

Stages of Change

Consuming fruits and vegetables at the recommended amounts was the most difficult dietary behavior to achieve and maintain in this population. As shown in Table 6, at baseline and during the follow-up periods, none of the participants reported being at action or maintenance phase with regards to fruits and vegetables consumption. There were similar percentages of individuals at the pre-contemplation stage in the two groups at baseline for fruit and vegetable intake, but at the 3-month follow-up visit, this percentage decreased to 30% in the intervention group because they moved into the contemplation stage while in the control group the proportion of individuals considering the possibility to have more fruits and vegetables increased to 53.3%. Similarly, 10% of the intervention group and 13% of the control group reported being at the contemplation stage at baseline with fruit and vegetable intake, but at the follow-up visit, this percentage increased to 20% as they moved from pre-contemplation closer to taking action in the intervention group, while that for the control group decreased to 0%.

With regards to dietary fiber stage, more than half (53%) of the control group did not progress in their readiness to increase their fiber intake, compared to only 27% in the intervention group. Similarly, only 23% of the intervention group did not improve in their readiness to lowering dietary fat intake compared to 47% in the control group.

Dietary Intake and Nutritional Status

There were no significant differences in dietary intake [Table 7] and nutritional status [Table 8] between the groups at baseline. Further analysis shows that the intervention did not significantly impact dietary intake, although the intervention group increased their calorie and fat intakes compared to the control group at follow-up visits. Overall, there were no significant interactions on mean scores by group by time for BMI:$F\ (2, 86) = 1.22$, $P = 0.28$; hemoglobin:$F\ (2, 86) = 1.10$, $P = 0.90$; hematocrit:$F\ (2, 86) = 0.13$, $P = 0.88$ and albumin $F\ (2, 86) = 0.39$, $P = 0.63$.

DISCUSSION

The prevalence of obesity among PLHIV is increasing, mirroring the trend observed in the general public [9,10]. Among the general population, promotion of lifestyle modification which includes healthy eating habits has been significant in managing obesity [35,36]. The goal of this pilot study was to determine the effectiveness of nutrition education in improving nutrition knowledge and behavior, dietary intake, and nutritional status, including weight change in a cohort of HIV-infected adults. Study results indicate the intervention did not have a significant impact on nutrition knowledge and behavior, dietary intake, and nutrition status indicators. According to studies conducted in the 1990's, individuals diagnosed with HIV infection reported interest in nutrition, and eagerly made dietary changes [37]. This is because they believed nutrition played a significant role in disease management and their chances of survival. A study by Wright [38], that investigated the impact of nutrition education on nutrition knowledge found significant improvement in nutrition knowledge in the intervention group compared to the control group. Due to the advances with HIV treatment, HIV is now a chronic disease with a decrease in disease associated morbidity and mortality. As such, interest in nutrition as an important part of treatment may have waned among PLHIV, explaining the lack of significant increase in nutrition knowledge and self-efficacy among study participants. Health challenges related to nutrition continues to be prevalent among PLHIV, as such education to increase nutrition awareness needs to be continued with this population. Previous studies that have used nutrition education or counseling to improve dietary intake and nutrition status among HIV-infected populations have focused on weight gain as the nutritional status outcome [3]. To the best of our knowledge, there is no known prior study that has used nutrition education to improve dietary intake and achieve weight loss among HIV-infected individuals. There are, however, a few studies that have investigated the effect of nutrition education intervention in improving diet related morphologic changes among PLHIV. A study by Almeida *et al.* [39], provided a 12-month nutrition counseling intervention to improve diet

