Published in final edited form as:

South Med J. 2017 November ; 110(11): 733–737. doi:10.14423/SMJ.0000000000000728.

Subclinical Atherosclerosis Among Young and Middle-Aged Adults Using Carotid Intima-Media Thickness Measurements

Deborah L. Jones, PhD, MEd, Violeta J. Rodriguez, MEd, Maria L. Alcaide, MD, Nicole Barylski, HS, Digna Cabral, BS, Tatjana Rundek, MD, PhD, Stephen M. Weiss, PhD, MPH, and Mahendra Kumar, PhD

Departments of Psychiatry and Behavioral Sciences, Medicine, and Neurology, University of Miami School of Medicine, Miami, Florida

Abstract

Objectives—The presence of atherosclerotic plaques in the carotid arteries is a strong predictor of cardiovascular disease (CVD). Research and data on CVD risk have been derived primarily from individuals aged 55 years or older, and assessment of CVD risk among young and middle-aged adults seldom has been studied. The use of ultrasonography to measure carotid intima-media thickness (IMT) and carotid plaque appears to have utility to detect subclinical atherosclerosis in asymptomatic adults. This study evaluated the presence of carotid plaque using ultrasonography among healthy young and middle-aged adults.

Methods—Participants were men and women recruited in Miami, Florida, and were 18 to 50 years old with no history of CVD. Participants underwent a general physical examination and a carotid artery ultrasonography to evaluate carotid IMT and carotid plaque.

Results—From a total of 173 participants with a mean age of 34 years (standard deviation 8.9), 21.0% (95% confidence interval [CI] 15.0–27.2) were identified as having carotid plaque. IMT values ranged from 0.49 to 1.03 mm, with a mean value of 0.70 mm (standard deviation 0.09). In multivariable logistic regression older age (adjusted odds ratio [AOR] 1.08, 95% CI 1.01–1.16, $P=0.024$) and cigarette smoking (AOR 2.67, 95% CI 1.02–7.00, $P=0.045$) were associated with plaque, after controlling for IMT (AOR 2.55, 95% CI 1.40–4.65, $P=0.002$).

Conclusions—Traditional CVD risk factors such as those evaluated in this study may fail to provide adequate predictive value of carotid atherosclerosis in younger populations with no history of CVD, because the majority of traditional risk factors identified in previous research were not associated with carotid plaque in this young sample. Further research assessing nontraditional risk factors among asymptomatic individuals is required, and the evaluation of IMT as an intervention tool to detect CVD risk in these asymptomatic populations is warranted.

Keywords

cardiovascular disease; carotid plaque; intima-media thickness; ultrasonography

Correspondence to Dr Deborah Jones, Department of Psychiatry & Behavioral Sciences, University of Miami Miller School of Medicine, 1400 NW 10th Ave, Miami, FL 33136. d.jones3@med.miami.edu. To purchase a single copy of this article, visit sma.org/smj-home. To purchase larger reprint quantities, please contact Reprintsolutions@wolterskluwer.com.

The authors did not report any financial relationships or conflicts of interest.

Despite studies illustrating the strong relation between traditional cardiovascular risk factors (eg, cigarette smoking, hyperlipidemia, obesity) and atherosclerosis, and prevention methods targeting known risk factors, cardiovascular disease (CVD) remains the primary cause of mortality worldwide.¹ Data used in most studies, however, has been derived from individuals 55 years old or older,² and assessment of CVD risk among young and middle-aged adults has been studied seldom.

