A Preliminary Investigation of Cognitive Appraisal and Cardiovascular Reactivity and Recovery in Arab Americans

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Background: Arab Americans exhibit higher rates of hypertension and other cardiovascular risk factors relative to national averages. While research suggests some minorities may exhibit increased cardiovascular reactivity (CVR) to, and slowed recovery from, stress compared to Whites, which may represent a risk factor for hypertension and cardiovascular disease, this has not been studied in Arab Americans. This study examined differences between Arab Americans and Whites in cognitive appraisal, and blood pressure and heart rate (HR) reactivity and recovery to laboratory stressors.

Methods: The undergraduate sample included 27 Arab Americans (16 female) and 27 gender matched Whites. Eligible participants completed two stressful laboratory tasks (mental arithmetic [MA] and stress-recall [SR]). Cognitive appraisals were assessed for each task, and physiological data were collected during baseline, each laboratory task, and recovery. Ethnicity differences in baseline cardiovascular values and cognitive appraisals were examined with t-tests, while differences in CVR and recovery were tested with ANCOVA, controlling for initial values.

Results: Arab Americans showed lower baseline systolic blood pressure and mean arterial pressure than Whites. Arab Americans also reported greater threat and stress associated with MA, and greater threat for SR. No CVR differences were observed during MA; however during and after SR, Arab Americans evidenced lesser systolic and diastolic blood pressure reactivity and lesser HR recovery compared to Whites.

Conclusions: Overall, Arab Americans showed lesser reactivity than Whites, but also exhibited slower HR recovery. These results may be attributable to physiological habituation to chronic stress associated with minority status. (*Ethn Dis*. 2009;19:258–264)

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Introduction

Cardiovascular disease (CVD) is the leading cause of death in the United States and minority groups in general are at greater risk for a variety of cardiovascular pathologies. For example, African Americans and Native Americans are at increased risk of hypertension compared to Whites.[1] Although epidemiological data for Arab Americans is extremely scarce, this historically understudied population also demonstrates an increased risk of hypertension and CVD compared to Whites. A CVD reduction study conducted by the Arab Community Center for Economic and Social Services[2] using direct physiological measurement found that a greater percentage of Arab Americans had hypertension and hypercholesterolemia at all age groups except over the age of 60 years compared to national averages. Hatahet, Khosla, and Fungwe[3] using direct physiological measurement compared a sample of 352 Arab Americans to either NHANES III reference data or published data from Middle Eastern countries and concluded that Arab Americans had greater cardiovascular risks then the comparison groups. Similarly, Aswald[4] found higher levels of self-reported hypertension, diabetes, and hypercholesterolemia in Arab Americans in all age groups except those older than aged 65 years, compared to general population data.

Increased cardiovascular reactivity (CVR) to, and delayed recovery from, a variety of acute stressors have been implicated as potential pathological factors for hypertension and CVD.[5–8] For example, Moseley and Linden,[9] in a longitudinal study of 330 initially healthy individuals, found that CVR to handgrip, mental arithmetic, and anger-recall tasks predicted elevations in resting blood pressure at both 3 and 10 years. Delayed cardiovascular recovery was found to significantly relate to blood pressure elevations at 3 years but not 10 years. In a review of prospective studies, Treiber et al[10] concluded that there was evidence for a positive relationship between CVR and preclinical increases in blood pressure as well as cardiac events in individuals with existing hypertension.

Theoretical and empirical evidence suggests that cognitive appraisal theory provides a useful framework for conceptualizing the relationship between acute stressors and CVR.[11–13] Lazarus and Folkman[11] proposed that perceived stress was related to the cognitive appraisals that individuals make when exposed to environmental demands. In particular, primary appraisals are concerned with personal assessments of potential challenge (gain) or threat (harm/loss) and may be particularly relevant for CVR to environmental challenges. Within this framework, Houston[14] has argued that cognitive appraisal should be considered in studies of CVR.

