

Exploring the Association of Self-Reported Physical Activity with Peripheral Arterial Disease Severity: A Cross-Sectional Study from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) Database

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Research Article

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Abstract

Background

Engaging in physical activity (PA) has been proved to reduce the risk of developing cardiovascular diseases. In patients with peripheral artery disease (PAD), diminished PA predicts high overall mortality. However, it is unknown to what extent participation in PA is associated with PAD severity. Therefore, the overarching aim of this study was to investigate the association between PAD severity and PA levels using the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) database.

Methods

This was a cross-sectional cohort study that included 495 participants with PAD and a total of 14,536 participants without PAD from the HCHS/SOL database. The Global Physical Activity Questionnaire was administered to assess the time spent weekly in performing moderate to vigorous PA (MVPA) during work, leisure time, and transportation. The Ankle–Brachial Index (ABI) was used to measure PAD. PA status was categorized on the basis of MVPA as follows: physically active (MVPA \geq 150 min) and physically inactive (combined MVPA < 150 min). Eventually, the total sample was then classified as follows: normal ABI and physically active, normal ABI but physically inactive, PAD and physically active, and PAD but physically inactive. Regression models were used to investigate the association between different types of PA and the severity of PAD.

Results

Of the participants, 235 (47%) were involved in no to insufficient PA, and 260 (53%) engaged in at least 150 min/week of MVPA. The majority of participants (54%) with mild PAD were physically active, and 58% of those with severe PAD were physically inactive. After adjustment for covariates (age, sex, education, smoking status, body mass index, and statins), inactive people with a diagnosis of PAD were more likely to have severe PAD ($\beta = .79$, $p = .02$). In addition, decreases in work-related PA, total metabolic equivalents, and total PA were associated with increased PAD severity.

Conclusions

It was found that MVPA patterns were associated with PAD severity, and they explained high severity among patients with PAD who were physically inactive. These findings highlight the necessity of interventions in increasing PA in these participants. Future studies are required to identify appropriate exercise regimens or home-based programs to help patients with severe PAD meet the current PA recommendations.

Background

Peripheral artery disease (PAD) is prevalent in nearly 8.5 million people in the United States, and the number of concerns is rising, with PAD increasing in those who have diabetes, hypertension, and hypercholesterolemia [1]. In addition, a sedentary lifestyle is a risk factor for developing PAD [1]. In the Hispanic population, the age-adjusted death rates for PAD were 13.4 and 9.1 for men and women, respectively [1]. The Ankle–Brachial Index (ABI) is an indicator of the systolic pressure ratio measured in the ankle and arm, and it is used to diagnose and assess PAD severity [2]. The ABI is considered normal if its value is between 1.0 and 1.4, whereas values < 1.0 or > 1.4 are considered abnormal [3, 4]. The hazard ratios of deaths in men and women due to cardiovascular reasons were higher in people who had ABI values <

1.0 or > 1.4, which makes the ABI a suitable predictor of cardiovascular mortality or events. In people with ABI values < 1, the cardiovascular mortality rates in men and women were 18.7% and 12.6%, respectively [1, 2]. Thus, clinicians should pay attention to those who have abnormal ABI values and try to find appropriate interventions to minimize the risks of abnormal ABI.

Exercise, either supervised or home-based, is beneficial in reducing the unfavorable symptoms of PAD and increasing the distance of symptom-free walking in people diagnosed with PAD [1, 5, 6]. Research has established a positive association between moderate to vigorous physical activity (MVPA) and health-related quality of life [1, 5, 6]. A reduction of 9.5% in the ABI was reported as an immediate effect of 50 heel raise exercises [7]. Less attention has been paid to physical activity (PA) levels in people with PAD. Gerage et al. [8] found that men with a mean age of 67 years and diagnosed with PAD spent a mean of 15 min/day doing MVPA, whereas the rest of the day was spent being sedentary or doing light PA [8]. According to Parsons et al., older men with a mean age of 78 years with ABI values < 1.0 spent a mean of 25 min/day doing MVPA, and the rest of the day was spent being sedentary or doing light PA [4]. Gerage et al. reported to have found no association between ABI values and meeting the PA guidelines [8], whereas an inverse relationship was reported between increasing the duration of PA and ABI values [4]. However, only men were included in these studies [4, 8], and therefore, generalizing these results to women would not be appropriate. Evidence from large population-based studies examining the links between PA levels and PAD severity needs to be elucidated.

