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Fruit and Vegetable Intake Among Older African American and Hispanic Adults With Cardiovascular Risk Factors

Lucy W. Kibe, DrPH, MS, MHS, PA-C[1] **and Mohsen Bazargan, PhD**[1]

Abstract

African Americans and Hispanics are disproportionately burdened by cardiovascular risk factors including hypertension, diabetes mellitus, and obesity. There is evidence that fruits and vegetables have protective benefits for cardiovascular health. Factors associated with fruit and vegetable intake among older minority adults are not well established. A cross-sectional analysis of African American and Hispanic adults >55 years with diagnosis of hypertension and/or diabetes was conducted. Daily intake of fruits and vegetables was analyzed by socio-demographic, health status, health behaviors, and access to fruits and vegetables. 77% of participants did not meet the United States Department of Agriculture ≥5 a day serving guidelines. Fruit and vegetable consumption was not associated with having hypertension or diabetes. Body mass index >25 and regular exercise were significantly associated with more vegetable intake, but not fruit. African Americans consumed significantly less fruits and vegetables than Hispanics. Among those with access to fruits and vegetables, 78% did not meet the guidelines. Many older African American and Hispanic adults with cardiovascular disease risk factors do not meet the fruit and vegetable intake guidelines. Inadequate intake is worse among African Americans, sedentary, and non-overweight/obese adults. Studies are needed to understand the barriers associated with fruit and vegetable intake in this population.

Keywords

fruits and vegetables, older minorities, health disparities, food access, cardiovascular disease

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Introduction

Despite innovative medical advances in prevention and treatment, cardiovascular diseases (CVDs) remain the leading cause of morbidity and mortality in the United States (US) (CDC, 2021). Older adults, the fastest growing segment of the US population, have the highest risk for CVD mortality (CDC). In addition to age, hypertension, diabetes and obesity are well known risk factors for CVD.

In the United States, health disparities in CVD risk factors abound. Hypertension prevalence is higher among non-Hispanic African Americans (AAs) (40.3%) than Hispanics and non-Hispanic white (each 27.8%) (Fryar et al., 2015). Hispanics have the highest prevalence rate of diabetes (12.5%), followed by non-Hispanic AA (11.7%), and last, non-Hispanic whites (7.5%) (CDC, 2020). Non-Hispanic AAs (49.6%) have the highest prevalence of obesity, followed by Hispanics (44.8%), non-Hispanic whites (42.2%), and non-Hispanic Asians (17.4%) (Hales et al., 2017).

Adoption and maintenance of recommended health behaviors, including consuming a diet rich in fruits and vegetables, plays an important role in the prevention of CVD risk among persons living with hypertension and/or diabetes (Virani et al., 2020). Higher fruit and vegetable intake lowers coronary heart disease risk (He et al., 2007) while inadequate

[1]Charles R. Drew University of Medicine and Science, Los Angeles, CA, USA

Corresponding Author:
Lucy W Kibe, Director of Physician Assistant Program, Charles R. Drew University of Medicine and Science, 1731 East 120th Street, Los Angeles, CA 90059, USA.
Email: lucykibe@cdrewu.edu

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intake contributes to coronary heart disease (Dauchet et al., 2006; Dauchet et al., 2004; He et al., 2007; Micha et al., 2017; Miller et al., 2017) and stroke (Dauchet et al., 2005; He et al., 2006; Micha et al., 2017). Additionally, diets rich in fruits and vegetables are associated with lower CVD mediating factors including blood pressure (Appel et al., 1997; Steffen et al., 2005), diabetes incidence (Ford & Mokdad, 2001) and markers (HgbA1c) (Sargeant et al., 2001), and body mass index (BMI) (He et al., 2004; Kahn et al., 1997). However, older adults do not consume adequate fruits and vegetables due to age-related barriers such as functional limitations, physiological compromise (e.g., digestive and oral problems), cognitive decline, social isolation, and economic constraints (Nicklett & Kadell, 2013).

