AUTONOMIC BALANCE AND CONTROL OF STRESS FOR PARTICIPANTS IDENTIFIED AS HIGH OR LOW HOSTILE AND AS HAVING A POSITIVE OR NO FAMILY HISTORY OF CARDIOVASCULAR DISEASE

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The influence of autonomic activation in response to controllable versus noncontrollable stress, anger imagery induction, and relaxation imagery was studied among 80 participants between the ages of 18 and 34. Participants differed in level of trait hostility as assessed by the Irritability Subscale of The Buss-Durkee Hostility Inventory (Buss & Durkee,1957) and the Ho scale of the Cook-Medley Hostility Inventory (Cook & Medley, 1954). Groups were further subdivided with regards to either having a positive family history of cardiovascular disease or having no significant history. Results were obtained through analyses of electrocardiograph R-R intervals which produced an index of autonomic nervous system activation. Findings supported hypotheses involving the relations between autonomic balance and stress and hostility for the female and male populations. Among both populations, parasympathetic regulation was diminished during anger induction for individuals with high levels of trait hostility and having a family history of cardiovascular disease. Similar results were obtained for men during relaxation imagery induction.

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CHAPTER 1

INTRODUCTION

History and Development of Hostility as a Psychological Variable of Interest

With over four decades of research exploring the relationship between psychological factors and physiological health outcomes, hostility has been directly shown to be an independent risk factor for cardiovascular disease (CVD) (Miller, Smith, Turner, Guijarro, & Hallet, 1996). Since the initiation of the landmark Western Collaborative Group Study in 1957 (Rosenman, Friedman, Straus, Wurm, Kositchek, Hahn, et al., 1964), studies involving the relationship between personality and behavioral factors contributing to CVD have abounded. In the original Western Electric Study, 2,107 men aged 40-55 years old, who were employees of Hawthorne Works of the Western Electric Company in Chicago, were given physical examinations during 1957 through 1958. Men continuing in the study were reexamined annually through 1969. Follow up for mortality was conducted in 1978, as were additional health outcome data. After adjustment for age, blood pressure, serum cholesterol, cigarette smoking, and intake of ethanol, hostility was positively associated with crude 20 year mortality from coronary heart disease, malignant neoplasms, and renal disease (Shekelle, Gale, Ostfeld, & Paul, 1983). Overall, a difference in mean measures of hostility between the first and fifth quintile were associated with a 42% increase in risk of death.

The primary outcome of Rosenman and Friedman's work was the development of the construct of a Type A Behavior Pattern (TABP). The behavior pattern was said to be composed primarily of competitiveness, excessive drive and an enhanced sense of time urgency. Emergent in the construct was a principal subcomponent of easily aroused anger and hostility (Dembroski, MacDougal, Williams, Haney, & Blumenthal, 1985; Shekelle et al., 1983; Williams, Haney, Lee, Kong, Blumenthal, & Whalen, 1980). While the TABP represents a global construct and is applied to individuals who possess many, although not necessarily all defining characteristics, hostility as a behavioral manifestation, has become one of the most widely studied psychological correlates of CVD (Barefoot, Peterson, Dahlstrom, Siegler, Anderson, & Williams, 1991; Brosschot & Thayer, 1998; Gidron & Davidson, 1996).

Hostility has been broadly defined in many ways. One such conceptualization regards “Anger-In” as a critical dimension in the development of coronary atherosclerosis (CAD) (Dembroski et al., 1985; Donker, Breteler, & van der Staak, 2000; Haynes, Feinleib, & Kannel, 1980; Helmers, Krantz, Merz, Klein, Kop, & Gottdiener, 1995). This construct refers to the tendency on the part of persons to withhold expressions of anger or irritation against others, even when such expression would be appropriate or merited. Miller et al.(1996) in their meta-analytic review of research on hostility and physical health, have examined many other iterations of hostility. Many studies of hostility have looked with importance on “Anger-Out” (Donker, Breteler, & van der Staak, 2000; Houston & Vavak, 1991; Richards, Hof, & Alvarenga, 2000; Suls & Wan, 1993). This dimension typically emphasizes aggressive verbal or physical responses that are outwardly expressed. Verbal aggression includes insults, argumentativeness, shouting, and sarcasm. Physically harmful behaviors can be direct such as assaultive (physical attack or nonverbal threatening mannerism) or covert (theft). According to Miller et al. (1996), experienced anger and hostility have also been subdivided by researchers into such cognitive factors as cynicism or suspicion, or emotional factors such as trait anger or irritability. The cognitive-experiential dimension of hostility was defined as any measure that assessed brooding, suspicion, resentment, cynicism, or mistrust. Accordingly, suspiciousness reflects paranoia and fear of a threat to oneself. Cynicism is the belief that other people are selfish, dishonest, and willing to harm others. Emotional experiential components of hostility reflect nonverbal expressions of angry affect or hostile affect such as anger or irritation. While the meta-analysis attempted to cluster similar defining constructs and assessment measures, it concluded that few, if any, scales or rating systems were pure measures of only one component of hostility. This sentiment was echoed in another meta-analysis by Donker et al., (2000), that concluded, "… the findings in this study support previous research identifying hostility as a multidimensional construct… The distinct nature of the different measures, the interrelations between the measures, and the links of measures to different psychological constructs cannot be ignored" (Donker et al., 2000, p.173).

