Serum Total Cholesterol And Coronary Heart Disease In African American Women

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Abstract

This paper reviews evidence that serum total cholesterol predicts coronary heart disease (CHD) incidence or death in African American women. The NHANES I Epidemiologic Follow-up Study of over 1,000 African American women aged 25-74 and other published studies in African American women have yielded conflicting results concerning the association of serum total cholesterol and CHD. Perhaps due to the relatively small number of events in studies reviewed, the positive association of serum total cholesterol with CHD incidence in African American women was not consistently significant. Serum total cholesterol is a significant predictor of CHD risk in European American women especially at ages 25-54.

INTRODUCTION

In 1988-1994, 19.4% of African American women, and 20.2% of European American women in the US had age-adjusted elevated serum total cholesterol concentration (>=240mg/dL), down from 24.9% and 28.0%, respectively, in 1976-1980 (Table 1) ([1]). In all women, prevalence of elevated cholesterol increased from 7.3% at age 20-34 to 41.3% at 65-74 years ([1]). Also, coronary heart disease (CHD) mortality rates have been higher in African American than European American women in recent decades, e.g. 1997 age-adjusted death rates were 76.6 and 56.1, respectively ([1,2,3,4,5,6,7,8,9,10]). Consistent with higher US mortality rates in African American women, data from the Third National Health and Nutrition Examination Survey (1988-1994) revealed that prevalence of angina pectoris and self-reported myocardial infarction were higher among black than white women ([3]). Prevalence of myocardial infarction by electrocardiogram was the same in black and white women. In a national cohort at ages 25-54, age-adjusted incidence of CHD was higher in African American than in European American women: relative risk (RR) 1.76, 95% confidence interval 1.36-2.29 ([10]). However, few reports on serum total cholesterol and risk of coronary heart disease (CHD) incidence from prospective, longitudinal studies of population-based cohorts are available for African American women ([1,2,3,4,5,6,7,8,9,10,11,12,13,14,15]). This report will review results from the literature with an illustration from recently reported data from a national cohort which has now been followed for over 20 years ([9]).

Figure 1

Table 1: Serum cholesterol levels among women 20 years of age and over: United States 1976-80, and 1988-94.

	Percent >=240mg/dL		Mean, mg/dL	
Age, race, and Hispanic origin	1976-80	1988-94	1976-80	1988-94
20-74 y, age adjusted				
Total	27.6	20.0	214.0	205.0
White	28.0	20.2	214.0	205.0
Black	24.9	19.4	213.0	203.0
Mexican	20.0	17.5	207.0	203.0
20-74 y, crude				
Total	28.5	19.9	215.0	204.0
White	29.2	20.5	216.0	205.0
Black	23.7	16.8	212.0	199.0
Mexican	16.5	14.0	202.0	197.0

DISCUSSION

Despite its wide use in risk screening in all US population groups ([16, 17]), studies of serum total cholesterol concentration as an independent risk factor for coronary heart disease or mortality in African American women have yielded inconsistent findings ([2, 4,5,6,9,10,11, 18,19,20,21,22,23,24,25,26,27]). Results of the few cohort studies of African Americans reported prior to 1980, reviewed previously ([2]), failed to find an association of serum cholesterol with CHD in African American women or did not examine that subgroup. For example, the Evans County Study failed to find a significant association of serum

cholesterol and CHD risk in African American women ([5]). These prior cohort studies of African Americans ([2,4,18,19,20,21]) have consistently found elevated systolic blood pressure to be an independent risk factor for CHD in African American women and African American men ([1,2,3,4,5,6,7,8,9,10,11,18,19,20,21]). However, serum cholesterol has not consistently been found to predict CHD risk in African American women or men ([1,2,3,4,5,6,7,8,9,10,11,18,19,20,21]). A recent report from the Charleston Heart Study found in a small cohort of African Americans that a one standard deviation increase in serum cholesterol was significantly associated with increased CHD in African American women adjusting for age (RR=1.32; 95% confidence interval (9% CI) 1.04-1.68) but only borderline significant after adjusting for multiple risk factors (RR=1.29, 95% CI 0.99-1.67) ([4]).