Although the biological mechanisms are not fully understood, fruits and vegetables contain vitamins, minerals, and phytochemicals which can exert cardiovascular protective effects (Bazzano et al., 2003; Boeing et al., 2012). Fruits and vegetables contain vitamin C, vitamin E, magnesium, folate, potassium, and other elements with antioxidant properties. Independently or jointly, these compounds have been reported to increase insulin sensitivity, increase glucose tolerance, and lower blood pressure (Ekmekcioglu et al., 2016; Grillo et al., 2019). The low dietary glycemic index, low energy density, and high fiber properties of fruits and vegetables also contribute to lowering overall CVD risk.

In recognition of the benefits of fruits and vegetable intake to prevent CVD, the United States Department of Agriculture guidelines for Americans recommends a diet with two servings of fruits and three servings of vegetables a day (CDC, 2011). However, only 10.2% and 9.3% of all Americans meet the recommendation for fruit and vegetable intake, respectively (Lee-Kwan et al., 2017). Few studies have investigated the status and correlates of fruit and vegetable intake among older AA and Hispanic adults in under-resourced communities (Nicklett & Kadell, 2013).

The objective of this study was to characterize factors associated with fruit and vegetable intake among older AA and Hispanic adults with CVD risk factors (hypertension, diabetes, and/or obesity). Additionally, we examined whether access to fruits and vegetables was associated with intake.

Methodology

Study Sample: Participants (n = 505) were recruited from senior centers, senior housing centers, faith-based organizations, and apartment complexes in the South Los Angeles County (SoLA) using convenience and snowball sampling between 2016 and 2020.

Home to over one million residents, SoLA has the highest population of Hispanics (68%) and AA (27%) in California and considerably higher than the United States (approximately 18% and 13%, respectively). Residents of SoLA are disproportionately harmed by health disparities compared to the rest of Los Angeles County (*Los Angeles County Department of Public Health, Office of Health Assessment and Epidemiology. Key Indicators of Health by Service Planning Area; January* 2017).

Inclusion and Exclusion Criteria: The study included participants who self-identified as non-Hispanic AA or Hispanic (any race), age >55 years and self-reported a diagnosis of diabetes and/or hypertension. Institutionalized or cognitively impaired participants were excluded.

Measurements

Socio-demographic variables. Participant self-reported their age, gender, race, ethnicity, education attainment, household income, and living arrangements.

Health status. Self-rated health and diagnosis of diabetes and hypertension were self-reported. Body mass index was calculated from self-reported weight and height.

Health behaviors. Past or current cigarette smokers were coded as smokers. Alcohol was assessed by the number of drinks per day, week, month, or year. Exercise was assessed by how often participants walked non-stop at least one mile per day, week, month, year and categorized to "Rarely (0–1 time a week); two to four times a week (occasionally); and every day (regularly)."

Fruit and vegetable consumption and access. Participants reported the number of servings of fruits and the number of vegetables they ate every day.

We measured access to fruits and vegetables with the question "Are there any grocery stores within walking distance or an easy bus ride?" Those who answered "yes" were asked "Does your grocery store carry a lot of vegetables and fruits?"

Data Analysis

We used SPSS 24.0 (IBM Inc, NY, US) to perform our analysis which had three parts. The first section was a descriptive analysis of all participants. This descriptive work reported means and *SD* for continuous measures and frequency and percentages for the categorical variables. Next, we conducted Pearson correlation coefficients, independent t-test, and ANOVA to examine the bivariate association between fruit and vegetable intake and all other independent variables. Finally, multivariate linear analyses were performed to determine association between the consumption of fruits, vegetables and both fruits and vegetables (fruit + vegetable) and all covariates. A p-value of less than 0.05 was considered significant.

Results

Participant Characteristics

Of the 505 participants (Table 1), about one-third were male, and about one-third identified as Hispanic. Mean age was

69.9 years (range 55–96). More than 40% did not have a high school diploma. The majority of our participants (80%) reported a monthly income of less than US$1500. About 60% lived alone.

Poor health behavior was observed, with more than 60% having sedentary behavior and 60% reporting current or past use of cigarettes. However, more than 90% did not drink alcohol or were light drinkers (<1 drink a month).

In this cohort of community-living minority older adults, 80% had a BMI ≥ =25. Additionally, 49% and 32% had two or three CVD risk factors (hypertension, DM and ≥25), respectively. About 45% rated their health as fair or poor.