Thus, this study aimed to characterize PA levels among people with PAD. Also, it aimed to investigate the extent to which PAD severity—using the ABI—explains the differences in PA levels in people with PAD. It is expected that the information gathered through this study would provide health-care providers with information to establish appropriate PA promotion programs and interventions to attenuate the risks of PAD and enhance the quality of life of people with PAD.

Methods

Study design and participants

In this cross-sectional study, data from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) database were analyzed for the period 2008 to June 2011. The HCHS/SOL was a multisite community-based cohort study that examined the prevalence of chronic diseases and the associated health factors in a sample of Hispanic/Latino adults aged 18 to 74 years at baseline (2008–2011). The HCHS/SOL recruited 16,415 self-identified Hispanic/Latino people in four cities (Bronx, NY; Chicago, IL; Miami, FL; and San Diego, CA). Participants were recruited from randomly selected households. The detailed methods were reported previously [9]. The institutional review boards at each site approved the study, and all procedures adhered to the Declaration of Helsinki. In this study, oversampled middle-aged and older adults (45–74 years) who reported having ABI scores from 2008 to 2011 were included. In addition, 2374 participants with missing data related to PA or who reported having comorbidities—such as heart diseases and respiratory disorders—were excluded. Therefore, the total primary analytical sample consisted of 15,031 participants.

Measures

Peripheral arterial disease (PAD)

The ABI is a noninvasive measure of PAD (arterial stenosis and stiffness) [10]. The standard Doppler procedure using a Nicolet Doppler Elite 100R probe (Natus, Golden, CO) was used to measure the ABI, as described in previous studies [11]. Low ABI values (≤ 0.9) were considered indicative of PAD and prognostic for atherosclerosis [10]. Also, the classification of low ABI severity considered an index value between the ratio of 0.7 and 0.90 on either the left or right limb. A value between 0.7 and <0.4 was considered to indicate moderate to severe PAD, and all others were coded as normal.

Physical activity (PA):

The Global Physical Activity Questionnaire assesses the time spent in a typical week performing MVPA during work and leisure time, walking or biking for transportation, and being sedentary. Work-related, transportation-related, and leisure-time PA were included in our moderate PA variable. In the vigorous PA variable, only work-related and leisure-time PA were included. During a week, the MVPA and vigorous PA variables were created in accordance with the 2008 Physical Activity Guidelines for Americans. The PA recommendations for the general population, including people with PAD, were classified into three categories [12]. The three categories for MVPA were as follows: (1) met the guidelines (≥ 150 min/week); (2) insufficiently active (>0 to <150 min/week); and (3) inactive (0 min/week).

Group classification:

The ABI is considered normal if its value is between 1.0 and 1.4, whereas values <1.0 or >1.4 are considered abnormal [4, 13]. In this study, the ABI was classified as normal or abnormal (mild, moderate, and severe). The sample was categorized as follows: normal ABI and physically active (combined MVPA >150 min), normal ABI but not physically active (combined MVPA <150 min), PAD and physically active (combined MVPA >150 min), and PAD but not physically active (combined MVPA <150 min).

Data analysis and statistical plan:

Baseline characteristics of the study population were compared across four different categories of combined PAD and PA: (1) normal ABI and physically active (combined MVPA >150 min), (2) normal ABI but not physically active (combined MVPA <150 min), (3) PAD and physically active (combined MVPA >150 min), and (4) PAD but not physically active (combined MVPA <150 min). The data were presented as means and standard deviations ($M \pm SD$) for normally distributed continuous variables, medians and interquartile range (MED [IQR]) for a non-normally distributed variables, and percentages for categorical variables. For categorical demographic characteristics, the Pearson chi-square test was performed to assess the differences in the four groups (PAD–non-PA, PAD–PA, healthy control and PA, and healthy control PA) and the two groups (PAD–mild and PAD–moderate to severe). In addition, the differences in continuous variables of demographic characteristics were assessed using the Kruskal–Wallis H test for the four groups and the Mann–Whitney U test for the two groups.