It has also been suggested that frequent negative, recurrent life events, or chronic stress may modulate the relationship between acute stress and CVR and recovery. While a fairly robust effect has been found between chronic stress and delayed recovery,[15,16] the relationship for reactivity remains somewhat unclear. In a review of the literature, Gump and Matthews[15] found a positive association between background stressors and CVR in 6 of 11 studies and an inverse relationship in four studies. Other studies have also

…there is a paucity of research examining this relationship in the Arab American population despite the increased rates of hypertension and other risk factors for CVD…

produced mixed results. For example, Carroll et al,[17] in a study of middle aged and elderly adults, found a blunted cardiovascular response in individuals reporting significant disruptive life events, while Lepore, Miles and Levey[16] found a positive relationship between the number of chronic life stressors and CVR in 150 healthy college students. It has been suggested that differences in the interaction between types and duration of stressors along with demographic or dispositional differences, such as hardiness, may partially account for the mixed findings in reactivity.[8,15,18]

The effects of acute and chronic stressors on CVR and recovery have also been explored among minority populations. The majority of these studies have explored CVR among African Americans. Several excellent reviews suggest that, in general, Blacks display greater hemodynamic and heart rate (HR) reactivity than Whites to a variety of, but not all, acute laboratory stressors.[19–21]

Many of the blood pressure reactivity studies conducted with minorities have focused on the constructs of discrimination and racism as acute stressors. In their review of this literature, Brondolo, Rieppi, Kelly, and Gerin[19] reported that in 4 of 6 studies with African American participants, racist stimuli induced greater blood pressure reactivity than did anger-provoking stimuli. In a study to address differences between African American and White women, Guyll, Matthews and Bromberger[22] examined blood pressure reactivity to a mirror tracing task and a speech task that included elements of discriminatory treatment. As expected, the African American women exhibited greater hemodynamic reactivity to the speech task relative to Whites.

Discrimination and racism have also been identified as a form of chronic stress for minorities and have been implicated with negative health outcomes.[23–25] The relationship of these constructs, as a form of chronic stress, to CVR and recovery among minorities has been explored with mixed results. Clark,[26] in a study of 39 African American females, found a positive relationship between diastolic blood pressure (DBP) reactivity and scores of perceived racism. In contrast, Salomon and Jagusztyn[27] in a study of self-reported prior exposure to discrimination among Black, Latino, and White participants found a positive relationship between systolic blood pressure (SBP) and HR reactivity, and past discrimination for Latino, but not Black participants.

As with non-minority studies, the different findings associated with discrimination, racism, and other forms of chronic stress to CVR within the minority population may be influenced by a number of environmental and dispositional factors. A recent study examined the effects of prior exposure to discrimination, and the traits of hostility and optimism on CVR and recovery within a sample of 165 Black and White participants. The authors found that greater CVR and slowed recovery to an anger-recall task was associated with prior discrimination for those with low cynicism or high optimism in both racial groups, although the African Americans had greater reactivity and slowed recovery overall compared to Whites.[28]

In sum, the current literature has provided some insight into the relationship between chronic and acute stress and CVR and recovery in ethnic minorities, especially African Americans. However, there is a paucity of research examining this relationship in the Arab American population despite the increased rates of hypertension and other risk factors for CVD and numerous obstacles to receiving appropriate medical care.[29] Arab Americans may be a particularly important group to study as they have been the target of a significant negative reaction since the 9/11 terrorist attacks in the United States. In a report produced by the American-Arab Anti-Discrimination Committee,[30] self-report experiences of individuals from the Arab community show continued incidents of hate crimes, institutional discrimination and derogatory media coverage. It should be noted, however, that this report does not specifically address potential differences in either actual or perceived discrimination for recent Arab immigrants as opposed to domestic born United States citizens of Arab descent.