Fruit and Vegetable Consumption

In unadjusted models only 63% of Hispanic and 28% of African Americans met the recommended guidelines for daily intake for fruit and for vegetables. When we combined the recommended guidelines of >/=2 fruit and >/=3 vegetable servings daily, only 23% of all participants met the guidelines. This is despite 84% of all participants reporting that they had access to fruits and vegetables.

Table 1 shows unadjusted bivariate models for fruit and vegetable intake by our covariates. In all bivariate models, more participants met the guidelines for fruits than vegetables. The average fruit and vegetable consumption was: fruit (2.04 ± 1.22); vegetable (1.93 ± 1.17); and fruit + vegetable (5.95 ± 1.95). African Americans consumed significantly less fruits and vegetables compared to Hispanics. Male participants consumed significantly less vegetables compared to females, while participants with an education above a high school diploma consumed significantly more fruit than those without a high school diploma. Other variables associated with higher vegetable intake were living alone, regular exercise, excellent or good self-rated health, and BMI above 25. Participants who were current or previous smokers consumed significantly less fruits and vegetables compared to those who had never smoked.

In unadjusted models, the association of fruits and vegetables intake did not differ by age, household income, alcohol intake, access to fruits and vegetables, diabetes or hypertension status. Additionally, average fruit + vegetable intake among all covariates met the guidelines, but with relatively large *SD*s, suggesting a diverse pattern of intake.

Multivariate models (Table 3) did not yield significant associations between fruit and vegetable intake and current diagnosis of either diabetes or hypertension. However, participants who were overweight or obese (BMI >25) had a significantly higher intake of vegetables (1.99 ± 1.12; p = 0.027) and fruits + vegetables (6.04 ±1.94, p = 0.034), but not fruit (p = 0.11) after adjusting for all other covariates. Participants who exercised regularly were also ate more vegetables (2.15 ± 1.16, p = 0.004) and fruits + vegetables (6.31 ± 1.97;

Table 1. Characteristics of Participants (n = 505).

	n	%
Gender		
Male	176	34.9
Female	329	65.1
Race/ethnicity		
African American	340	67.3
Hispanics	165	32.7
Age (years)		
55–64	157	31.2
65–74	193	38.3
75 +	154	30.6
Education		
No HS diploma	208	41.2
HS diploma and higher	297	58.8
Household monthly income		
Less than US$1500	394	81.3
US$1500 +	91	18.8
Living alone		
No	206	40.8
Yes	299	59.2
Exercise (how often walk at least a mile)		
Regularly	140	28.7
Occasionally	55	11.3
Rarely	293	60.0
Smoking		
Current or past	301	61.1
Never	192	38.9
Alcohol consumption		
No/light drinker	452	91.1
Drinks regularly	444	8.9
Access to fruits and vegetables		
With difficulty	77	15.6
Without difficulty	418	84.4
Self-rated health		
Excellent-good	271	54.6
Fair/poor	225	45.4
Body mass index (BMI)		
Normal (18.5–24.9)	98	19.6
Overweight (25–29.9)	178	35.6
Obese (≥30)	224	44.8
Hypertension		
No	38	9.7
Yes	456	92.3
Diabetes		
No	306	61.8
Yes	189	38.2
Body mass index		
Normal (18.6–24.9)	98	19.6
Overweight or obese (≥25)	402	80.4
Hypertension, diabetes, overweight/obese		
One condition	92	18.9
Two conditions	241	49.4
All three conditions	155	31.8

Table 2. Bivariate Analysis of Consumption of Fruit and Vegetable among Underserved African American and Hispanic Older Adults with Cardiovascular Risk Factors (*n* = 505).