Measurement of carotid artery intima-media thickness (IMT) by ultrasonography has been used to evaluate the risk of future atherosclerotic plaque formation and development of CVD.³ Thickening of the carotid artery is a marker of subclinical atherosclerosis, and the predictive value of carotid IMT for CVD in younger individuals is equal to that of older individuals.^{4, 5} Studies evaluating carotid IMT and carotid plaque among individuals younger than 55 years have been conducted in college students,⁴ young adults with chronic renal failure,⁶ and non-US populations^{7–10}; however, findings may not generalize to young and middle-aged adults in the United States, particularly those from diverse ethnic, racial, and socioeconomic backgrounds. Predictors of new plaque formation in previous studies with older individuals include age, past and current cigarette smoking, hyperlipidemia, race, ethnicity, systolic blood pressure, male sex, and fasting glucose.^{11–13}

Studies indicate that as the number of childhood risk factors increases, IMT values increase,¹⁴ along with the severity of asymptomatic coronary and aortic atherosclerosis.^{15, 16} Conventional methods such as careful review of traditional risk factors or the use of risk prediction scales do not provide an accurate measure of CVD risk and atherosclerotic disease among asymptomatic individuals, and those who are asymptomatic make up a large portion (50%–64%) of sudden CVD-related deaths.¹⁷

In young patients with other comorbidities such as renal failure, the prevalence of carotid plaque may be as high as 92%⁶, but in healthy individuals younger than 50 years old, the prevalence appears to be low.^{8, 10} Because atherosclerosis is a slowly progressing disease that may begin early in life, investigation of early plaque formation is merited not only later in life but also in early adulthood.⁷ Our study measured carotid IMT and carotid plaque via ultrasonography as a measure of subclinical atherosclerosis and sought to identify the predictors of subclinical atherosclerosis among ethnically, racially, and socioeconomically diverse individuals 50 years old and younger living in Miami, Florida. It was anticipated that findings from the present study could facilitate early intervention and prevention of CVD.

Methods

Participants

Before any study-related activities were undertaken, approval from the University of Miami Miller School of Medicine institutional review board was obtained. Participants in this substudy were control participants, these being human immunodeficiency virus (HIV)–uninfected participants with no history of substance use, who were recruited as part of a larger study examining CVD in substance-using individuals with HIV. Candidates were recruited from December 2014 to September 2016 in Miami, Florida; inclusion criteria

required participants to be 18 to 50 years of age. Candidates were excluded if they had a history of hepatitis C, diabetes mellitus, hypertension, myocardial infarction, transient ischemic attack, bypass surgery, angioplasty, or lipid-lowering agents or statins use. HIV-infected participants and those with a history of cocaine use were excluded from the present study. A total of 173 participants were included in this study (91 men, 82 women).

Measures

Three resting systolic and diastolic blood pressure measurements were taken, and weight and height were measured. Body mass index (BMI) was derived from measured weight and height. The average of the three blood pressure measurements was used for data analyses. Participants completed a demographic and lifestyle assessment which included age, sex, current employment status, monthly personal income, cigarette smoking, and personal and family history of CVD. Cigarette smoking history was coded as never or current smoker based on a (yes/no) self-report. If the participant indicated being a current cigarette smoker, then he or she was asked to provide the approximate number of cigarettes smoked every day. Because the participants in this study were HIV uninfected, HIV testing was performed by using the rapid test OraQuick ADVANCE Rapid HIV-1/2 Antibody Test (OraSure Technologies, Bethlehem, PA).¹⁸

A carotid artery ultrasonography was performed using a high-resolution B-mode carotid ultrasound machine by a trained sonographer who was blinded to participant risk factors for CVD. A total of 400 carotid IMT and plaque ultrasonography images were taken at 1-cm segments of the distal common carotid artery near and far wall, 1 cm of bifurcation, and 1 cm proximal internal carotid artery near and far wall, which were then analyzed using a software measured offline with the automated edge tracking system M'Ath (Intelligence in Medical Technologies, Paris, France). M'Ath automatically searches in the vicinity of reference for the wall boundaries using an intensity-gradient detection algorithm. The final IMT values used in statistical analysis were calculated based on arithmetic averages for the IMT values obtained from each segment. Participants identified as being at risk of CVD by having IMT >1 mm or carotid plaque were referred for standard-of-care treatment for CVD risk.