Generalized binary models were used to investigate the association between moderate PA as an independent variable (inactive, insufficient, and active) and PAD severity as a dependent variable after adjusting for age (years), sex, and education (less than high school and high school or more). Odd ratios were added in the calculation to explain the strength of the association between the dependent and independent variables. In addition, generalized linear models were used to investigate the association between the types of PA as independent variables (continuous values including work-related, transportation-related, recreational, total metabolic equivalents [METs], and total PA) and the severity of PAD as dependent variables. The models were adjusted using three controlling categories: the first model was used to control for age, sex, and education; the second model for the first model and smoking status, and body mass index (BMI); and the third model for all covariates with statins medication prescription.

Results

A total of 15,031 participants were included in this study. The participants were divided into four groups according to the presence of PAD (i.e., normal or abnormal ABI) and the category of PA (i.e., physically active or inactive). These groups included participants who were physically active with normal ABI (healthy control PA; $n = 10,338$), physically inactive with normal ABI (healthy control non-PA; $n = 4198$), physically active with abnormal ABI (PAD–PA; $n = 260$), and physically inactive with abnormal ABI (PAD–non-PA; $n = 235$). Demographic characteristics of the groups are presented

in Table 1. There were significant differences found between the groups in all demographic and clinical variables. Investigating the PA pattern in accordance with the PA guidelines, the data revealed that the majority of participants with PAD (260; 53%) were physically active. A total of 156 (32%) participants performed insufficient PA, which indicated engagement in MVPA to be <150 min/week, and 79 (16%) participants were physically inactive.

On the basis of PAD severity, Table 2 presents the characteristics of the participants with mild and moderate to severe PAD, including the significant differences between the two groups. There were significant differences between people with mild and moderate to severe PAD in all demographic and clinical variables, except BMI, sex, dyslipidemia, and weekday sleep duration.

Table 1 Sociodemographic and physical characteristics of the study population					
Variables	PAD–non PA <i>n</i> = 235	PAD–PA <i>n</i> = 260	Healthy control and non-PA <i>n</i> = 4198	Healthy control PA <i>n</i> = 10,338	<i>p</i> -value
	Mean ± <i>SD</i>	Mean ± <i>SD</i>	Mean ± <i>SD</i>	Mean ± <i>SD</i>	
BMI (kg)	30.88 ± 6.80	29.21 ± 5.46	30.40 ± 6.13	29.35 ± 5.73	<.001
Height (cm)	157.87 ± 8.32	159.85 ± 8.88	160.96 ± 8.81	163.47 ± 9.23	<.001
Age (years)	58.80 ± 8.12	57.12 ± 8.14	47.02 ± 13.54	42.88 ± 14	<.001
Gender, <i>n</i> = 12,771	<i>n</i> = 235	<i>n</i> = 260	<i>n</i> = 4198	<i>n</i> = 8078	<.001
Female, <i>n</i> (%)	184 (1.44)	164 (1.28)	2850 (22.31)	4086 (31.99)	
Education, <i>n</i> = 12,700	<i>n</i> = 235	<i>n</i> = 256	<i>n</i> = 4195	<i>n</i> = 8014	<.001
No high school diploma, <i>n</i> (%)	128 (54)	1041 (41)	1698 (40)	2749 (34)	
High school diploma or an equivalent degree, <i>n</i> (%)	107 (45)	152 (59)	2497 (60)	5265 (66)	
Adjusted number of cigarettes per year	315.73 ± 510.35	435.91 ± 27.58	265.99 ± 4.15	246.70 ± 2.78	<.001
Dyslipidemia, <i>n</i> (%)	<i>n</i> = 233	<i>n</i> = 256	<i>n</i> = 4158	<i>n</i> = 7984	.003
	115 (67)	115 (61)	1611 (39)	3116 (39)	
Weekday sleep duration (h)	7.94 ± 1.49	7.80 ± 1.52	8.08 ± 1.46	7.87 ± 1.40	<.001
Fasting insulin	18.12 ± 48.17	12.82 ± 9.57	14.45 ± 11.91	12.45 ± 10.29	<.001
HbA1C	47.86 ± 16.62	46.20 ± 18.59	41.51 ± 14.21	40.10 ± 13.87	<.001
MVPA, median (IQR)	960 (1980)	31(60)	615 (1430)	29 (60)	<.001
<p><i>BMI</i> body mass index, <i>SD</i> standard deviation, <i>HbA1C</i> glycated hemoglobin, <i>METS (NCEP-definition)</i> metabolic syndrome is based on the updated Adult Treat Panel III of the National Cholesterol Education Program (NCEP) guidelines, <i>IQ</i> interquartile, <i>PAD–non-PA</i> peripheral artery disease and not physically active to insufficient PA, <i>PAD–PA</i> peripheral artery disease and physically active, <i>PA</i> physically active, <i>MVPA</i> moderate to vigorous physical activity</p> <p>Values are expressed as mean (<i>SD</i>)</p> <p>* <i>p</i>-value ≤ .05</p>					