	Vegetables			Fruits			Fruits and Vegetables		
Independent variables	Mean ± SD	Sig	% Not meeting guidelines	Mean ± *SD*	Sig	% Not meeting guidelines	Mean ± *SD*	Sig	% Not meeting both guidelines
All participants	1.93 ± 1.167	-	71.8	2.04 ± 1.221	-	36.6	5.95 ± 1.952	-	77.1
Race									
African American	1.82 ± 1.142	0.001	75.9	1.87 ± 1.251	0.001	43.9	5.57 ± 1.851	0.001	81.8
Hispanic	2.18 ± 1.185		63.0	2.41 ± 1.070		20.8	6.57 ± 1.942		66.9
Gender									
Male	1.79 ± 1.169	0.043	76.9	2.03 ± 1.221	0.176	37.8	5.79 ± 1.893	0.853	81.5
Female	2.01 ± 1.160		69.1	2.05 ± 1.224		36.0	6.04 ± 1.985		74.8
Age (years)									
55–64	1.92 ± 1.184	0.704	72.5	2.16 ± 1.343	0.342	32.7	6.05 ± 2.125	0.628	75.2
65–74	1.98 ± 1.192		71.8	2.01 ± 1.156		38.3	5.96 ± 1.877		78.7
75 +	1.87 ± 1.120		71.6	1.96 ± 1.170		39.2	5.83 ± 1.863		77.7
Education									
No HS diploma	2.00 ± 1.146	0.277	71.9	2.21 ± 1.173	0.014	30.2	6.19 ± 1.867	0.129	76.9
HS diploma and higher	1.88 ± 1.180		71.8	1.93 ± 1.243		41.0	5.79 ± 1.99		77.3
Household monthly income									
Less than US$1500	1.89 ± 1.173	0.155	72.9	1.99 ± 1.226	0.192	37.6	5.87 ± 1.93	0.097	78.4
US$1500 +	2.09 ± 1.164		65.1	2.19 ± 1.232		36.0	6.26 ± 2.06		70.9
Living alone									
No	2.12 ± 1.196	0.004	67.0	2.21 ± 1.188	0.072	31.5	6.30 ± 2.002	0.001	70.6
Yes	1.81 ± 1.132		75.1	1.93 ± 1.233		40.1	5.72 ± 1.886		81.6
Exercise									
Regularly	2.15 ± 1.156	0.005	64.3	2.20 ± 1.315	0.102	35.0	6.31 ± 1.968	0.007	72.1
Occasionally	2.11 ± 1.117		69.1	2.15 ± 1.145		27.3	6.22 ± 1.892		72.7
Rarely	1.79 ± 1.166		76.1	1.95 ± 1.184		39.2	5.72 ± 1.929		80.5
Smoking									
Never	2.10 ± 1.128	0.011	67.4	2.19 ± 1.174	0.024	30.4	6.27 ± 1.851	0.003	72.8
Current or past	1.83 ± 1.181		74.6	1.93 ± 1.243		41.2	5.74 ± 1.982		80.0

(continued)

Table 2. (continued)

	Vegetables			Fruits			Fruits and Vegetables		
Independent variables	Mean ± SD	Sig	% Not meeting guidelines	Mean ± *SD*	Sig	% Not meeting guidelines	Mean ± *SD*	Sig	% Not meeting both guidelines
Alcohol consumption									
No/light drinker	1.92 ± 1.153	0.507	72.5	2.03 ± 1.204	0.788	36.8	5.93 ± 1.1925	0.542	77.7
Drinks regularly	2.05 ± 1.290		65.1	2.09 ± 1.377		37.2	6.14 ± 2.111		72.1
Access to fruits and vegetables									
With difficulty	1.97 ± 1.124	0.456	68.8	2.26 ± 1.174	0.090	27.3	6.23 ± 1.986	0.169	72.7
Without difficulty	1.92 ± 1.176		72.4	2.00 ± 1.227		38.3	5.91 ± 1.944		78.0
Self-rated health									
Excellent-good	2.04 ± 1.152	0.032	68.8	2.04 ± 1.219	0.924	36.9	6.03 ± 1.889	0.320	74.9
Fair/poor	1.81 ± 1.178		75.3	2.03 ± 1.229		37.4	5.86 ± 2.023		79.9
Diabetes									
No	1.93 ± 1.172	0.876	72.1	2.03 ± 1.253	0.953	38.3	5.94 ± 1.985	0.963	77.9
Yes	1.95 ± 1.169		71.4	2.04 ± 1.180		35.2	5.95 ± 1.909		76.2
Hypertension									
No	2.06 ± 1.273	0.524	69.7	2.21 ± 1.244	0.380	27.3	6.27 ± 2.01	0.320	72.7
Yes	1.93 ± 1.162		71.8	2.02 ± 1.223		37.9	5.92 ± 1.945		77.4
Body mass index									
to 24.9	1.70 ± 1.144	0.027	71.9	1.86 ± 1.219	0.112	41.7	5.57 ± 1.929	0.034	78.1
≥25	1.99 ± 1.165		71.7	2.09 ± 1.214		35.1	6.04 ± 1.937		76.9