The International Physical Activity Questionnaire¹⁹ was used to assess exercise frequency. Participants were asked to report the number of days in the past week in which they engaged in physical exercise for >10 continuous minutes and the approximate average number of minutes participants spent exercising on each day. To obtain a total number of minutes spent exercising in 1 week, the number of days spent exercising was multiplied by the average number of minutes reported. Given the high variability in responses, total scores were dichotomized into whether the participant had completed less or more than 150 minutes of exercise in a week using recommend exercise cutoffs.²⁰

Eating habits were assessed using the Rapid Eating Assessment for Participants.²¹ This scale assesses the intake of a variety of food groups. A greater score on this scale indicates better eating habits that are consistent with a balanced diet. Reliability for this scale in this sample was acceptable ($\alpha = 0.75$).

Depressive symptoms were measured using the Center for Epidemiological Studies-Depression Scale.²² Respondents were asked to provide the frequency of a variety of symptoms in the past week. Scores range from 0 to 60; higher scores indicate more severe depressive symptomatology. In this sample, the internal consistency was excellent ($\alpha = 0.87$).

Results

Participant ages ranged from 18 to 50 years, with a mean of 34.18 (standard deviation 8.9). Approximately half of the participants were men, two-thirds were African American, and half were employed. IMT values ranged from 0.49 to 1.03 mm, with a mean value of 0.70 mm (standard deviation 0.09). One-fifth of the participants (21%, 95% confidence interval [CI] 15.0–27.2) were identified as having carotid plaque in the carotid artery via ultrasound. In bivariate analyses, the detection of plaque was associated with older age, male sex, greater IMT, increased diastolic blood pressure, and current or past cigarette smoking (Table).

In multivariable logistic regression, older age (adjusted odds ratio [AOR] 1.08, 95% CI 1.01–1.16, $P = 0.024$), and cigarette smoking (AOR 2.67, 95% CI 1.02–7.00, $P = 0.045$) were associated with carotid plaque, after controlling for sex, diastolic blood pressure, and IMT (model Nagelkerke R^2 0.419). In other words, a 1-year increase in age was associated with an OR of 1.08 of having plaque in the carotid artery. Because carotid IMT is a precursor of carotid plaque, a model without IMT as a predictor also was tested. Excluding IMT, only age was associated with carotid plaque.

Given the high percentage of overweight/obese (73%) participants and current/past cigarette smokers (47 %), stratified analyses were conducted by BMI category and cigarette smoking status. In normal-weight participants ($n = 47$), no associations with carotid plaque were found; however, among overweight/obese participants, only older age (AOR 1.17, 95% CI 1.00–1.36, $P = 0.044$) remained associated with carotid plaque. No differences in associations with carotid plaque emerged between nonsmoking and smoking strata.

Discussion

This study evaluated subclinical atherosclerosis measured by the presence of carotid plaque in an ethnically, racially, and socioeconomically diverse sample 18 to 50 years old, and evaluated demographic and psychosocial risk factors associated with carotid plaque, adding to previous research conducted with older individuals, individuals with comorbidities, and non-US populations.^{23, 24} Consistent with previous studies, this study found that older age and cigarette smoking were associated with the presence of carotid plaque, with age being the most robust predictor of subclinical atherosclerosis.^{25, 26} In stratified comparisons, however, age was associated with carotid plaque only in overweight and obese participants, but not among participants of normal weight.

Our findings differ from what has been described in the literature. We did not find associations with other traditional risk factors such as systolic blood pressure, race, and sex.^{27–31} A few possibilities may account for these findings. This sample comprised

predominantly young ethnic and racial minority participants in whom elevated blood pressure may not have yet manifested. In addition, CVD risk among minority participants is typically assessed using white participants as the reference group,¹³ and in our sample white participants represented a small portion of our sample size, which may have disguised the potential to detect ethnic and racial differences in rates of subclinical atherosclerosis. The lack of association with sex may be accounted for by the reduction in the gender gap in previous decades,³² although historically men have had significantly higher rates of CVD.