Table 2 Characteristics of individuals with PAD			
Variables	PAD—mild	PAD—moderate to severe	<i>p</i> -value
	<i>n</i> = 430	<i>n</i> = 63	
	Median (IQ)	Median (IQ)	
BMI (kg)	29 (25.55–33.29)	28 (24.42–31.87)	.28
Height (cm)	158 (152.90–164)	163 (155–169)	.001
Age (years)	57 (50.25–63)	62 (57–69)	<.001
Gender, female, <i>n</i> (%)	220 (51)	31 (49)	.62
MVPA (min/week)	165 (0–750)	95 (0–4300)	.02
Income, <i>n</i> = 430, <i>n</i> (%)			.01
<\$10,000	94 (25)	25 (46)	
\$10,001–\$20,000	131(35)	15 (28)	
\$20,001–\$40,000	111(29)	9 (17)	
\$40,001–\$75,000	29 (8)	5 (9)	
>\$75,000	11 (3)	0	
Education, <i>n</i> (%)			.002
No high school diploma	191 (45)	41 (65)	
High school diploma or an equivalent degree	237 (55)	22 (35)	
Number of cigarettes per year	235.45 (79.53–109.75)	286.47 (61.74–89.30)	.005
Dyslipidemia, <i>n</i> = 415 yes <i>n</i> (%)	206 (55)	24 (44)	.12
Weekday sleep duration (h)	8 (7–8.5)	8 (7–9)	.24
Sedentary behavior, yes <i>n</i> (%)	130 (30)	26 (42)	.07
<i>PAD</i> peripheral artery disease, <i>IQ</i> interquartile, <i>BMI</i> body mass index, <i>MVPA</i> moderate to vigorous physical activity			
Values are expressed as mean rank and interquartile value or frequency			
* <i>p</i> -value ≤.05.			

As provided in Table 3, being physically inactive was significantly associated with a 0.78 increase in PAD severity even after controlling for age, sex, education, smoking status, BMI, and statin. In addition, a decrease in work-related PA ($\beta = -.008$; $p = .05$), total METs ($\beta = -.001$; $p = .03$), and total MVPA ($\beta = -.005$; $p = .02$) was associated with increased PAD severity after controlling for age, sex, education, smoking status, BMI, and statin (Table 4).

Table 3. The associations between moderate physical activity and severity of peripheral artery disease.

MVPA	ABI (mild/moderate to severe)											
	Unadjusted β (95% CI)	OR	p-value	Model 1 ^a β (95% CI)	OR	p-value	Model 2 ^b β (95% CI)	OR	p-value	Model 3 ^c β (95% CI)	OR	p-value
Inactive	.59 (.003-1.17)	.57	.04	.78 (.14-1.43)	.46	.02	.78 (.13-1.44)	.46	.02	.79 (.12-1.47)	.45	.02
Insufficient	.38 (-.38-1.13)	.81	.33	.23 (-.60-1.06)	.57	.59	.24 (-.59-1.07)	.60	.57	.3 (-.54-1.14)	.61	.48
Active	1			1			1			1		

Dependent: PAD severity using ABI

^a Adjusted for age, sex, education.

^b Adjusted for model 1 covariates, smoking status, and BMI

^c Adjusted for model 2 covariates, and statin

Table 4. The associations between type of physical activity and severity of peripheral artery disease