The NHANES I Epidemiologic Follow-up Study (NHEFS) is a longitudinal study of participants in NHANES I who were 25-74 years of age at the time of the survey in 1971-75 ([12,13,14,15]). A report based on the initial wave of follow-up of NHEFS in 1982-84 failed to demonstrate a significant difference in predictive power of systolic blood pressure, serum cholesterol and income in African Americans compared to European Americans aged 25-74, although the association was not significant for serum cholesterol in African American women ([6]). A more recent study pooling data from NHEFS and the follow-up of NHANES II also failed to demonstrate significant differences in incidence density ratio for serum total cholesterol >240 mg/dL and coronary death between black and white women ([22]). However, the incidence density ratio for black women, estimated from a Cox regression model, was not significantly different from 1 (95% CI 0.94-2.08). Another NHEFS analysis estimated that 4% of all coronary events adjusting for age were attributable to serum cholesterol > 240 mg/dL in black women (compared to 10% in white men) ([11]).

One NHEFS study focused on serum total cholesterol as a risk factor for coronary incidence and death over a 20-year follow-up in 1,046 African American women free of CHD ([9]). In this analysis of African American women, results were inconsistent. At age 25-74, age-adjusted analyses yielded an association that did not attain statistical significance (fifth versus first quintile RR=1.62, 95% CI 0.89-2.98, p=0.12) ([9]). Adjusting for multiple risk factors (age, systolic blood pressure, body mass index, smoking, history of diabetes, low education, and low family income), the risk in the fifth quintile of serum cholesterol (261-591 mg/dL) was significantly higher than that in the first (53-179 mg/dL) (RR 1.88, 95% confidence interval 1.02-3.45, p=0.04) (Table 2) ([9]). However no dose response pattern was seen. Further, no significant relation to coronary heart disease death was seen (Table 2) ([9]). However, confidence intervals were wide so that an important effect could not be excluded. In this 20-year follow-up of over 1,000 African American women, a clear consistent relationship of serum total cholesterol and CHD incidence could not be established. Further, serum total cholesterol could not be shown to be related to coronary or all-cause mortality in African American women ([9]).

Figure 2

Table 2: Risk-adjusted relative risk of incident coronary heart disease and coronary

Death in black women aged 25-74 years by quintile of serum total cholesterol: NHANES I Epidemiologic Follow-up Study.

Quintile	Incidence		Death	
	RR	(95% CI)	RR	(95% CI)
1	1.00		1.00	
2	1.62	(0.88-2.99)	0.72	(0.23-2.26)
3	1.25	(0.67-2.32)	0.45	(0.15-1.41)
4	1.68	(0.92-3.07)	1.09	(0.40-2.93)
5	1.88	(1.02-3.45)*	1.00	(0.37-2.70)

*p<0.05

The prospective, cohort studies reviewed above were similar in study design, and directionality of findings. They were heterogeneous in sample size and number of endpoints, geographic region (Southeast only versus national), urbanization of subjects, and time period (1960's to 1990's) and significance of findings.

It should be noted that none of the studies reporting no significant association of serum cholesterol with CHD risk in African American women have had sufficient statistical power to exclude an important association. In such a case, a quantitative meta-analysis would be useful in aggregating the results of the smaller studies with the larger. Newer studies, such as the Jackson Heart Study, and data from large clinical trials may help shed light on this issue ([23]).