The prevalence of subclinical atherosclerosis as measured by the presence of carotid plaque in this sample was 21%. A previous study in Finland among young adults reported a prevalence of carotid plaque of 2%,¹⁰ another in India reported 30%,³³ and in Japan plaque prevalence was not found among adults younger than 50 years old.⁸ The high prevalence of subclinical atherosclerosis in this sample may, in part, result from the predominantly African American racial composition of the sample. African Americans are at greater risk for CVD³⁴; however, any racial differences in this sample may have been obscured by the small sample size. Our findings suggest that early intervention with this group may be necessary to reduce health disparities in CVD risk and development for African Americans.

Previous studies have measured changes in carotid artery IMT changes over time using ultrasound to detect plaque formation as a measure of cardiovascular risk among older patients,³⁵ but IMT has not been used consistently in younger, multiethnic populations in the United States. The use of ultrasound to measure IMT and carotid plaque may be a useful tool in measuring and detecting CVD risk in young and middle-aged asymptomatic adults who smoke tobacco products or who are obese/overweight. The best approach to attempt to reverse plaque formation is a combination of behavioral (dietary, physical activity and smoking centered) and pharmacological (statins) interventions. New approaches to promote healthy behaviors, such as the use of motivational interviewing (interviewing techniques to promote self-motivated change), have been successful in reducing risk behaviors and should be explored in CVD risk-reduction programs.³⁶

This study was limited by the use of a cross-sectional design, restricting temporal and causal associations. Lack of variability in the sample may have limited the potential to detect associations with other factors (eg, using BMI, because no associations with carotid plaque were found among those who were normal weight). Given that the only traditional risk factors found to be associated with carotid plaque in this sample were age and cigarette smoking, it is possible that other nontraditional risk factors not assessed in this study may have influenced these findings. In addition, blood lipids and Framingham or coronary artery calcium scores were not measured or calculated in this study, and these may be more predictive of immediate CVD risk among asymptomatic individuals.³⁷ IMT has been found to be superior in detecting subclinical atherosclerosis in comparison to traditional measures of CVD risk, however.³⁸ Finally, the use of a dichotomous variable to define carotid plaque, rather than plaque size³⁹ and density,²⁹ also may limit results.

Conclusions

Although the link between CVD and cigarette smoking has been well established,¹¹ these results provide evidence that the cardiovascular damage caused by smoking may occur early. We propose to include the use of carotid ultrasound to detect subclinical atherosclerosis among young and middle-aged adult smokers and to explore the relative impact of providing IMT measurements to illustrate the physical evidence of developing CVD so as to enhance engagement in CVD prevention strategies. Future studies in younger populations could explore the relative impact of providing IMT measurements to enhanced interventions such as motivational interviewing³⁶ found to reduce risk, in comparison with the standard of care for CVD risk reduction.

Acknowledgments

We thank our research team at the University of Miami, community sites that provided referrals, and the men and women who participated in this study.

The contents of this publication are solely the responsibility of the authors and do not represent the official views of the National Institute on Drug Abuse or the National Institutes of Health.

This study was funded by National Institute on Drug Abuse grant no. R01DA034589, with support from the Miami Center for AIDS Research at the University of Miami Miller School of Medicine (National Institutes of Health grant no. P30AI073961).