PA	ABI (mild/moderate to severe)									
	Unadjusted β (95% CI)	p-value	Model 1 ^a β (95% CI)	p-value	Model 2 ^b β (95% CI)	p-value	Model 3 ^c β (95% CI)	p-value		
Work	-.008 (-.018, -.003)	.02	-.007 (-.01-.002)	.04	-.007 (-.01, -.002)	.05	-.007 (-.02-.002)	.05		
Transport	-.004 (-.01-.001)	.22	-.006 (-.01-.001)	.16	-.005 (-.01-.001)	.18	-.005 (-.01-.001)	.48		
Recreational	.000 (-.01-.009)	.95	.005 (-.008-.01)	.32	.006 (-.008-.01)	.32	.006 (-.008, .01)	.28		
Total METs	-.001 (-.002-.000)	.01	-.001 (-.002-.000)	.02	-.001 (-.002-.000)	.03	-.001 (-.002-.000)	.04		
Total Moderate to vigorous PA	-.005 (-.01-.002)	.01	-.005 (-.01-.002)	.02	-.005 (-.0-.001)	.02	-.005 (-.01-.001)	.03		

Dependent: PAD severity using ABI

^a Adjusted for age, sex, education.

^b Adjusted for model 1 covariates, smoking status, and BMI

Discussion

The overarching aim of this study was to assess PA patterns among individuals with PAD and investigate whether or not these patterns were associated with PAD severity. The main findings are that PAD severity contributes to a decline in MVPA and work-related PA. Patients engaged in MVPA and meeting the PA guidelines had less severe PAD compared to those inactive. The study showed that the majority of patients with PAD (53%) were physically active and achieved global PA recommendations (≥ 150 min/week), whereas 48% were physically inactive to physically insufficient. There was a significant difference in the MVPA level between patients with mild vs. moderate to severe PAD. Examining PAD severity in association with engagement in MVPA showed a high percentage (16%) of moderate to severe PAD among inactive individuals and only 10% of severe PAD among active individuals. It was found that MVPA patterns were associated with PAD severity and explained the high severity among physically inactive patients with PAD. Furthermore, in this study, the amount of work per week and number of METs consumed per week were influenced by PAD severity, whereas recreational PA was not associated with PAD severity. These findings highlight the necessity of interventions in increasing PA in these participants. Future studies are required to identify appropriate exercise regimens or home-based programs to help patients with severe PAD meet the current PA recommendations.

PA patterns among participants with PAD

This study stratified the patients and healthy control groups on the basis of their PA patterns. Despite the fact that the two groups of healthy participants and those with PAD attained the recommended level of MVPA, there were significant differences in the total PA. Patients with PAD who met the current guidelines for adult MVPA and counted toward the recommended 150 min/week had significantly lower PA activity compared to those healthy and physically active. When patients with mild PAD were compared to those with moderate to severe PAD, there was a significant difference noted in terms of their level of work-related PA and total MVPA. Nevertheless, transportation-related and recreational PA were not significantly different among patients on the basis of PAD severity. The lack of PA has been studied previously; it has been shown that women with symptomatic PAD were found to report less MVPA and more barriers to PA than did men [14]. These findings are in parallel with our results. Contrary to our findings, a previous study reported a decline in PA among this subset of the population and showed that the main barriers to PA practice were related to claudication [15, 16]. However, a high percentage of our participants with PAD and physically active reported a lack of claudication symptoms ($n = 157$; 62%), which could be attributed to our findings. Thus, the participants with PAD and physically active demonstrated lower ABI values compared to those with PAD who were physically inactive. These findings are in line with other studies that reported that PA is an important factor in treating patients with intermittent claudication and encouraging supervised exercise programs to improve functional capacity [6, 17].

This study showed that patients with PAD who met the current PA guidelines displayed a lower frequency of dyslipidemia and mild disease severity than those who did not engage in MVPA 150 min/week. The participants with PAD and physically active had significantly lower times per week of MVPA than those without PAD. The findings of this study support a systematic review that provided an association between self-initiated PA and a reduced risk of PAD [18]. This finding concurred with a previous study that linked the improvement in atherosclerotic risk factors, such as dyslipidemia, to PA [19]. A previous study showed that exercise programs, especially the supervised ones, were more effective in improving the walking distance by up to 210 m after 3 months of intervention among patients with intermittent claudication [17]. It is well documented that PA helps treat many established atherosclerotic risk factors, such as dyslipidemia, arterial hypertension, obesity, insulin resistance, and glucose intolerance [20]. However, these findings do not prove that exercise impedes the progression of PAD or improves the flow-mediated dilatation of arteries.