Table 6: Dietary stages of change across the three assessment periods by group

	Stages of change (*n* (%))				
	Pre-contemplation	Contemplation	Preparation	Action	Maintenance
Fruit and vegetable					
Intervention (*n*=30)					
Baseline	13 (43.3)	14 (46.7)	3 (10.0)	-	-
Post-test	10 (33.3)	16 (53.3)	4 (13.3)	-	-
Follow-up	9 (30.0)	15 (50.0)	6 (20.0)	-	-
Control (*n*=15)					
Baseline	6 (40.0)	7 (46.7)	2 (13.3)	-	-
Post-test	5 (33.3)	6 (40.0)	4 (26.7)	-	-
Follow-up	8 (53.3)	7 (46.7)	0 (0.00)	-	-
Dietary fiber					
Intervention (*n*=30)					
Baseline	7 (23.3)	8 (26.7)	0 (0.00)	5 (16.7)	10 (33.3)
Post-test	3 (10.0)	3 (10.0)	4 (13.3)	6 (20.0)	14 (46.7)
Follow-up	5 (16.7)	3 (10.0)	3 (10.0)	9 (30.0)	10 (33.3)
Control (*n*=15)					
Baseline	2 (13.3)	4 (26.7)	1 (6.7)	4 (26.7)	4 (26.7)
Post-test	5 (33.3)	2 (13.3)	1 (6.7)	2 (13.3)	5 (33.3)
Follow-up	5 (33.3)	4 (26.7)	0 (0.0)	5 (33.3)	1 (6.7)
Dietary fat					
Intervention (*n*=30)					
Baseline	4 (13.3)	7 (23.3)	0 (0.00)	10 (33.3)	9 (30.0)
Post-test	3 (10.0)	4 (13.3)	5 (16.7)	12 (40.0)	6 (20.0)
Follow-up	4 (13.3)	2 (6.7)	0 (0.00)	16 (53.3)	8 (26.7)
Control (*n*=15)					
Baseline	2 (13.3)	0 (0.00)	2 (13.3)	6 (40.0)	5 (33.3)
Post-test	3 (20.0)	1 (6.7)	1 (6.7)	5 (33.3)	5 (33.3)
Follow-up	4 (26.7)	5 (33.3)	3 (0.0)	3 (20.0)	3 (20.0)

Table 7: Dietary intake across the three assessment periods by group

Study period	Mean±SD		*F**	*P* value*
	Intervention	Control		
Total calories (kcal)			0.32	0.71
Baseline	1855.93±981.26	1953.76±748.02		
Post-test	2035.88±979.65	1942.38±1004.62		
Follow-up	2048.80±926.40	1886.77±633.80		
Carbohydrates intake (g)			0.31	0.74
Baseline	228.64±123.65	257.13±105.54		
Post-test	255.52±121.58	269.07±166.10		
Follow-up	254.54±120.35	245.44±111.41		
Protein intake (g)			0.45	0.62
Baseline	80.99±48.65	89.14±47.80		
Post-test	82.14±41.34	75.40±40.14		
Follow-up	83.25±45.01	86.66±28.75		
Fat intake (g)			0.29	0.63
Baseline	62.98±43.29	61.71±32.37		
Post-test	73.50±43.83	62.39±31.28		
Follow-up	74.37±39.73	63.13±30.45		

*Repeated measures ANOVA group by time interaction, SD: Standard deviation

Table 8: Nutritional status indicators across the three assessment periods by group

Study period	Mean±SD		*F**	*P* value*
	Intervention	Control		
BMI (kg/m^2)			1.22	0.28
Baseline	28.84±6.61	27.91±4.88		
Post-test	29.05±6.6	28.32±4.68		
Follow-up	28.26±4.94	28.60±4.61		
Hemoglobin (g/dl)			1.10	0.90
Baseline	13.76±1.39	13.47±1.49		
Post-test	13.63±1.61	13.45±1.17		
Follow-up	13.76±1.51	13.53±1.21		
Hematocrit (%)			0.13	0.88
Baseline	41.13±4.03	40.76±4.67		
Post-test	40.93±4.84	40.58±3.80		
Follow-up	41.23±4.06	40.53±3.79		
Albumin (g/dl)			0.39	0.63
Baseline	4.24±0.32	4.20±0.54		
Post-test	4.28±0.26	4.16±0.45		
Follow-up	4.27±0.27	4.14±0.32		

*Repeated measures ANOVA group by time interaction, BMI: Body mass index, SD: Standard deviation

and prevent morphological and metabolic changes related to HIV treatment. The 1 year intervention produced slight dietary and morphological changes in the intervention group, although the differences were not statistically significant. Contrary to this present study, Almeida *et al.* [39] provided individualized counseling as opposed to the group education used in this study.