References

1. World Health Organization. [Accessed August 24, 2017] Global atlas on cardiovascular disease prevention and control. http://www.who.int/cardiovascular_diseases/publications/atlas_cvd/en. Published 2011
2. Kesse-Guyot E, Vergnaud AC, Fezeu L, et al. Associations between dietary patterns and arterial stiffness, carotid artery intima-media thickness and atherosclerosis. *Eur J Cardiovasc Prev Rehabil*. 2010; 17:718–724.
3. Touboul PJ, Hennerici MG, Meairs S, et al. Mannheim carotid intima-media thickness and plaque consensus (2004–2006–2011). An update on behalf of the advisory board of the 3rd, 4th and 5th watching the risk symposia, at the 13th, 15th and 20th European Stroke Conferences, Mannheim, Germany, 2004, Brussels, Belgium, 2006, and Hamburg, Germany, 2011. *Cerebrovasc Dis*. 2012; 34:290–296. [PubMed: 23128470]
4. Breton CV, Wang X, Mack WJ, et al. Carotid artery intima-media thickness in college students: race/ethnicity matters. *Atherosclerosis*. 2011; 217:441–446. [PubMed: 21679950]
5. Eikendal AL, Groenewegen KA, Anderson TJ, et al. Common carotid intima-media thickness relates to cardiovascular events in adults aged <45 years. *Hypertension*. 2015; 65:707–713. [PubMed: 25624341]
6. Oh J, Wunsch R, Turzer M, et al. Advanced coronary and carotid arteriopathy in young adults with childhood-onset chronic renal failure. *Circulation*. 2002; 106:100–105. [PubMed: 12093777]
7. Oren A, Vos LE, Uiterwaal CS, et al. Cardiovascular risk factors and increased carotid intima-media thickness in healthy young adults: the Atherosclerosis Risk in Young Adults (ARYA) Study. *Arch Intern Med*. 2003; 163:1787–1792. [PubMed: 12912713]
8. Homma S, Hirose N, Ishida H, et al. Carotid plaque and intima-media thickness assessed by b-mode ultrasonography in subjects ranging from young adults to centenarians. *Stroke*. 2001; 32:830–835. [PubMed: 11283378]
9. Laitinen, T. [Accessed August 24, 2017] Cardiovascular health from childhood to adulthood—with special reference to early vascular changes. The Cardiovascular Risk in Young Finns Study. <https://www.doria.fi/bitstream/handle/10024/104430/AnnalesD%201174Laitinen.pdf?sequence=2>. Published 2015

10. Puttonen S, Kivimäki M, Elovainio M, et al. Shift work in young adults and carotid artery intima-media thickness: the Cardiovascular Risk in Young Finns study. *Atherosclerosis*. 2009; 205:608–613. [PubMed: 19215924]
11. Tattersall MC, Gassett A, Korcarz CE, et al. Predictors of carotid thickness and plaque progression during a decade: the Multi-Ethnic Study of Atherosclerosis. *Stroke*. 2014; 45:3257–3262. [PubMed: 25213342]
12. Sacco RL, Roberts JK, Boden-Albala B, et al. Race-ethnicity and determinants of carotid atherosclerosis in a multiethnic population. The Northern Manhattan Stroke Study. *Stroke*. 1997; 28:929–935. [PubMed: 9158627]
13. Polak JF, Tracy R, Harrington A, et al. Carotid artery plaque and progression of coronary artery calcium: the multi-ethnic study of atherosclerosis. *J Am Soc Echocardiogr*. 2013; 26:548–555. [PubMed: 23522805]
14. Hartiala O, Magnussen CG, Kajander S, et al. Adolescence risk factors are predictive of coronary artery calcification at middle age: the cardiovascular risk in young Finns study. *J Am Coll Cardiol*. 2012; 60:1364–1370. [PubMed: 22981553]
15. Berenson GS, Srinivasan SR, Bao W, et al. Association between multiple cardiovascular risk factors and atherosclerosis in children and young adults. The Bogalusa Heart Study. *N Engl J Med*. 1998; 338:1650–1656. [PubMed: 9614255]
16. Sillesen H, Muntendam P, Adourian A, et al. Carotid plaque burden as a measure of subclinical atherosclerosis: comparison with other tests for subclinical arterial disease in the High Risk Plaque BioImage study. *JACC Cardiovasc Imaging*. 2012; 5:681–689. [PubMed: 22789936]
17. Toth PP. Subclinical atherosclerosis: what it is, what it means and what we can do about it. *Int J Clin Pract*. 2008; 62:1246–1254. [PubMed: 18564201]
18. Reynolds SJ, Muwonga J. OraQuick ADVANCE Rapid HIV-1/2 antibody test. *Expert Rev Mol Diagn*. 2004; 4:587–591. [PubMed: 15347252]
19. Craig CL, Marshall AL, Sjostrom M, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sport Exer*. 2003; 35:1381–1395.
20. MacAuley D, Bauman AE, Frémont P. Exercise: not a miracle cure, just good medicine. *Br J Sports Med*. 2016; 50:1107–1108. [PubMed: 27587835]
21. Gans KM, Risica PM, Wylie-Rosett J, et al. Development and evaluation of the nutrition component of the Rapid Eating and Activity Assessment for Patients (REAP): a new tool for primary care providers. *J Nutr Educ Behav*. 2006; 38:286–292. [PubMed: 16966049]
22. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Appl Psychol Meas*. 1977; 1:385–401.
23. Costa RA, Reiber JH, Rybicki FJ, et al. Cardiovascular imaging 2010 in the *International Journal of Cardiovascular Imaging*. *Int J Cardiovasc Imaging*. 2011; 27:309–319. [PubMed: 21347592]
24. Santos IS, Bittencourt MS, Oliveira IR, et al. Carotid intima-media thickness value distributions in the Brazilian Longitudinal Study of Adult Health (ELSA-Brasil). *Atherosclerosis*. 2014; 237:227–235. [PubMed: 25244507]
25. Boulous NM, Gardin JM, Malik S, et al. Carotid plaque characterization, stenosis, and intima-media thickness according to age and gender in a large registry cohort. *Am J Cardiol*. 2016; 117:1185–1191. [PubMed: 26869392]
26. Pursnani S, Diener-West M, Sharrett AR. The effect of aging on the association between coronary heart disease risk factors and carotid intima media thickness: an analysis of the Atherosclerosis Risk in Communities (ARIC) cohort. *Atherosclerosis*. 2014; 233:441–446. [PubMed: 24530776]
27. Dong C, Cabral D, Marquez C, et al. Segment-specific association of body mass index with carotid plaque and intima-media thickness: the Northern Manhattan Study. *Arterioscler Thromb Vasc Biol*. 2012; 32(Suppl 1):A38–A38.
28. Martinsson A, Ostling G, Persson M, et al. Carotid plaque, intima-media thickness, and incident aortic stenosis: a prospective cohort study. *Arterioscler Thromb Vasc Biol*. 2014; 34:2343–2348. [PubMed: 25231637]
29. Alsulaimani S, Gardener H, Elkind MS, et al. Elevated homocysteine and carotid plaque area and densitometry in the Northern Manhattan Study. *Stroke*. 2013; 44:457–461. [PubMed: 23287787]