The profusion of measures designed to assess hostility in one way or another, attest to the richness in research and subtleties in distinction among theoretical constructionists in conceptualizing and measuring trait hostility. The Anger Expression Scale (Speilberger, Johnson, Russell, Crane, Jacobs, & Worden, 1985) rates Anger-In and Anger-Out, as well as total Anger Expression. It is comprised of 20 statements concerning anger expression that are rated on a 4-point scale. It is both a measure of trait anger and style of anger expression.

The Multidimensional Anger Inventory Anger-In subscale (MDAI) (Siegel, 1986) and the Framingham Anger-In scales (Haynes et al., 1980) also purport to measure the

Anger-In dimension of hostility. The latter questionnaire also has an Anger-Out subscale. The (MDAI) was derived from a factor analysis of a number of existing trait hostility measures.

Although not specifically referred to as an assessment of Anger-In and Anger-Out, the Hostility and Direction of Hostility Questionnaire (Foulds, 1965), is designed to measure hostility directed inwardly and outwardly toward others. Other measures of these dimensions not specifically referring to Anger-In/Out include the Novaco Anger Scale (Novaco, 1975) and the Buss-Durkee Hostility Inventory (Buss & Durkee, 1957).

The Buss-Durkee Irritability subscale is of particular importance in the study of physiological reactivity because of its emphasis on emotional experiential components of hostility that reflect nonverbal expressions of angry affect. According to Buss and Durkee (1957), the Irritability subscale reflects "a readiness to explode with negative affect at the slightest provocation. This includes quick temper, grouchiness, exasperation, and rudeness" (p.343). Considerable research has examined this dimension of trait hostility as a probable marker for the development of CVD (Miller et al., 1996; Siegman, Townsend, Civelek, & Blumenthal, 2000; Suls & Wan, 1993).

While numerous other self-report and structured interview assessments of hostility exist, the most widely used has been the Cook-Medley Hostility Scale (Ho) (Cook & Medley, 1954). The scale is based on 50 items of the Minnesota Multiphasic Personality Inventory, answered either in the original true-false format or in a Likert-scale format. It was originally developed for use by teachers in assessing their ability to get along with students. Studies examining the construct validity of this scale find it primarily assesses suspiciousness, resentment, and cynical mistrust (Smith & Frohm, 1985).

Ho scales assessing cynicism, hostile affect, and aggressive responding were predictive of a decrease in survival rate of lawyers from CVD and all other causes of death in a study by Barefoot, Dodge, Peterson, Dahlstrom & Williams, (1989). It should be noted that in another study by Gidron & Davidson (1996), a brief intervention program (eight 90 minute sessions) was successful in lowering antagonism, cynicism, and anger reactions. The Cook-Medley Hostility Scale has also been correlated with sociodemographic variables in a national survey of 2,536 adults (Barefoot et al., 1991). In general, the survey found that high Ho scores were over-represented in men, non-Whites, and those of lower socioeconomic status. It also suggested that hostility may account for some of the demographic variations in health status.

The numerous measures of hostility, each assessing a variety of subtle behavioral and psychological dimensions, have made the advancement of hostility as an independent risk factor of CVD tenuous. While few, if any, studies discount this important variable, comparing research outcomes has to some extent been impeded by the multiple assessment methods utilized. Once again, the meta-analytic review by Miller et al. (1996) asserts this perhaps moot distinction. It concludes that few, if any, scales or rating systems were pure measures of only one component of hostility. After controlling for other risk factors for CVD, the widely used Ho scale and other cognitive-experiential measures such as the Irritability scale of the Buss-Durkee, were most predictive of all-cause mortality (weighted mean $r = .16$) and to a lesser extent, CVD (weighted mean $r = .08$).