p = 0.012) compared to those who rarely exercised. Exercise was however, not significant for fruit consumption.

We observed a racial/ethnic difference in fruit and vegetable consumption. After adjusting for all other covariates, AAs had lower daily servings compared to their Hispanic counterparts: fruits (1.87 ± 1.25 vs. 2.41 ± 1.07; p = 0.029); vegetables (1.82 ± 1.14 vs. 2.18, *SD* 1.19; p = 0.019); and fruits + vegetables (5.57 ± 1.85 vs. 6.57 ± 1.94; p = 0.004).

About 84.4% of all participants reported having access to fruits and vegetables. However, among those with access, 38% and 78% did not meet the guidelines for fruit and vegetable consumption, respectively.

Discussion

The cardiovascular health benefits of a diet rich in fruits and vegetables are well known. Retrospective and prospective studies have found significant inverse dose–response associations between fruits and vegetables consumption and CVD factors (Dauchet et al., 2004, 2005, 2006; He et al., 2006, 2007; Micha et al., 2017; Miller et al., 2017). This is particularly important among older adults because not only does CVD risk increase with age, aging also increases the risk for poor dietary intake due to physiological deterioration, functional and cognitive limitations, social isolation and economic constraints (Nicklett & Kadell, 2013). Relatively few studies have examined the correlates of fruits and vegetable intake among older adults, and even fewer among minority older adults (Nicklett & Kadell, 2013). Our study provides foundational knowledge on the correlates of fruit and vegetable intake among older AA and Hispanic adults in under-resourced settings.

Overall, the majority of the minority older adults in our study did not meet the recommended guidelines for fruit and vegetable consumption, but this was not associated with hypertension or diabetes prevalence, or having access to fruits

Table 3. Multiple Linear Regression Analysis of Consumption of Fruit and Vegetable among Underserved African American and Hispanic Older Adults with Co-morbidities (N = 505).

	Vegetables		Fruits		Vegetable and Fruit	
Independent Variables	Beta	Sig	Beta	Sig	Beta	Sig
Race/Ethnicity (Hispanic vs. African American)	−0.161	0.019	−0.150	0.029	−0.194	0.004
Gender (female vs. male)	0.078	0.105	−0.007	0.887	0.047	0.330
Age (years)	0.057	0.254	−0.082	0.104	−0.007	0.884
Education (years)	0.087	0.161	−0.055	0.376	0.020	0.749
Household income ($$)	0.002	0.972	0.052	0.294	0.036	0.461
Living alone (no vs. yes)	−0.081	0.107	0.009	0.852	−0.039	0.435
Exercise						
Regularly	0.142	0.004	0.072	0.149	0.124	0.012
Occasionally	0.056	0.238	0.025	0.603	0.046	0.326
Rarely (ref)						
Smoking (current or past vs. never)	−0.053	0.310	−0.069	0.185	−0.075	0.144
Alcohol consumption (no/light vs. regularly)	0.058	0.240	0.003	0.952	0.036	0.463
Access to fruits and vegetables (with difficulty vs. without difficulty)	−0.013	0.773	−0.083	0.072	−0.065	0.156
Self-rated health (excellent-good vs. fair/poor)	0.010	0.829	−0.010	0.827	0.013	0.777
Diabetes (no vs. yes)	−0.019	0.684	−0.029	0.543	−0.031	0.512
Hypertension (no vs. yes)	0.036	0.472	0.028	0.569	0.035	0.476
Body mass index (18.6–24.9 vs. ≥25)	0.104	0.027	0.077	0.102	0.102	0.029

and vegetables. Fruit and vegetable consumption was worse among African Americans. Our findings are vital for successful interventions that are age-appropriate, culturally relevant, and socio-economically practical.

