



## Neuroticism, acculturation and the cortisol awakening response in Mexican American adults

Deborah Mangold<sup>a,\*</sup>, Jim Mintz<sup>b</sup>, Martin Javors<sup>b</sup>, Elise Marino<sup>a</sup>

<sup>a</sup> The University of Texas at San Antonio, San Antonio, TX 78249, USA

<sup>b</sup> The University of Texas Health Science Center at San Antonio, San Antonio, TX, USA

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### ABSTRACT

Neuroticism is associated with greater susceptibility to the adverse effects of stress and greater exposure to the stressors associated with acculturation in U.S. born Mexican Americans. Neuroticism and acculturation have been associated with injury to crucial stress response systems and are known risk factors for certain mood and anxiety disorders. The purpose of the current study was to examine the effects of neuroticism, and acculturation on the cortisol awakening response (CAR) in healthy Mexican-American adults. Salivary cortisol samples were collected at awakening and 30, 45, and 60 min thereafter, on two consecutive weekdays from 59 healthy Mexican American adult males (26) and females (33), ages 18 to 38 years. Participants were assessed for level of neuroticism and acculturation. Data were analyzed using a mixed effects regression model with repeated measures at four time points. Results showed a significant Neuroticism  $\times$  Acculturation  $\times$  Time interaction. The CAR was virtually eliminated in highly acculturated Mexican Americans with greater Anglo orientation and high neuroticism compared with less acculturated Mexican Americans with greater Mexican orientation and lower neuroticism. Findings suggest that some Mexican Americans with high levels of neuroticism may be particularly susceptible to certain challenges and stressors associated with acculturation leading over time to the development of allostatic load, desensitization of the Hypothalamic CRF system and attenuation of the CAR.

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### Introduction

Neuroticism is one of five independent personality dimensions that are heritable and stable over the adult life span (Costa and McCrae, 1992a, 1992b). Neuroticism is defined as the proneness of the individual to experience negative affective states, and is associated with increased exposure to stressful life events (Bolger and Zuckerman, 1995; Felsten, 2002, 2004) greater susceptibility to the adverse effects of stress (Kendler et al., 2004; Ormel et al., 2001) and thus, a major risk factor for mood and anxiety disorders (De Graaf et al., 2002; Fanous et al., 2002; Roberts and Kendler, 1999).

The relationship between neuroticism and stress may be of particular importance in Mexican Americans given that studies suggest that a number of Hispanics face unique stressors associated with some aspects of acculturation (Finch et al., 2000; Huebner et al., 2005; Mena et al., 1987; Miranda and Matheny, 2000). Acculturation involves adaptation into a host culture (Mena et al., 1987) and acculturative stress includes the psychological, somatic, and social stressors that are associated with the process of acculturation (Bernal and Saez-Santiago, 2006; Berry, 1980; Cervantes and Castro, 1985).

Neuroticism is associated with more exposure to acculturative stress (Mangold et al., 2007) and greater exposure to acculturative stress is associated with increased risk for mood and anxiety disorders in U.S. born Mexican Americans (Finch et al., 2000; Matheson et al., 2008; Romero and Roberts, 2003; Thoman and Suris, 2004). Indeed, exposure to acculturative stress is more likely to predict depressive symptomatology in Mexican Americans with high neuroticism (Hovey and King, 1996; Huebner et al., 2005; Salgado de Snyder, 1987). These findings raise the possibility that neuroticism may be a risk factor that significantly increases susceptibility to the adverse effects of stressors associated with acculturation.

There is growing interest in the extent to which chronic exposure to stressful life events leads to dysregulation of crucial biological stress response systems associated with increased vulnerability for mood and anxiety disorders. Stress-induced dysregulation of the Hypothalamic-Pituitary-Adrenal (HPA) axis is one neurobiological pathway that may link neuroticism with increased risk for mood and anxiety disorders in Mexican Americans exposed to high levels of acculturative stress. The cortisol awakening response (CAR) has received increasing attention as a useful method to assess the integrity of the HPA axis. The CAR is a reliable biological marker of HPA activity, dependent on a moderate genetic influence (Bartels et al., 2003; Schmidt-Reinwald et al., 1999; Wust et al., 2000a) and changes in the CAR can yield important information regarding the relationship

\* Corresponding author at: The University of Texas at San Antonio, HSS 4.04.21, 6900 North Loop 1604 West, San Antonio, TX 78249, USA. Fax: +1 210 458 5728.

E-mail address: [dmangold@utsa.edu](mailto:dmangold@utsa.edu) (D. Mangold).

between altered stress responsivity and attenuation of the awakening portion of the cortisol circadian rhythm. The sensitivity/capacity of the adrenal cortex is proposed to play a crucial role in the magnitude of the CAR (Kudielka and Kirschbaum, 2003; Pruessner et al., 1997, 1999). Thus, examinations of the extent to which neuroticism may link high levels of acculturative stress with dysregulations of the CAR and greater risk for mood and anxiety disorders in Mexican Americans, may be of particular interest.

While studies examining the effects of neuroticism on the CAR in Mexican Americans are non-existent, results from studies in non-Hispanics are mixed showing an enhanced CAR (Polk et al., 2005; Portella et al., 2005; Vedhara et al., 2006), diminished CAR (Hauner et al., 2008), and no association between neuroticism and the CAR (Chan et al., 2007; Van Santen et al., 2011). Inconsistent results may be due to differences in cortisol measurement and the diagnostic status of the samples examined (i.e., subjects with and without a formal diagnosis of depression versus subclinical symptomatology). Moreover, no available studies have examined the effects of neuroticism on the CAR while controlling for childhood trauma, a factor known to alter the HPA axis and the CAR (Heim and Nemeroff, 2001; Stetler and Miller, 2005; Mangold et al., 2010).