Psychophysiology of Parasympathetic and Sympathetic Activation

The underlying mechanisms affected by strong feelings of anger and hostility have been less clearly defined. In general, negative emotions, typically induced by some form of stress, have been found to increase metabolic demands. When metabolic demands on the individual increase, the autonomic system is believed to support increased metabolic needs by vagal withdrawal (which speeds heart rate) and sympathetic nervous system activation (Fabes, and Eisenberg, 1997). Vagal tone is an index of heart rate and heart rate variability and is thought to reflect vagal control of the autonomic nervous system. The study of vagal control of the heart has found application as a probable marker of individual differences in physiological responsiveness and adaptation to challenging environments (Sloan, Shapiro, Bagiella, Fishkin, Gorman, & Myers, 1995: Fabes &Eisenberg, 1997: Brosschot & Thayer, 1998).

Measurement of vagal tone involves detection of the heart beat and the timing between the heart beats. According to Porges's (1985) method of calculating vagal tone, an estimate of the influence of the vagus nerve on the heart is made by quantifying the amplitude of respiratory sinus arrhythmia. The temporal coupling between respiration and heart period, the phase relationship between respiration and heart period, and the periodicies of the respiratory and heart period oscillations, are quantified by a detrending procedure involving spectral analysis. High vagal tone reflects greater vagal regulation of metabolic activity, whereas low vagal tone, characterized by highly invariable heart rate patterns, reflects relatively weak vagal regulation. These assumptions about what vagal tone is thought to physiologically represent, allow for the direct "measurement" of how such emotions as hostility impact normal cardiovascular responsivity. Individuals with higher and more enduring heart rate responses to environmental stimuli are at increased risk for the development of cardiovascular disease and essential hypertension (Krantz & Manuck, 1984; Sloan, Shapiro, Bagliella, Myers, and Gorman, 1999). Low vagal tone is associated with decreased control of heart rate and slower recovery of both heart rate and blood pressure. Blood pressure switches from primarily cardiac regulation (via changes in cardiac output) to primarily vascular regulation (via changes in vascular resistance), resulting in greater blood pressure variability. When anger inhibition is made chronic or hyperresponsive, a persistent decrease in cardiovascular recovery speed and shift to long-term vascular control of blood pressure may result in CVD (Brosschot & Thayer, 1998).

According to Lovallo and Al'Absi (1998), there are two primary models of hypertension development. The hyperkinetic circulatory model postulates an inappropriately elevated cardiac output leads to changes in vascular structure and flexibility thereby permanently elevating vascular resistance. The second model focuses on morophological changes in thickened blood vessels and the left ventricle that precedes elevated cardiac output. Both models recognize an increased central nervous system activation and sympathetic outflow in the prehypertensive state (Lovallo & Al'Absi, 1998). The genesis of essential hypertension and factors germane to its development are unclear.

Physiological hyperresponsivity to environmental stressors is thought to promote endothelial damage via hemodynamic (ex. sheer stress, turbulence) and catecholamine-induced metabolic changes (ex. platelet aggregation, lipolysis, down-regulation of low density lipoprotein receptors), as well as excessive and sustained stress hormone production such as cortisol that are suspected in contributing to atherogenesis (Suarez, Kuhn, Schanberg, Williams, & Zimmerman, 1998). Suarez et al., (1998) have in fact found significant elevations of cortisol in men rated highly hostile when harassed during a stress-induction task over men assessed as being low hostile. The authors further found that the high hostile group in the harassed condition also exhibited greater cortisol elevations during recovery from the task. Such hormonal and sympathetically mediated reactivity presumably increases endothelial injury and subsequent accumulation of atheroma and incidence of cardiac arrhythmias (Krantz & Manuck, 1984).

Studies examining the relationship between parasympathetic cardiovascular control and disregulation of anger states (inhibition of hostility, under-expression of anger, etc.), support that the lack of heart rate and blood pressure variability is a prime contributor to CVD (Sloan, Shapiro, Bagiella, Myers & Gorman, 1999). In one such study, Brosshot and Thayer (1988) found that anger inhibition and slow cardiovascular recovery were associated with persistently low vagal tone. They attributed this finding to a belief that in social reality, incidences of anger inhibition outnumber incidences of anger expression. Slow cardiac recovery rather than high reactivity may be the mechanism underlying CVD risk associated with anger inhibition.