Many Americans with already established CVD risk factors including diabetes, hypertension, and obesity do not follow recommended dietary guidelines (Jen et al., 2007; Nelson et al., 2002a). In our study of community living, older AA and Hispanic adults with these cardiovascular risk factors, 77% did not meet the fruit and vegetable guidelines. A slightly lower, but similarly poor compliance was reported in a national sample of diabetic adults ages 61± 0.6 years in the Third National Health and Nutrition Examination Survey (NHANES III). Sixty two percent of AA (n = 408) and 65% of Hispanics (n = 452) did not meet the fruit and vegetable guidelines (Nelson et al., 2002b). Another large, 20-year longitudinal NHANES study reported an inverse association between consumption of less than five daily servings of fruit and vegetable and the incidence of diabetes (Ford & Mokdad, 2001). These findings strengthen the hypothesis that fruits and vegetables have a protective effect on the incidence and severity of diabetes. This effect has further been supported by the evidence of decreased HgbA1c with the intervention of fruit and vegetable "prescriptions." In one such study in a low-income, urban, mostly AA and Hispanic cohort with uncontrolled diabetes, HgbA1c decreased from 9.54% to 8.83%, (p = 0.001) within 13 weeks of the intervention (He et al., 2004). Among those with hypertension, there is evidence that dietary modifications play a role in blood pressure management. In a randomized controlled trial to assess the effect of diet on blood pressure, the Dietary Approaches to Stop Hypertension demonstrated a decrease in blood pressure within 8 weeks of increasing fruit and vegetable consumption (Appel et al., 1997). Therefore, dietary strategies to increase fruit and vegetable intake among older minority adults may lower the burden of cardiovascular risk factors in this population.

Obesity plays an important role as an independent CVD risk factor, or indirectly as a risk factor for diabetes and hypertension. In our study, participants who were overweight or obese consumed more vegetables and fruit + vegetables compared to those with normal weight. Other cross-sectional studies (Alinia et al., 2009; Jen et al., 2007) have reported opposing results - overweight and obese people consumed less fruits and vegetables. Similar results have been reported in longitudinal studies. After 12 years in the Nurses' Health Study (He et al., 2004), participants who consumed more fruits and vegetables gained significantly less weight. There is evidence that replacing foods of high energy density with foods of lower energy density, such as fruits and vegetables, can be an important part of a weight-management strategy (Lee-Kwan et al., 2017). Theoretically, the increased viscosity and satiety of fruits and vegetables is thought to play a role in preventing obesity. We speculate that the opposing paradoxical finding in our study may be related to reporting bias. Reasons pertaining to higher vegetable intake among overweight/obese participants in our study warrant further investigation.

Several studies have documented that in general, AAs consume less vegetables than Whites and Hispanics, while

Hispanics consume more vegetables than Whites (Dubowitz et al., 2008; Gary et al., 2004; Hiza et al., 2013; Kahn et al., 1997; Lee-Kwan et al., 2017). Other studies have reported inadequate intake of fruits and vegetables among AA with diabetes (Nelson et al., 2002a) and hypertension of all ages (Jen et al., 2007). In our study, more AA (82%) compared to Hispanic (67%) adults did not meet the fruit and vegetable guidelines. This may be because the traditional diet components of Latino foods include more vegetables and fruits. Some of our participants may also have been immigrants from Latin countries that typically consume more fruits and vegetables than Americans. More studies are needed to elucidate cultural barriers and promote positive cultural influences related to fruit and vegetable intake among both groups.

In our study, even after adjusting for other factors, physically active participants consumed more fruits and vegetables. Reduced physical functioning in aging may be associated in with reduced ability to shop and prepare food. Additionally, others have reported that engagement in physical activity may be a marker of health consciousness (Bazzano et al., 2003), thus increasing the likelihood of higher fruit and vegetable intake.