Equally lacking are studies examining the effects of unique forms of cultural stress on the CAR. Studies conducted in our laboratory showed a positive association between acculturative stress and neuroticism in Mexican Americans (Mangold et al., 2007) and that greater acculturative stress and more Anglo-orientation are associated with attenuation of the CAR, after controlling for the effects of childhood trauma and independent of a formal diagnosis of depression (Mangold et al., 2010). These findings suggest that similar to childhood trauma (Mangold et al., 2010), and subclinical symptomatology (Mangold et al., 2011; Dedovic et al., 2010), acculturative stress is associated with attenuation of the CAR in adults. This perhaps is not surprising given that theorists propose greater acculturation and more Anglo orientation may contribute to the erosion of crucial protective factors in some individuals, resulting in greater susceptibility to the adverse effects of chronic exposure to acculturative stress (Finch and Vega, 2003; Vega and Amaro, 1994). The absence of protective factors, in turn, may lead to the development of allostatic load, decreased adrenal capacity over time (McEwen and Lasley, 2003) and attenuation of the CAR. Indeed, theorists have proposed the “attenuation hypothesis” as one possible explanation that is consistent with the differences observed in the CAR in these studies. The “attenuation hypothesis” suggests that following chronic exposure to stress the hypothalamic CRF system may undergo desensitization, transitioning over time from a system with increased stress responsivity to a system with attenuated cortisol responses to stress and an attenuated CAR (Gunnar and Vazquez, 2001; Heim et al., 2008; Susman, 2006; Trickett et al., 2010). Results from a meta-analysis showing a negative correlation between length of time following the onset of chronic stress and the magnitude of the CAR provide additional support for this contention (Miller et al., 2007).

To date, there is a notable absence of studies examining the effects of neuroticism on the CAR in Mexican Americans and the majority of previous studies have failed to examine the effects of neuroticism while adequately controlling for factors known to alter the CAR (e.g., depression and childhood trauma, cortisol measurement with respect to time of awakening). Moreover, studies designed to distinguish the effects of neuroticism from the effects of acculturative stress on the CAR in Mexican Americans may be of particular importance. In view of the fact that neuroticism is associated with increased reactivity and susceptibility to the negative effects of psychosocial stressors, it is plausible that Mexican Americans with high levels of neuroticism, who are exposed to chronic acculturative stress, may represent an extraordinarily vulnerable group at high risk for attenuation of the CAR. Therefore, the aims of the current investigation were to: (1) examine the effects of neuroticism on the CAR in Mexican

Americans utilizing a carefully constructed sample monitoring system; (2) examine the effects of neuroticism on the CAR while carefully screening for a diagnosis of depression and controlling for the effects of childhood trauma, age and sex and; (3) distinguish the effects of neuroticism from the effects of acculturative stress on the CAR. Based on previous findings supporting the “attenuation hypothesis”, we hypothesized a significant Time  $\times$  Neuroticism  $\times$  Acculturation interaction where neuroticism would be associated with a significantly attenuated CAR in highly acculturated Mexican Americans with greater Anglo orientation after controlling for childhood trauma, depression, age and sex.

## Materials and methods

### *Participants and study design*

The study was approved by the University of Texas Institutional Review Board, and all participants gave written, informed consent prior to participation. Participants of Mexican descent ( $n = 59$ ), aged 18 to 38, were recruited from the San Antonio metropolitan area, through advertisements in the community and local college campuses. Specific details of procedures for the current study have been reported elsewhere (Mangold et al., 2010). During an initial visit to the laboratory participants underwent a screening interview and a battery of self-report assessments designed to identify and exclude factors known to potentially affect the HPA axis including: lifetime depression (Bhagwagar et al., 2005; Shea et al., 2007); use of oral contraceptives in the past 60 days (Meulenberg and Hofman, 1990; Pruessner et al., 1997, 1999); current pregnancy (Meulenberg and Hofman, 1990); menstrual cycle abnormalities (Bao et al., 2003, 2004; Suh et al., 1988); strenuous aerobic exercise (Hansen et al., 2008; Kanaley et al., 2001; Kelly et al., 2008); major medical conditions or history of head trauma; use of medications; severe obesity and current alcohol or other drug use disorders (Hansen et al., 2008; Huizink et al., 2006; Wand and Dobs, 1991). In addition, participants reporting abnormal sleeping patterns (Lasikiewicz et al., 2008), shift work or overtime (Lundberg and Hellstrom, 2002) were excluded from participation in the study (Clow et al., 2004; Hanrahan et al., 2006).

### **Psychometric assessment**

#### *Personality/neuroticism*

Personality was measured with the Revised NEO Personality Inventory (NEO PI-R; Costa and McCrae, 1992a, 1992b) a 240-item self-report measure of the five factors of personality including Neuroticism, Extraversion, Openness to Experience, Agreeableness and Conscientiousness (Costa et al., 1991; Costa and McCrae, 1992a,b; McCrae and Costa, 1983). Reliability for the current sample was strong ( $\alpha = .92$ ) and consistent with reliability reported in a previous study conducted in our laboratory, employing the NEO with healthy, English-speaking Mexican and Mexican American young adults (Mangold et al., 2007).

#### *Acculturation*

Acculturation was measured with the revised Acculturation Rating Scale for Mexican Americans (ARSMA-II; Cuellar et al., 1995). The ARSMA-II measures acculturation by assessing scores on two subscales: The Anglo Orientation Scale (AOS) and the Mexican Orientation Scale (MOS). The ARSMA-II has strong psychometric properties with good reliability for the current sample  $\alpha = .89$ .

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