While Arab Americans are at increased risk for both hypertension and cardiovascular disease in general, no studies have examined CVR or recovery within this population. This may be an important atherogenic factor for this population given the variety of stressors, both acute and chronic, to which they are exposed. Therefore the main goal of this preliminary study was to examine potential differences between Arab Americans and Whites in blood pressure and HR reactivity to, and recovery from, two laboratory stressors. One stressor, mental arithmetic (MA) has been used extensively in the literature as a cognitively challenging task. The second stressor, a stress-recall task, was designed to elicit more personally salient experiences from the participants and to focus on eliciting emotional responses. Drawing from studies with African Americans that demonstrate that this population, like Arab Americans, are both at increased risk for CVD

and are exposed to institutional discrimination, and findings that support that African Americans demonstrate, in general, greater CVR and slowed recovery compared to Whites, we hypothesized that Arab Americans would exhibit greater blood pressure and heart rate reactivity to both laboratory tasks and slowed recovery compared to Whites. As a preliminary study, a secondary goal was to examine possible ethnic differences in cognitive appraisals as this may influence overall perceived stress. Because Arab Americans, like African Americans, are exposed to direct institutional discrimination potentially resulting in increased vigilance, it was hypothesized that they would make greater cognitive appraisals of threat and stress compared to Whites.

METHODS

Participants

Fifty-four students, aged 18–29 years, were recruited from introductory psychology classes. The study advertisement stated that participants must refrain from alcohol (12 hours) and caffeine (6 hours) prior to attending. Initial screening assessed adherence to these requirements along with exclusionary criteria that included a family history of early CVD; medical or psychiatric conditions or use of medications that could affect cardiovascular function; tobacco use; a body mass index >30; high blood pressure (systolic >140, diastolic >90); or aged >35 years. The sample consisted of 27 participants who self-identified as Arab (19 female) and 27 gender-matched participants self-identifying as White. The use of self-report for the collection of race and ethnicity data has been shown to provide a highly reliable means of classification.[31]

Measures

Heart rate was calculated from an electrocardiogram collected using a Biopac MP150 system (Biopac Systems Inc., California). Systolic blood pressure, DBP, and mean arterial pressure (MAP) data were collected every 90 seconds using a Critikon 1846sxp blood pressure monitor. Readings were averaged over time periods of baseline, MA, and stress-recall task. Minutes 5 through 9 of the recovery period were averaged to assess the degree to which participant's cardiovascular function had recovered from the recall task.

The Stress Appraisal Measure (SAM) was used to measure cognitive appraisals.[32] This is a 12-item instrument measuring appraised stress according to cognitive appraisal theory.[11] The threat and stress subscales were chosen because of their consistency with the model of stress appraisal and CVR. Each subscale consists of four items using a 5-point response scale. The response format for each item is: 1 (*not at all*), 2 (*slightly*), 3 (*moderately*), 4 (*considerably*), and 5 (*extremely*). Validation studies of the SAM indicate that the subscales reflect relatively independent factors.[32]

Following preparation for physiological data acquisition, participants sat quietly in a climate-controlled room for 8 minutes. The last 4 minutes of acquisition were used for baseline physiological data. Physiological data were then collected during and following each 4-minute task described below.

Verbal MA was administered first. Participants responded aloud after mentally subtracting units of seven from a large three-digit number. The experimenter prompted them to work faster, make fewer mistakes, and to try harder throughout. Participants then immediately completed an administration of the SAM with instructions to report how they predominantly felt during the task.

Following an additional 2-minute rest period, participants received instructions for the stress-recall task. We chose a stress-recall task to examine a more general, personally salient, stress response. Participants were instructed to think about "a very stressful time in your life, but one that you are willing to talk to the researcher about." Participants had 2 minutes to recall this scenario before being asked to try and "re-live the situation" by describing the stressful time for the next 4 minutes while physiological data were collected. Throughout the task, the experimenter actively prompted participants for emotional expression, encouraging participants to state what they said, felt, and did in the situation. After the task, participants again completed the SAM, and then re-engaged in the task for 2 minutes prior to a 10-minute recovery period. This re-engagement was designed to minimize the effect of reporting appraisal during recovery, which could affect recovery through distraction, altering rumination,[33] or affective expression.[34] Physiological data were then collected during a 10-minute recovery period.