The lack of changes observed in dietary behavior and intake as well as nutrition status among this population of HIV-infected individuals may be due to the high prevalence of food insecurity occurring in the population. The current food insecurity rate in this cohort of HIV-infected individuals is 56% (unpublished). This report is consistent with those from other cohorts of PLHIV [40,41]. Food insecurity is associated with poor diet quality and dietary intake [42,43]. In addition, food insecure HIV-infected individuals are less likely to seek and adhere to treatment therapies [44]. They may, therefore, be less likely to adhere to nutrition education recommendations especially when lacking economic access to healthy food. Participants in

the intervention group consistently increased their caloric and fat intakes over the study period. While this could be explained by possible overeating under the guise of eating "healthy," it could also be attributed to food insecurity and non-adherence to education recommendations. Future interventions to improve diet and health among PLHIV should consider food security status of the target group and include strategies to improve food security and the perception of food insecurity among the participants in program design and implementation. In addition, participants in the control group reported positive gains in many of the targeted behavior areas, similar to that of the intervention group at the post-test and follow-up visits, although they were not exposed to the group intervention. These increases may be due to Hawthorne's effect [45], where multiple exposures to survey materials and assessments led to the recognition of research outcomes and, in an attempt to impress researchers, control group participants reported favorable information.

Limitations of this study are the small sample size, a relatively short study duration and low participation rate. Only 56.7% of the intervention group attended more than two sessions, even though the topics were chosen and tailored based on participants interests. Several outcomes from the pilot study were, however, encouraging; participants showed a trend toward improved nutrition knowledge, self-efficacy with fruits and vegetable intake, and readiness for behavior change. Increasing access to healthy foods will help foster lasting changes with dietary intake. Further studies are needed to ascertain the use of nutrition education intervention to effect changes in the dietary habits and nutritional status, which could improve disease state and quality of life of HIV-infected individuals.

ACKNOWLEDGEMENTS

We are grateful to our study participants, the FIU research clinic funded by NIDA and NIAAA and the Borinquen Health Center in Miami, FL for providing space for program implementation. We also acknowledge the University Graduate School at FIUl, for the data and evidence acquisition fellowship support during data collection for this study.