Suppressed vagal tone was also found in response to aversive imagery and worrisome thinking among participants identified with generalized anxiety disorder (GAD) as compared to those participants showing little or no anxiety (Lyonfields, Borkovec, & Thayer, 1995). The authors point out that "autonomic inflexibility may be a chronic characteristic of GAD and a phasic feature of emotionally negative cognitions" (pp. 465). Results are consistent with a similar finding in which electrophysiological evidence was indicative of abnormal cardiac autonomic control and increased risk of fatal ventricular arrhythmias for participants experiencing significant levels of anxiety (Kubzansky, Kawachi, Weiss, & Sparrow, 1998). Additional research comparing psychophysiological indexes of heart rate, heart period variability, and vagal tone, among high "panickers" and "blood phobics" in response to shock avoidance and cold face stress, demonstrated similar low levels in vagal tone index (Friedman & Thayer, 1998).

Perhaps the underlying cognitive-behavioral manifestations of anxiety involving sustained hypervigilance are similar to the hyperreactivity often demonstrated in individuals with high levels of hostility. Grossman, Brinkman, and De Vries (1992), found that hypertensives manifested heightened systolic blood pressure reactivity and attenuated cardiac parasympathetic responsivity to specific situations (memory comparison task and cold-pressor). Essential hypertension is a significant cause of organ damage, contributing to cardiovascular disease morbidity and mortality (Lovallo & Al'Absi, 1998). The consistently lower magnitude of respiratory sinus arrhythmia in the hypertensives group suggests that reduced parasympathetic control may be involved in the pathophysiology of hypertensives. This finding is similar to an earlier study of normotensives in which cardiac vagal tone was found to be responsive to varying behavioral demands and may interact in different ways with beta-adrenergic mechanisms (Grossman, Stemmler, and Meinhardt, 1990).

Hyperreactivity may be differentially elicited for different types of stressful situations (Suls & Wan, 1993). While Grossman et al. (1992), were able to arouse hyperreactivity in their hypertensive subject group through memory comparison and cold pressor tasks, another study using mental arithmetic and public speaking tasks were able to induce myocardial ischemia in CVD patients identified as defensively hostile

(Helmers, et al., 1995). Low hostile CVD patients did not demonstrate the same duration of ischemic episodes. It has also been suggested that stressors involving interpersonal antagonism or mistrust may be required to elicit differences in reactivity between persons measuring high versus low on trait hostility (Smith & Allred, 1989; Suarez & Williams, 1990).

Experimental stressors chosen to somehow approximate real-world stress may not accurately represent the psychological stress implicated in the etiology of cardiovascular disease. According to Sloan et al. (1995): “If reactivity in one condition generally is unrelated to reactivity in another, it will be difficult to identify individuals at risk…the reactivity hypothesis must take into account the extent to which individuals experience the autonomic context” (p. 457-458), (ie. magnitude of reactivity). Sloan et al. add that it would be unreasonable to expect that reactivity is stable across different contexts. In their comparison of 3 stress tasks, simple arithmetic, speeded subtraction, and Stroop color-word task, in either standing or supine conditions, data did in fact demonstrate substantial consistency of psychophysiological variables within the baseline and task periods. Using a procedure known as orthostatic tilt, sympathetic and parasympathetic influences were altered prior to task commencement. Basically, it is well known that the supine position is marked by greater parasympathetic activity than in an upright position. Using this experimental manipulation, Sloan et al. compared intraindividual psychophysiological variables across autonomic contexts (lower or high parasympathetic baseline levels of activation). There was only limited support for intraindividual consistency across different autonomic contexts for reactivity of vagal and sympathovagal activation. In essence, the tonic level of parasympathetic influence may effect further physiological responding to stress. This calls to mind the importance of the Law of Initial Values in properly assessing baselines of physiological activity. Simply put, if the baseline activity is low, relatively large responses are likely to be observed, whereas small magnitude responses are likely when the tonic level of arousal is high (Papillo & Shapiro, 1990).

In light of such findings, the influence of inhibited hostility on cardiac function is deserving of additional research. The present study aims to more closely examine the relationship between hostility, perceived control of mental stress, situational hostility, as well as examine any possible moderating effect of relaxation on reducing maladaptive physiological responses (ie. high sustained heart rate with low variability vis a vis vagal tone).