In discussions about dietary intake, it is imperative to consider access to healthy food options. Neighborhoods lacking market availability or access to healthy foods—referred to as food deserts—may contribute to inadequate consumption of fruits and vegetables. In our study, 84% of the participants reported having access to fruits and vegetables. Another study of food pantry clients in California reported that 41% of participants were within walking distance to a store with fresh produce. Despite the majority of our study participants having access to fruits and vegetables, only 23% met the recommended guidelines. Therefore, access does not necessarily equate consumption.

Investigations on the relationship between access and consumption of fruits and vegetables have yielded negative (Aggarwal et al., 2014; Boone-Heinonen et al., 2011), positive (Becerra et al., 2017; Caldwell et al., 2009; Zenk et al., 2009), or inconclusive results (Mello et al., 2010; Singleton et al., 2015). Similar to our study, Aggarwal et al. (Aggarwal et al., 2014) and Boon-Heinonen et al. (Boone-Heinonen et al., 2011) did not find an association between access to grocery stores and fruit and vegetable consumption. However, Caldwell et al. (Caldwell et al., 2009) by measuring the display space devoted to fruit and vegetable offering, price, variety, and freshness and Zenk et al. (Zenk et al., 2009) by using store availability, proximity, and fruit and vegetable supply both found access to fruits and vegetables significantly associated with higher consumption. However, Zenk et al. observed a racial/ethnic disparity. When both AA and Latinos had access to a large grocery store, Latinos consumed 2.2 more daily servings of fruit and vegetables. In regard to fresh fruits and vegetables, access to fresh produce was significantly associated with an increase in consumption among Latinos but not among AA. These findings agree with our findings on racial/ethnicity consumption of fruits and vegetables. In California, many farm workers are Hispanic and may be more likely to have access to fresh produce.

The paradox of market availability but inadequate consumption of fruits and vegetables may be explained by other mediating factors. In addition to access, several barriers have been identified including high cost, store proximity, perceived lack of preparation time, taste preferences, and cultural practices (Algert et al., 2006; Fish et al., 2015; Zenk et al., 2011). Fish et al. (Fish et al., 2015) conducted an in-depth qualitative study of factors influencing the consumption of fresh fruits and vegetables among AA and Latino women. Among both groups, access, cost, concern for spoilage, family preferences and concerns about chemicals used on fresh produce were barriers to fresh fruit and vegetable consumption. AA women also reported poor cooking skills, while Latina women were less open to trying new foods. It is also notable that the majority of our participants had limited income.

The CDC Guide to Strategies to Increase the Consumption of Fruits and Vegetables identifies 10 strategies to increase access to and improve the availability of fruits and vegetables (CDC, 2011). These include improving access to retails stores that sell high-quality fruits and vegetables, starting and/or expanding farmers' markets, ensuring access to fruits and vegetables at school and workplace cafeteria, and promoting food policies at the state and local level. Others have recommended food policies that would reduce the price of fruits and vegetables and expansion of vouchers for under resourced populations (Hood et al., 2012). In addition to access, further studies are needed to identify additional barriers to fruit and vegetable intake among minority older adults with CVD factors, particularly in underserved communities.

Limitations

The challenges associated with accessibility and measurement of fruit and vegetable consumption patterns are well recognized, particularly among participants of diverse racial/ethnic backgrounds (Roark & Niederhauser, 2013). Because many of the participants had low income, they may have been enrolled in government food assistance programs. However, we did not ask that question and therefore may have missed an opportunity for future intervention in that domain.

In our study, fruit and vegetable intake reporting relied on participant recall and thus subject to recall bias. Total caloric intake which may have a confounding effect on the results was not assessed. Height and weight measurements were reported by participants and may be inaccurate. Additionally, the severity of diabetes or hypertension was unknown. Finally, our study used convenience sampling and may therefore lack generalizability.

Conclusion

Many older AA and Hispanic adults with CVD risk factors and living in an underserved community did not meet the recommended guidelines for fruits and vegetable intake. This is an important finding because of the protective benefits of fruit and vegetables for cardiovascular health. More studies, in this population specifically, are needed to understand factors associated with fruit and vegetable intake, including barriers associated with aging, cultural influences, and dynamics of food access.

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ORCID iD

Lucy W. Kibe https://orcid.org/0000-0002-6802-8451

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