30. Dawber TR, Meadors GF, Moore FE Jr. Epidemiological approaches to heart disease: the Framingham Study. *Am J Public Health Nations Health*. 1951; 41:279–281. [PubMed: 14819398]
31. Rundek T, Gardener H, Della-Morte D, et al. The relationship between carotid intima-media thickness and carotid plaque in the Northern Manhattan Study. *Atherosclerosis*. 2015; 241:364–370. [PubMed: 26071659]
32. Mosca L, Barrett-Connor E, Wenger NK. Sex/gender differences in cardiovascular disease prevention: what a difference a decade makes. *Circulation*. 2011; 124:2145–2154. [PubMed: 22064958]
33. Khalil A, Huffman MD, Prabhakaran D, et al. Predictors of carotid intima-media thickness and carotid plaque in young Indian adults: the New Delhi birth cohort. *Int J Cardiol*. 2013; 167:1322–1328. [PubMed: 22537976]
34. Bahrami H, Kronmal R, Bluemke DA, et al. Differences in the incidence of congestive heart failure by ethnicity: the multi-ethnic study of atherosclerosis. *Arch Intern Med*. 2008; 168:2138–2145. [PubMed: 18955644]
35. Masiá M, Bernal E, Padilla S, et al. A pilot randomized trial comparing an intensive versus a standard intervention in stable HIV-infected patients with moderate-high cardiovascular risk. *J Antimicrob Chemother*. 2009; 64:589–98. [PubMed: 19625372]
36. Miller, WR., Rollnick, S. *Motivational Interviewing: Helping People Change*. New York: Guilford Press; 2012.
37. Greenland P, LaBree L, Azen SP, et al. Coronary artery calcium score combined with Framingham score for risk prediction in asymptomatic individuals. *JAMA*. 2004; 291:210–215. [PubMed: 14722147]
38. Carpenter M, Sinclair H, Kunadian V. Carotid intima media thickness and its utility as a predictor of cardiovascular disease: a review of evidence. *Cardiol Rev*. 2016; 24:70–75. [PubMed: 26825762]
39. Tiozzo E, Gardener H, Hudson BI, et al. High-density lipoprotein subfractions and carotid plaque: the Northern Manhattan Study. *Atherosclerosis*. 2014; 237:163–168. [PubMed: 25240111]