REFERENCES

1. Fields-Gardner C, Fergusson P, American Dietetic Association, Dietitians of Canada. Position of the American Dietetic Association and Dietitians of Canada: Nutrition intervention in the care of persons with human immunodeficiency virus infection. J Am Diet Assoc 2004;104:1425-41.
2. Nerad J, Romeyn M, Silverman E, Allen-Reid J, Dieterich D, Merchant J, *et al*. General nutrition management in patients infected with human immunodeficiency virus. Clin Infect Dis 2003;36:S52-62.
3. Kaye HL, Moreno-Leguizamon CJ. Nutrition education and counselling as strategic interventions to improvehealth outcomes in adult outpatients with HIV: A literature review. Afr J AIDS Res 2010;9:271-83.
4. McDermott AY, Shevitz A, Must A, Harris S, Roubenoff R, Gorbach S. Nutrition treatment for HIV wasting: A prescription for food as Medicine. Nutr Clin Pract 2003;18:86-94.
5. Van Niekerk C, Smego RA, Sanne I. Effect of nutritional education and dietary counselling on body weight in HIV-seropositive South Africans not receiving antiretroviral therapy. J Hum Nutr Diet 2000;13:407-12.
6. Berneis K, Battegay M, Bassetti S, Nuesch R, Leisibach A, Bilz S, et al. Nutritional supplements combined with dietary counselling diminish whole body protein catabolism in HIV-infected patients. Eur J Clin Invest 2000;30:87-94.
7. Schwenk A, Steuck H, Kremer G. Oral supplements as adjunctive treatment to nutritional counseling in malnourished HIV-infected patients: Randomized controlled trial. Clin Nutr 1999;18:371-4.
8. Segal-Isaacson CJ, Tobin JN, Weiss SM, Brondolo E, Vaughn A, Wang C, *et al*. Improving dietary habits in disadvantaged women with HIV/AIDS: The SMART/EST women's project. AIDS Behav 2006;10:659-70.
9. Crum-Cianflone N, Tejidor R, Medina S, Barahona I, Ganesan A. Obesity among patients with HIV: The latest epidemic. AIDS Patient Care STDS 2008;22:925-30.
10. Crum-Cianflone N, Roediger MP, Eberly L, Headd M, Marconi V, Ganesan A, *et al*. Increasing rates of obesity among HIV-infected persons during the HIV epidemic. PLoS One 2010;5:e10106.
11. Jones CY, Hogan JW, Snyder B, Klein RS, Rompalo A, Schuman P, et al. Overweight and human immunodeficiency virus (HIV) progression in women: Associations HIV disease progression and changes in body mass index in women in the HIV epidemiology research study cohort. Clin Infect Dis 2003;37 Suppl 2:S69-80.
12. Shor-Posner G, Campa A, Zhang G, Persaud N, Miguez-Burbano MJ, Quesada J, *et al*. When obesity is desirable: A longitudinal study of the Miami HIV-1-infected drug abusers (MIDAS) cohort. J Acquir Immune Defic Syndr 2000;23:81-8.
13. Data Collection on Adverse Events of Anti-HIV drugs (D:A:D) Study Group, Smith C, Sabin CA, Lundgren JD, Thiebaut R, Weber R, *et al*. Factors associated with specific causes of death amongst HIV-positive individuals in the D:A:D Study. AIDS 2010;24:1537-48.
14. Adih WK, Selik RM, Hu X. Trends in diseases reported on US death certificates that mentioned HIV infection, 1996-2006. J Int Assoc Physicians AIDS Care (Chic) 2011;10:5-11.
15. Dorey-Stein Z, Amorosa VK, Kostman JR, Lo Re V 3rd, Shannon RP. Severe weight gain, lipodystrophy, dyslipidemia, and obstructive sleep apnea in a human immunodeficiency virus-infected patient following highly active antiretroviral therapy. J Cardiometab Syndr 2008;3:111-4.
16. Shah K, Alio AP, Hall WJ, Luque AE. The physiological effects of obesity in HIV-infected patient. J AIDS Clin Res 2012;3:151.
17. Klein S, Allison DB, Heymsfield SB, Kelley DE, Leibel RL, Nonas C, *et al*. Waist circumference and cardiometabolic risk: A consensus statement from Shaping America's Health: Association for Weight Management and Obesity Prevention; NAASO, The Obesity Society; the American Society for Nutrition; and the American Diabetes Association. Am J Clin Nutr 2007;85:1197-202.
18. Crum-Cianflone NF, Roediger M, Eberly LE, Vyas K, Landrum ML, Ganesan A, *et al*. Obesity among HIV-infected persons: Impact of weight on CD4 cell count. AIDS 2010;24:1069-72.
19. Crum-Cianflone NF, Roediger M, Eberly LE, Ganesan A, Weintrob A, Johnson E, *et al*. Impact of weight on immune cell counts among HIV-infected persons. Clin Vaccine Immunol 2011;18:940-6.
20. Bauer LO, Wu Z, Wolfson LI. An obese body mass increases the adverse effects of HIV/AIDS on balance and gait. Phys Ther 2011;91:1063-71.
21. Hadigan C. Dietary habits and their association with metabolic abnormalities in human immunodeficiency virus-related lipodystrophy. Clin Infect Dis 2003;37 Suppl 2:S101-4.
22. Keithley JK, Fields-Gardner C. Antiretroviral-related nutritional problems: Closing the science and practice gap. J Assoc Nurses AIDS Care 2001;12 Suppl:85-7.
23. Ball K, Crawford D, Mishra G. Socio-economic inequalities in women's fruit and vegetable intakes: A multilevel study of individual, social and environmental mediators. Public Health Nutr 2006;9:623-30.
24. Beydoun MA, Wang Y. Do nutrition knowledge and beliefs modify the association of socio-economic factors and diet quality among US adults? Prev Med 2008;46:145-53.
25. Forshee RA, Storey ML. Demographics, not beverage consumption, is associated with diet quality. Int J Food Sci Nutr 2006;57:494-511.
26. McAuley PA, Blair SN. Obesity paradoxes. J Sports Sci 2011;29:773-82.
27. Gittelsohn J, Anliker JA, Sharma S, Vastine AE, Caballero B, Ethelbah B. Psychosocial determinants of food purchasing and preparation in American Indian households. J Nutr Educ Behav 2006;38:163-8.
28. Department of Children and Families (DCF). ACCESS, Florida, 2012.