Hypotheses

The following hypotheses represent a synthesis of how hostility as a primary independent behavioral variable is thought to interact with situational factors of control, anger imagery and relaxation. Electrocardiography (ECG) findings comparing R-R intervals serves as the dependent measure in deriving an index of autonomic balance. Indirectly, this is used to describe and predict parasympathetic and sympathetic influences (autonomic balance) of cardiac function as dependent on level of trait hostility, situation, and family history of cardiovascular disease. The primary overriding research question is: *Are factors of perceived control and relaxation cardio protective for high hostile individuals?* The following hypotheses (in italics) address specific components of this primary question:

It is predicted that individuals scoring high on trait hostility will have lower autonomic balance than individuals scoring low on trait hostility. Situations in which there is no control over mental stressors will show less autonomic balance than situations where individuals have control.

This anticipated outcome is consistent with previous findings by Fabes and Eisenberg (1997) who found that as the level of stressor increased, individuals with relatively high vagal tone (i.e. high regulatory control) were less likely to experience negative emotional arousal than those individuals with relatively lower vagal tone. If a great deal of parasympathetic nervous system activation is demonstrated with increases in perceived control of the hostile situation, then control will have been shown to moderate the effect of hostility. The specific pattern of parasympathetic and sympathetic activation is unclear. An index of autonomic balance will therefore assist in clarifying the preponderance of relative influences of vagal activation and/or withdrawal as compared to sympathetic activation.

It is predicted that high hostile participants with a family history of cardiovascular disease will show decreased autonomic balance in response to anger than low hostile participants with or without a family history of CVD. In addition, it is predicted that the two factors will interact such that high hostile individuals without a family history will exhibit responding more similar to the low hostile individuals than to the high hostiles with a family history.

According to Lovallo and Al'Absi, (1998), positive parental history for hypertension is a major risk factor for hypertension and increased risk of CVD. Additional research by Higgins, Keller, Metzner, Moore, & Ostrander (1980) suggest that the two strongest risk factors for hypertension are parental history and elevated blood pressure. It is therefore predicted that high hostile participants will show a different pattern of cardiovascular responding to stress compared to low hostile participants, and that individuals with a family history of cardiovascular disease will show a different pattern than individuals without such a history. In addition, it is predicted that the two factors will interact such that high hostile individuals without a family history will exhibit responding more similar to the low hostile individuals than to the high hostiles with a family history.

It is predicted that individuals scoring high on trait hostility will show lower autonomic balance then individuals scoring low on trait hostility during self-reported periods of anger during anger imagery.

High hostile participants with a family history of cardiovascular disease will show decreased autonomic balance in response to anger as compared to low hostile participants with or without a family history of CVD. In addition, it is predicted that the two factors will interact such that high hostile individuals without a family history will exhibit responding more similar to the low hostile individuals with a family history. The reverse pattern of responding is anticipated during subjective reports of relaxation.

While attempts have been made to limit experimental confounding through careful participant screening (see Participants), variables that have not been experimentally held constant include cardiovascular fitness. Graham, Zeichner, Peacock, and Dishman, (1996) have found enhanced vagal tone index among aerobically fit participants. In this case, cardiovascular fitness mediated sustained bradycardia during autonomic challenge. In another study by Boutcher, Nugent, McLaren, & Weltman (1998), similar advantages in heart period variability and recovery during two mental tasks were noted for men with superior levels of aerobic training. Balancing cardiovascular fitness levels within group assignment would involve experimental resources beyond the capabilities of the present investigation. While it is anticipated that experimental randomization should negate this potential confound, physical fitness level may affect outcome hypotheses.

Anticipated Benefits

Recently, researchers have begun to question the role of the parasympathetic nervous system in the regulation of cardiovascular responses to stress. Time series analyses and detrending techniques have been developed to analyze heart period variability, providing an index of cardiac parasympathetic tone or vagal tone (Katona & Jih, 1975). Most of the research assessing vagal contributions to cardiovascular reactivity has been independent of the research assessing sympathetic influences on cardiovascular reactivity. Therefore, the relative contributions of the sympathetic and parasympathetic nervous systems to cardiovascular reactivity still are unclear. In addition, very little research has been conducted to assess how personality characteristics (e.g. hostility) moderate autonomic balance during stress and relaxation.

CHAPTER 2

METHOD

Participants

Eighty normotensive adult male and female students scoring either in the upper or lower 1/3 of selected hostility measures were utilized. While it may been more experimentally robust to establish high versus low hostile groups based on more extreme criteria (ie. base group selection on the lowest decile and highest decile of measure scores), results are more likely to be exaggerated when compared to the normal distribution. As Houston and Vavak, (1991) point out, when extreme groups are employed, "it assumes that the relations under investigation are linear. The potential weakness of such a design is that it underestimates the complexity and potential magnitude of the relations if they are not linear" (p. 11). By separating groups based on upper and lower thirds, a more conservative and likely more representative division of the normal population has been made.