Analysis

Repeated measures ANOVAs for SBP, DBP, MAP and HR were conducted to assess whether the tasks elicited the expected cardiovascular reaction. Ethnic differences in the cognitive appraisals of the two tasks were assessed using independent *t*-tests with Cohen's *d* as an index of effect size. The primary analysis of ethnicity differences in CVR and recovery were assessed using analysis of covariance (ANCOVA) for SBP, DBP, MAP, and HR with ethnicity as the between subjects factor and initial cardiovascular values as the covariate. That is, for reactivity, baseline cardiovascular values were used as the covariate, while recall values were used as the covariate for recovery analysis. ANCOVA was chosen for interpretability of between group differences.

RESULTS

Ethnic Differences in Baseline and Demographic Characteristics

Means and standard deviations of sample demographics and baseline car-

Table 1. Demographic and baseline cardiovascular values by ethnicity

	Arab *n*=27		White *n* =27			
Variable	***M***	***SD***	***M***	***SD***	***t***	***d***
Age	19.89	2.59	19.15	2.05	−1.16	0.32
BMI	22.63	3.14	22.83	3.32	0.22	0.06
Systolic BP	103.86	7.43	108.81	8.02	2.35*	0.64
Diastolic BP	64.48	6.07	66.12	6.95	0.93	0.25
MAP	79.22	5.43	82.82	6.65	2.18*	0.59
HR	80.00	10.21	78.42	9.40	−0.60	0.16

Note: *d* = Cohen's *d*; BMI = body mass index; HR = heart rate; BP = blood pressure (mm Hg); MAP = mean arterial pressure (mmHg). * $P < .05$.

diovascular data are presented in Table 1 with results of *t* tests for ethnic differences. Arab Americans and Whites significantly differed across baseline with Arab Americans demonstrating lower SBP, $t\ (52) = -2.35$, $P < .05$, and MAP, $t\ (52) = -2.18$, $P < .05$. While these results are not consistent with the prior community-based epidemiological studies, they may partially reflect the fact that our undergraduate sample tends to be younger, more educated, and were attending a university that is highly engaged with the Arab American community. No other baseline or demographic differences were observed.

Task Effects

Separate repeated measures ANOVAs for each cardiovascular variable were conducted as a manipulation check to determine if the laboratory tasks were effective in eliciting physiological arousal as expected. This analysis was conducted on the total sample. All main effects for the cardiovascular variables were statistically significant [SBP: $F\ (5,260) = 93.56$, $P < .01$; DBP: $F\ (5,260) = 85.37$, $P < .01$; MAP: $F\ (5,260) = 112.88$, $P < .01$: and HR: $F\ (4,212) = 97.72$, $P < .01$]. Pair-wise comparisons indicated significant change scores in the expected direction with elevated blood pressure and HR for both tasks compared to baseline followed by reduction of all cardiovascular values relative to stress-recall (recovery).

Task and Ethnicity Effects

Between-group differences on measures of cognitive appraisal were assessed during the mental arithmetic and stress-recall task using *t* tests (Table 2). Arab Americans had greater levels of both appraised threat and stress during the mental arithmetic task, $t\ (52) = -2.15$, $P < .05$ and $t\ (52) = -2.13$, $P < .05$, respectively. Additionally, Arab Americans reported higher levels of threat than White participants during the stress-recall task, $t\ (52) = -2.16$, $P < .05$.