Key Points

- Despite prevention efforts, cardiovascular disease (CVD) remains the primary cause of mortality worldwide.
- Assessment of CVD risk among young and middle-aged adults younger than 50 years has seldom been studied.
- Carotid artery intima-media thickness measured by ultrasonography is a marker of subclinical atherosclerosis and may be used to predict CVD.
- Asymptomatic individuals comprise a large portion (50%–64%) of sudden CVD-related deaths.
- We measured carotid intima-media thickness and carotid plaque via ultrasonography as a measure of subclinical atherosclerosis and sought to identify the predictors of subclinical atherosclerosis among asymptomatic individuals 50 years old and younger living in Miami, Florida.

Table

Comparison between HIV-negative, cocaine-negative participants with and without carotid plaque

	No carotid plaque (n = 137) Median (SD) Min-max n (%)	Carotid plaque (n = 36) Median (SD) Min-max n (%)	<i>t/χ², P</i>
Age, y	30.0 (8.3) 18–49	43.0 (6.8) 20–50	7.03, < 0.001
Sex (%)			5.00, 0.025
Male	66 (48.5)	25 (69.4)	
Female	70 (51.5)	11 (30.6)	
Race (%)			2.54, 0.278
White	12 (9.0)	5 (15.6)	
African American	85 (63.9)	22 (68.8)	
Hispanic	36 (27.1)	5 (15.6)	
Employment (%)			0.113, 0.737
Not working	68 (49.6)	19 (52.8)	
Working	69 (50.4)	17 (47.2)	
Personal income/mo			2.91, 0.234
\$0–\$500	52 (38.0)	16 (44.4)	
\$500–\$1000	38 (27.7)	6 (16.7)	
\$1000	47 (34.3)	14 (38.9)	
Carotid IMT	0.67 (0.07) 0.50 – 0.89	0.80 (0.09) 0.64 – 1.03	6.30, < 0.001
Systolic blood pressure	115.5 (13.7) 91 – 153	116.5 (13.3) 96 – 153	0.82, 0.144
Diastolic blood pressure	71.0 (9.0) 51 – 98	74.5 (9.60) 58 – 94	3.34, 0.001
BMI (%)			4.30, 0.117
Normal	40 (29.2)	7 (19.4)	
Overweight	40 (29.2)	17 (47.2)	

	No carotid plaque (n = 137) Median (SD) Min-max n (%)	Carotid plaque (n = 36) Median (SD) Min-max n (%)	$t/\chi^2, P$
Obese	57 (41.6)	12 (33.3)	
Exercise, min/wk (IPAQ) (%)			1.77, 0.183
149	34 (25.0)	13 (36.1)	
150	102 (75.0)	23 (63.9)	
Smoking status (%)			11.24, 0.001
Nonsmoker	81 (59.1)	10 (27.8)	
Current/past smoker	56 (40.9)	26 (72.2)	
Family history of CVD (%)			0.49, 0.485
No	103 (75.2)	25 (69.4)	
Yes	34 (24.8)	11 (30.6)	
Nutritional habits (REAP) (%)	53.1 (8.2)	52.9 (8.5)	0.14, 0.892
Depression (CES-D) (%)	6 (8.36)	5.50 (6.70)	0.21, 0.832

Bivariate analysis, N = 173. Boldface type indicates statistical significance. BMI, body mass index; CES-D, Center for Epidemiological Studies-Depression Scale; CVD, cardiovascular disease; HIV, human immunodeficiency virus; IMT; intima-media thickness; IPAQ, International Physical Activity Questionnaire; REAP, Rapid Eating Assessment for Participants; SD, standard deviation.