Hostility has been shown to be more prevalent with males than females (Barefoot, Peterson, et al., 1991), is highly related in angiographic findings for males and not females (Dembroski, MacDougal, Williams, Haney, & Blumenthal, 1985), as well as for atherosclerosis (Williams, Haney, Lee, Kong, Blumenthal, & Whalen, 1980). In addition, measures of hostility may be assessing different psychological constructs in males and females (Brosschot & Thayer, 1998; Davidson, Prachkin, Lefcourt, & Mills, 1996; Gidron & Davidson, 1996). While recent studies have called for the inclusion of female participants in cardiovascular reactivity studies, Miller et al. (1996) caution against combined gender studies. They point out that men have higher levels of coronary heart disease than women and that data should be analyzed separately. Additionally, Suarez et al. (1998) have found a significant correlation between plasma testosterone levels and expression of anger among high hostile men when harassed. Other researchers have found that females benefit differentially from males when given the chance to make some behavioral response including positive responding and/or adaptive coping to hostile situations (Brosschot & Thayer, 1998; Saab, Llabre, Schneiderman, Hurwitz, Mcdonald, Evans, Wohlgemuth, Hayashi, & Klein, 1997). Clearly, simple aggregation of data across genders would not reflect these significant underlying hormonal and behavioral response differences. Male and female data were therefore treated separately in the present study.

Children were specifically excluded from this study on the basis that a separate age-specific study in children is warranted and preferable due to specific cognitive and developmental stages, and extraordinary effort would be needed to include children.

Additional exclusion criteria included the use of medications which affect cardiovascular functioning and the use of recreational drugs. Individuals experiencing moderate depression were also excluded from the study due to potential confounds with suppressed cardiac responsivity. Participants received extra credit toward a health psychology course offered at U.N.T. (see Appendix A for “Participant Sign-up Sheet”). Health psychology students represent a large student pool from a variety of academic disciplines. Students range in age throughout the adult age span and represent a variety of ethnocultural and linguistic backgrounds. Participants ranged in age between 18 and 34 years old in order to acquire lawful consent and minimize cardiovascular disease confounds more prevalent in individuals over the age of 35.

Questionnaires

Although the Cook-Medley (Cook & Medley, 1954) has been the most widely used hostility inventory for assessing cardiovascular responsivity, it has been criticized due to the inconsistent results that have been obtained, its poorly defined internal structure, and weak construct validity (Contrada & Jussim, 1992). Other measures, such as the Buss-Durkee Hostility Inventory, have been well established and subjected to substantial validation (Contrada & Jussim, 1992; Miller, Smith, Turner, Guijarro, & Hallet, 1996). Therefore, the Irritability subscale from the Buss-Durkee Hostility Inventory (Buss & Durkee, 1957), as well as the Cook-Medley Hostility Inventory was utilized as the assessment measures of hostility (see Appendix B and C). Participants scoring in the upper 1/3 of the Irritability subscale and also scoring in the upper 1/3 of the Ho Total Hostility score were classified in the High Hostile Group; those in the lower third of both measures were included in the Low Hostile Group. Students scoring in the middle 1/3 were excluded. The hostility measures used to classify group membership were compared and a Pearson correlation of .574 ($p < .001$) was found between the Total Hostility score of the Cook Medley Inventory and the Irritability subscale of the Buss-Durkee Hostility inventory.

The Beck Depression Inventory II (BDI) (Beck, 1996) was completed by all participants prior to group assignment. Individuals scoring in the moderately depressed range were excluded as experimental participants. The instrument is one of the most popular brief measures for screening depression with acceptable reliability and validity.

A questionnaire developed to assess family history of cardiovascular disease was completed by the participants (see Appendix D). Participants were asked to indicate if either parent or their 4 grandparents had a cardiac event (heart attack or stroke), or death from cardiac event, prior to the age of 50. Participants were screened until each of four groups had an N=>20 (high/low hostile with a family history and high/low hostile without a family history, 10 female and 10 male per group). In total, 412 individuals completed the hostility measures, family history questionnaire, and the BDI. Females represented the largest number of respondents with 252 or 61%, while males accounted for 160 or 39%.