Ethnic differences in CVR to the two tasks and cardiovascular recovery from the stress-recall task were assessed using ANCOVAs for each cardiovascular variable (see Table 3). Contrary to the hypothesis, no significant group differences in CVR were found from baseline to the MA task. For the more emotionally based stress-recall task, Arab Americans demonstrated lower levels of SBP and DBP reactivity than Whites, which is in contrast to what was hypothesized. While not statistically significant, there was also a trend with Arab Americans demonstrating lesser MAP reactivity ($P < .07$) and lesser HR reactivity ($P < .07$) contrary to our hypothesis. Finally, the results from the ANCOVAs for cardiovascular recovery from the stress-recall task showed that Arab Americans had slower rates of HR recovery than Whites.

Table 2. Cognitive appraisal by ethnicity

	Arab *n*=27		White *n*=27			
Variable	***M***	***SD***	***M***	***SD***	***t***	***d***
MA SAM Threat	8.48	3.59	6.70	2.38	−2.15*	0.58
MA SAM Stress	11.67	3.59	9.52	3.81	−2.13*	0.58
Recall SAM Threat	9.93	3.85	7.85	3.18	−2.16*	0.59
Recall SAM Stress	13.33	4.10	11.48	3.65	−1.75	0.48

Note: *d* = Cohen's *d*; SAM = Stress Appraisal Measure; MA = mental arithmetic task; Recall = stress recall task; * $P < .05$.

DISCUSSION

The aim of our preliminary study was to examine potential differences in cognitive appraisal and CVR to, and recovery from, stressful stimuli between a sample of Arab Americans and Whites. While Arab Americans have been shown to have increased incidence of hypertension and other risk factors for CVD, CVR and recovery have not been studied in this population.

One hypothesis was that compared to Whites, Arab Americans would make greater cognitive appraisals of threat and stress to the two tasks. This would be consistent with the theoretical impact of chronic or recurrent social stressors experienced by this population, which may be tied to greater vigilance to the social environment. This hypothesis was largely supported. Arab Americans reported greater appraisals of threat for both the traditional MA task and the potentially more personally salient stress-recall task and greater appraisals of stressfulness for the performance based MA task. It should be noted, however, that given our sample of undergraduate students, their cognitive appraisals may be less influenced by

Table 3. Results of ANCOVA of cardiovascular score by ethnicity with initial cardiovascular score as covariate

Time Period	Variable	*F*	*P*	Arab *n*=27		White n=27		Mean Diff. Arab-White
				EMM	*SE*	*EMM*	*SE*	
Baseline to MA	SBP	3.28	.076	119.60	1.76	124.20	1.76	−4.62
	DBP	1.11	.297	74.13	1.16	75.87	1.16	−1.74
	MAP	1.06	.309	93.19	1.23	95.01	1.23	−1.82
	HR	0.99	.324	89.93	1.54	92.11	1.54	−2.18
Baseline to Recall	SBP	4.30	.043	121.40	1.98	127.40	2.02	−5.99*
	DBP	7.98	.007	73.24	1.35	78.70	1.37	−5.46*
	MAP	3.59	.064	94.34	1.56	98.64	1.59	−4.31†
	HR	3.49	.067	85.58	1.39	89.27	1.39	−3.68†
Recall to Recovery	SBP	1.50	.227	106.30	1.28	108.60	1.31	−2.33
	DBP	0.53	.469	64.68	0.98	63.63	1.00	1.06
	MAP	0.20	.656	81.12	1.09	81.84	1.11	−.072
	HR	7.72	.008	80.34	1.03	76.27	1.03	4.07*

Note: MA = mental arithmetic; SBP = systolic blood pressure (mm Hg); DBP = diastolic blood pressure (mm Hg); MAP = mean arterial pressure (mm Hg); HR = heart rate; EMM = estimated marginal means. † < .07; * $p < .05$.

discrimination relative to a sample that more closely represents the general community.