The findings of this study distinguished between different types of PA, such as leisure-time and transportation-related PA, which were reported to lack any significant differences between the PAD and healthy groups. However, the activity that required locomotor and extensive PA levels— such as MVPA—was different between the groups. These findings may be explained by the disease, as PAD affects legs and could explain our findings [21, 22]. The preventive effect against the progression of PAD was reported, and it was reported that walking for longer than 30 mins at least three times per week or to the point of claudication improved pain distance [19]. Future studies are required to determine whether or not the degree of walking impairments alone is associated with low PA levels.

Our results enhance the sparse research linking PA and cardiovascular health in the adult population with PAD. A significant association was found between PA levels and PAD severity. The association between physical inactivity and PAD was robust after controlling for sex, age, education, smoking status, BMI, and statins. It was shown that inactive participants with PAD had a significantly higher odds ratio of developing PAD. This is in alignment with previous research that examined the association between PA and PAD; it showed a significantly lower odds ratio of developing PAD for participants who engaged in PA [23]. Our finding that PAD severity is favorably related to MVPA performed, but not recreational or transportation-related PA, embraces the evidence of a link between the type of activity and its intensity and degree of severity in adults with PAD. There is a lack of clear evidence for the association between PA and incident PAD, as prospective cohort studies are required to detect the association between PA levels and PAD severity.

This study has limitations that need to be acknowledged. This is a cross-sectional study that provided information on the co-occurrence of PA. However, findings would not imply causation on PA impact on the progression of PAD. Furthermore, the presence of claudication among patients with PAD would more likely affect engagement in PA between the groups of various severity levels. However, our analysis ruled out any differences in the presence of claudication between the groups. Thus, the small sample size of the participants with PAD precluded the generalization of this study and resulted in a lack of statistical power to precisely estimate the association between PAD severity and PA patterns. The recommended level of MVPA was measured according to the 2008 Physical Activity Guidelines for Americans [12]. The self-administered questionnaire measure of PA used in the study came with self-reported bias, measurement error, and limited measurement of the context in which PA was performed. Future studies are required to objectively measure PA data using accelerometers. Although a wide range of confounding factors in regression models were adjusted for in this study, other factors may be present and must be taken into consideration. The results should be carefully extrapolated to other patients.

Conclusions

Individuals with PAD and less physically active tend to associate with severe PAD. Active individuals with PAD reported less dyslipidemia and risk of cardiovascular disease and showed a mild ABI value. The findings suggest that PA decreases the risk of PAD, although better-powered studies are needed to confirm this.

Abbreviations

PAD, Peripheral arterial disease

PA, Physical activity

ABI, Ankle brachial index

MVPA, Moderate-to-vigorous physical activity

ORs, Odds ratios

Declarations

Ethics approval and consent to participate

The institutional review boards at each participating site of the HCHS/SOL database including the Albert Einstein College of Medicine, the University of Illinois at Chicago, the University of Miami, San Diego State University, and the University of North Carolina at Chapel Hill approved the study protocol. All procedures were adhered to the Declaration of Helsinki. Written informed consent was obtained from all participants prior to data collection. The proposal of this study was sent for approval to the National Sleep Research Resource (Grant Number: HL114473; from the National Heart, Lung, and Blood Institute, NIH) via support@sleepdata.org. Approval was obtained to access the raw data of the HCHS/SOL database (reference number: 1.1.2.56256d2).

Consent for publication

Not applicable

Availability of data and materials

The data for the current study are available from HCHS/SOL on <https://sleepdata.org/datasets/hchs>. However, restrictions apply to the availability of these data, and are not publicly available. MMA received administrative permission to access and use the sleep data (number of permissions: 1.1.2.56256d2). The following institutes/centers/offices contributed to the baseline HCHS/SOL funding period through a transfer of funds to the NHLBI: National Institute on Minority Health and Health Disparities, National Institute on Deafness and Other Communication Disorders, National Institute of Dental and Craniofacial Research, National Institute of Diabetes and Digestive and Kidney Diseases, National Institute of Neurological Disorders and Stroke, and National Institutes of Health Office of Dietary Supplements.

Competing interests

We declare that written informed consent was obtained from the participants for the publication of any associated data as explained in the HCHS/SOL.

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Authors' contributions

All the authors contributed substantially to the manuscript. MA, MMA contributed to the conception and analysis of the study. MA, AA, and MMA were involved in preparation of the manuscript and reviewed the manuscript for important intellectual content. MMA conducted that statistical analysis of the data. All authors revised and approved the final version of the manuscript.

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