Physiological Recording

A three lead electrocardiograph (ECG) was used to continuously record data using a Grass polygraph (Model 7D) coupled to a WinDaq DI220 analogue-to-digital (A/D) converter (WinDaq Pro Plus for Windows Instruments Incorporated, Akron, OH) and microcomputer, using a 200 Hz sampling rate. The digitized ECG signals were scored on a beat to beat basis and then ensemble averaged with reference to the peak of the ECG R-R interval (RRI). The data from each 6-min segment were then linearly interpolated and detrended with a third-order polynomial fitting and divided into 128-point segments with 50% overlap for fast Fourier transform analysis using templates created with the data analysis and display software (DADisp/AdvDSP, DSP Development; Cambridge, MA). Harmonic power in the high frequency (HF; 0.20-0.28 Hz) and low frequency (LF; 0.04-0.12) was extracted. In addition, the high frequency (HF) and low frequency (LF) of the RRI variability was normalized from the ratio of LF/HF to derive an index of autonomic balance. A higher autonomic balance index is thought to represent a preponderance of sympathetic activation with diminished parasympathetic activation and is generally reflective of lower autonomic balance.

Scores of lower autonomic balance index represent a higher ratio of parasympathetic activation over sympathetic and is reflective of higher autonomic balance (Wray, Formes, Weiss, O-Yurvati, Raven, & Zhang, 2001).

Tasks

Most studies of cardiovascular reactivity have utilized cognitive (e.g. mental arithmetic) and/or physical (e.g. cold pressor, tread mill) stressors. Recently it has been suggested that emotional stressors may offer a more valid form of stress that would be more representative of “real world” stressful situations (Jamner, Shapiro, & Goldstein, 1995; Suls & Wan, 1993). It has also been suggested that stressors involving interpersonal antagonism or mistrust may be required to elicit differences in reactivity between persons measuring high versus low on trait hostility (Smith & Allred, 1989; Suarez & Williams, 1989). In addition, no study has assessed whether hostile individuals exhibit differential sympathetic and parasympathetic responses to a relaxation response. Imaging has become an accepted method of inducing emotional responses (Grossman, et. al, 1995; Lyonfields, Borkovec, & Thayer, 1995). Therefore, participants performed two guided imagery tasks - anger and relaxation. Prior to guided imagery induction, participants were asked to discuss a situation which makes them extremely angry. In addition, they reported on what they found threatening, as well as what they valued as personally important. This information was used to tailor the guided imagery and to prepare the participant for the task. A standard progressive mental relaxation script was read to each participant for the relaxation phase (see Appendix E). While no standardized anger/relaxation induction script exists, manipulation checks, in which participants rate the level of arousal induced has been used reliably in other studies (Suarez et al., 1998).

A simple 7 point Likert-type scale with 7 representing “very much” and a score of 1 representing “not at all” was used to assess psychological reactivity in each of the 4 experimental conditions - anger imagery, relaxation, as well as level of control in the following two cognitive stressor tasks (see Appendix F for Manipulation Check Scales). Participants performed an arithmetic task involving the mental subtraction of 13 from a random four digit number. For each presentation, participants responded verbally to the mental arithmetic stimulus item. In one condition, participants had no control over the speed of stimuli presentation. Each item was flashed on the computer screen in a progressively more rapid fashion. In another presentation, the participants were able to control the rate of stimulus presentation in such a way that when they stated the answer they then pressed a key to bring up the next stimulus item.

Procedures

Upon arrival at the psychophysiology laboratory, the procedures (including the anger/relaxation induction) were explained to the participants and an informed consent was obtained (see Appendix G). The participant was seated and ECG leads were attached on the right and left forearms and left calf region. Participants were asked to sit for 10 minutes to allow them to acclimate to the environment. A continuous 6 minute baseline was then recorded. Participants performed each task for a minimum of 6 minutes. The order of the tasks were counterbalanced and there were 6 minute recovery periods between each task in which baseline data were obtained. When all tasks were completed, sensing devices were removed and participants were debriefed to ensure that there was no residual anger or frustration. None of the participants reported excessive or unusual distress arising from the anger induction imagery. The Education and Testing

Counseling Center was available for crisis response in the event residual anger required additional psychological interventions. Further, Dr. Franks was available for telephone consultation in the unlikely event additional safety or crisis response measures were necessary.

CHAPTER 3

RESULTS

Statistical Procedures

A 2 group (high/low trait hostility) x 2 group (with/without family history) x 4 experimental conditions (arithmetic task: no control or speeded, and anger induction visualization and relaxation conditions) design was utilized. Dependent variables of interest were index of autonomic balance and magnitude of subjective change in anger, relaxation, and control during arithmetic tasks. Responses from the manipulation check (i.e. magnitude of subjective change) were multiplied with the autonomic balance index in order to derive a change score for each condition, or "weighted autonomic balance index".