Cross-sectional or retrospective studies have also suggested a positive association of serum total cholesterol and CHD in African American women. One study of angiographically defined coronary artery disease in 568 African American women showed significantly higher unadjusted mean serum

total cholesterol level in women with coronary stenosis (227 mg/dL) than in those without (209 mg/dL) in univariate analyses ([24]). In another angiographic study of 217 African American women, the unadjusted association (1 mg/dL change odds ratio=1.01, 95% CI 1.00-1.01) was no longer significant after controlling for multiple variables including history of hypercholesterolemia (odds ratio=1.0050, 95% CI 0.9979-1.0121); however this may represent over-control of confounding ([25]). On the other hand, the ratio of total cholesterol to HDL cholesterol was a significant independent predictor of coronary stenosis (adjusted odds ratio=1.58, 95% CI 1.2746-1.9744). In another analysis, Maynard et al. ([26]) found a significant association in African American women and men combined but failed to report race-, sex-specific results. A case control analysis of in black women indicated that self-reported history of elevated cholesterol was related to self-reported history of heart attack (adjusted RR=2.9, 95% CI 2.2-3.9) ([27]). However, substantial information bias cannot be excluded in such a study.

Some limitations of the use of classical race categories have been previously identified ([28]). Classical race categories are primarily social and political classifications which largely fail to capture biologically and clinically meaningful variation ([28]). For example, genetic variation among Africans is greater than that among classical races and up to 30% of genes of African Americans are of European or Amerindian origin.

Recent studies have found TC/HDL ratio to be as good as any single lipid variable and better than most in predicting CHD in women ([25]). Dilution (bias toward the null) of TC-CHD associations by HDL-C may explain the equivocal findings for TC in published studies. Unfortunately, few published data are available to make such comparisons in African American women. One potential source of such data is the ARIC Study, which has unfortunately failed to report comparisons within ethnic groups to date ([28]). However, one ARIC report stated "there were no significant race-lipid interactions except among women for HDL_2-C (P=0.02)" ([28]). This finding, mentioned only in passing, suggests such ethnicity-specific analyses should be included in future ARIC reports. The NHANES II and NHANES III follow-up studies also offer an opportunity to examine this question. However, NHANES II data are limited to mortality only and the number of African American women is small. CDC researchers and others will analyze NHANES III follow-up data when they become available by the middle of this decade.

Given the large burden of cardiovascular disease in women ([1,2,3,4,5,6,7,8,9,10,11]), national research as well as disease control efforts are vital ([30,31,32])(Table 3)

Figure 3

Table 3: Health promotion and disease prevention objectives for 2010: overweight, diet, and serum cholesterol

Overweight and diet
- Increase the proportion of adults who are at a healthy weight.
- Reduce the proportion of adults who are obese.
- Increase the proportion of persons aged 2 years and older who consume at least two daily servings of fruit.
- Increase the proportion of persons aged 2 years and older who consume at least three daily servings of vegetables, with at least one-third being dark green or deep yellow vegetables.
- Increase the proportion of persons aged 2 years and older who consume less than 10 percent of calories from saturated fat.
- Increase the proportion of persons aged 2 years and older who consume no more than 30 percent of calories from fat.

Cholesterol
- Reduce the mean total blood cholesterol levels among adults.
- Reduce the proportion of adults with high total blood cholesterol levels.
- Increase the proportion of adults who have had their blood cholesterol checked within the preceding 5 years.
- Increase the proportion of persons with coronary heart disease who have their LDL-cholesterol level treated to a goal of less than or equal to 100 mg/dL.

CONCLUSION

In conclusion, data from the NHANES I Epidemiologic Follow-up Study and other studies revealed that the statistical significance of the association between serum total cholesterol and CHD incidence, CHD mortality, and all cause mortality in African American women, after adjustment for age and other risk factors, has not been consistent. However, in a number of studies there was a non-significant or inconsistently significant trend towards increased risk of CHD with elevated serum total cholesterol. Thus it seems prudent to assume that elevated serum cholesterol is a risk factor for CHD in African American women. Further cohort studies of larger numbers of African American women are needed to provide more precise estimates of the magnitude of this association for total serum cholesterol, and to examine HDL cholesterol and the ratio of total or LDL to HDL cholesterol as predictors of CHD in this group. Pooling of results from multiple studies and meta-analysis would also be productive and less expensive approaches for produce more precise estimates of effect.

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