Our primary hypothesis was that Arab Americans would exhibit greater CVR and slower recovery to the stressful laboratory tasks compared to Whites. This was based in part on findings from studies of CVR for African Americans, which represent another population exposed to racism and institutional discrimination. This hypothesis was generally not supported. For the MA task, cardiovascular responses did not significantly differ between groups despite greater cognitive appraisal of threat and stress by the Arab American participants, although there was a marginally significant trend ($P < .08$) with Arab Americans demonstrating lesser SBP reactivity. For the stress-recall task, Arab Americans exhibited lesser SBP and DBP reactivity than Whites and marginally less MAP and HR reactivity despite greater cognitive appraisals of threat; although they also demonstrated slowed HR recovery as predicted. This differential pattern of CVR for the two ethnic groups across the two tasks may partially reflect the nature of the tasks themselves. The MA task is primarily a cognitive challenge and may be more consistent with the typical stressors experienced by undergraduate students, while the stress-recall task may represent a more novel experience in a college setting. Thus, qualitative differences in the stressors could result in between group differences in factors such as task engagement resulting in differential patterns of CVR by task.[14]

The general findings of lesser CVR for Arab Americans may be conceptualized within the context of possible differences in patterns of physiological responding between ethnic groups, and habituation to recurrent stressors. In a review of differences in physiological patterns of CVR between African Americans and Whites, Anderson, McNeilly, and Myers[35] suggested that one mechanism linking greater CVR in African Americans may be greater α-adrenergic activity leading to increased total peripheral resistance while Whites demonstrate relatively greater β- adrenergic activity leading to increased cardiac output and decreased vasoconstriction. This mechanism is reviewed elsewhere.[21] While both α and β-adrenergic activity may lead to increased blood pressure, Kelsey[36] suggests that the β- adrenergic response may be more prone to habituation (attenuation after repeated exposure to stressors) then the α-adrenergic pathway. This interaction between differing CVR patterns and habituation may partially account for racial differences in CVR and hypertension between Blacks and Whites.

Given our findings of attenuated blood pressure and marginally attenuated HR reactivity in the presence of greater threat appraisal by Arab American during the stress-recall task, one could speculate that Arab Americans may demonstrate similar patterns of α-adrenergic and β- adrenergic activity relative to whites, and that the increased psychosocial stress and institutional discrimination experienced by Arab Americans may lead to relatively greater habituation of the cardiovascular response.

Finally, the general finding of attenuated blood pressure reactivity for Arab Americans relative to Whites does not support the overall idea that increased CVR to stressors represents a mechanistic factor in the development of hypertension for members of this minority group. While CVR should also be examined using a non-college student sample, the results suggest that other cardiovascular risk factors may be more clinically relevant for this population.

One limitation with the present study is that the tasks were not counterbalanced to assess cardiovascular recovery from the emotionally focused task. As a preliminary study, this decision was made to emphasize recovery from the more personally salient stress-recall task. This leaves the possibility that the findings were influenced

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by task order. In addition, it is important to note that this study used a convenience sample of undergraduate students and thus may not be representative of the Arab American community in general. This, combined with the relatively small sample may limit the generalizability of the results. Despite these limitations, a strength of this study is that it is the first examination of CVR within the understudied and at risk Arab American community.

In conclusion, while the hypotheses that Arab Americans would report greater cognitive appraisal of threat and stress to acute stressors compared to Whites was supported, Arab Americans demonstrated attenuated, as opposed to increased, CVR. In addition, while blood pressure recovery was not delayed, HR recovery was. The findings of attenuated CVR may be consistent with cardiovascular habituation to repeated stressors by Arab Americans. These preliminary findings do not support the supposition that increased CVR to stressors may be a pathogenic factor for hypertension or CVD for Arab Americans. In order to further elucidate potential mechanisms for the increased incidence of CVD, future studies should examine other possible factors associated with CVR in Arab Americans by exploring cardiac output and total peripheral resistance in addition to blood pressure and HR, as well as assessing the magnitude and nature of chronic or recurrent stressors experienced by Arab Americans.

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