Available from: https://www.dcfaccess.dcf.state.fl.us/access2florida/prescreening/welcome.do?performAction=init&mode=Inter. [Last accessed on 2012 Dec 10].
29. Pawlak R, Colby S. Benefits, barriers, self-efficacy and knowledge regarding healthy foods; perception of African Americans living in eastern North Carolina. Nutr Res Pract 2009;3:56-63.
30. Robinson AH, Norman GJ, Sallis JF, Calfas KJ, Rock CL, Patrick K. Validating stage of change measures for physical activity and dietary behaviors for overweight women. Int J Obes (Lond) 2008;32:1137-44.
31. Prochaska JO, DiClemente CC. Stages and processes of self-change of smoking: Toward an integrative model of change. J Consult Clin Psychol 1983;51:390-5.
32. Campbell MK, Honess-Morreale L, Farrell D, Carbone E, Brasure M. A tailored multimedia nutrition education pilot program for low-income women receiving food assistance. Health Educ Res 1999;14:257-67.
33. Norcross JC, Krebs PM, Prochaska JO. Stages of change. J Clin Psychol 2011;67:143-54.
34. Bandura A. Social Foundations of Thought and Action: A Social Cognitive Theory. Englewood Cliffs, NJ: Prentice Hall; 1986.
35. Elizondo-Montemayor L, Gutierrez NG, Moreno DM, Martínez U, Tamargo D, Treviño M. School-based individualised lifestyle intervention decreases obesity and the metabolic syndrome in Mexican children. J Hum Nutr Diet 2013;26 Suppl 1:82-9.
36. Siwik V, Kutob R, Ritenbaugh C, Cruz L, Senf J, Aickin M, *et al*. Intervention in overweight children improves body mass index (BMI) and physical activity. J Am Board Fam Med 2013;26:126-37.
37. Mantero-Atienza E, Baum MK, Javier JJ, Shor-Posner G, Millon CM, Szapocznik J, *et al*. Nutritional knowledge, beliefs and practices in the HIV-infected patient. Nutr Res 1991;11:33-40.
38. Wright LY. The impact of nutrition education on nutrition knowledge, attitude and behavior of persons with HIV/infection. AIDS Patient Care 1995;9:249-51.
39. Almeida LB, Segurado AC, Duran AC, Jaime PC. Impact of a nutritional counseling program on prevention of HAART-related metabolic and morphologic abnormalities. AIDS Care 2011;23:755-63.
40. Vogenthaler NS, Hadley C, Lewis SJ, Rodriguez AE, Metsch LR, del Rio C. Food insufficiency among HIV-infected crack-cocaine users in Atlanta and Miami. Public Health Nutr 2010;13:1478-84.
41. Wang EA, McGinnis KA, Fiellin DA, Goulet JL, Bryant K, Gibert CL, *et al*. Food insecurity is associated with poor virologic response among HIV-infected patients receiving antiretroviral medications. J Gen Intern Med 2011;26:1012-8.
42. Tarasuk VS. Household food insecurity with hunger is associated with women's food intakes, health and household circumstances. J Nutr 2001;131:2670-6.
43. Kendall A, Olson CM, Frongillo EA Jr. Relationship of hunger and food insecurity to food availability and consumption. J Am Diet Assoc 1996;96:1019-24.
44. Weiser SD, Tsai AC, Gupta R, Frongillo EA, Kawuma A, Senkungu J, *et al*. Food insecurity is associated with morbidity and patterns of healthcare utilization among HIV-infected individuals in a resource-poor setting. AIDS 2012;26:67-75.
45. Parsons HM. What happened at Hawthorne? New evidence suggests the Hawthorne effect resulted from operant reinforcement contingencies. Science 1974;183:922-32.

Source of Support: Nil, Conflict of Interest: None declared.