Prior to analyses, dependent measures were examined through various SPSS programs for accuracy of data entry, missing values, and fit between their distributions and the assumptions of multivariate analysis. There were no missing cases and data conformed to basic assumptions of normality, linearity, and homoscedasticity of variance.

Experimental conditions were counterbalanced in order to minimize the influence of order effects. Baseline indexes of autonomic balance including recovery periods between experimental conditions were compared by use of a one-way ANOVA in order to ensure that recovery periods were unrelated. No significant differences between baselines emerged; the means and standard deviations (*SD*) are as follows: baseline 1 =

.433, .034 (*SD*), baseline 2 = .429, .025 (*SD*), baseline 3 = .423, .023 (*SD*), and baseline 4 = .420, .028 (*SD*).

A one-way ANOVA was conducted in order compare means among weighted autonomic balance indexes for anger, relaxation, and control conditions for low versus high trait hostility participants. Comparisons revealed significant between group differences for weighted autonomic balance for the anger and relaxation conditions. Table 1 summarizes the ANOVA findings:

Table 1

Analysis of Variance for Weighted Autonomic Balance per Experimental Condition

Experimental Condition[a]	*df*	*F*	*Mean Square*	*p*
Anger	3	3.007	.901	.035[*]
Relaxation	3	4.523	1.336	.006[**]
Control	3	2.244	.996	.090
No Control	3	2.650	1.314	.055

Note. [a]*n* = 20 for each group.
[*]$p < .05$. [**]$p < .01$.

A post hoc test for multiple comparison of means (Fisher's least significant difference (LSD)) was applied in order to specify group differences. Significant mean differences were observed among female participants in the anger condition. Specifically, high hostile females had higher weighted autonomic balance indexes than low hostile females. Significant mean differences were also observed among female participants in the relaxation condition. In this case, high hostile females had higher weighted autonomic balance indexes than low hostile females. Table 2 summarizes group means, standard deviations, standard errors, and levels of significance for these groups:

Table 2

Least Significant Differences per Experimental Condition for Females

Experimental Condition[a]	*Mean*	*Standard Deviation*	*Standard Error*	*p*
<u>Anger</u>				
Low Hostile	1.268	.454	.102	
				.046[*]
High Hostile	1.619	.533	.120	
<u>Relaxation</u>				
Low Hostile	1.05	.548	.123	
				.006[**]
High Hostile	1.54	.460	.103	

Note. [a]$n = 20$ for each group.
[*]$p < .05$. [**]$p < .01$.

A series of independent sample T-Tests were conducted in order to examine the relations between levels of hostility and family history of CVD across experimental conditions. Significant differences emerged only between female groups. Specifically, low hostile females with no family history of CVD demonstrated significantly lower weighted autonomic balance indexes than high hostile females with a family history of CVD during anger and relaxation conditions. Low hostile females with a family history of CVD also demonstrated significantly lower weighted autonomic balance indexes than high hostile females with a family history of CVD during anger and relaxation conditions. Tables 3 and 4 summarize group means, standard deviations, standard errors, and levels of significance for these groups.

Table 3

Significant Independent T-Tests per Experimental Condition for females

Experimental Condition[a]	*Mean*	*Standard Deviation*	*Standard Error*	*t*	*df*	*p (2-tailed)*
Anger						
Lo Hos No Fam Hx of CVD	1.276	.442	.140	-2.325	18	.032*
Hi Hos Fam Hx of CVD	1.790	.542	.172			
Relaxation						
Lo Hos No Fam Hx of CVD	.970	.635	.201	-2.432	18	.026*
Hi Hos Fam Hx of CVD	1.54	.387	.122			

Note. [a]*n* = 10 for each group.
*$p < .05$.

Table 4

Significant Independent T-Tests per Experimental Condition for females

Experimental Condition[a]	*Mean*	*Standard Deviation*	*Standard Error*	*T*	*df*	*p (2-tailed)*
Anger						
Lo Hos Fam Hx of CVD	1.260	.489	.155	2.295	18	.034*
Hi Hos Fam Hx of CVD	1.790	.542	.172			
Relaxation						
Lo Hos Fam Hx of CVD	1.14	.464	.147	2.104	18	.050*
Hi Hos Fam Hx of CVD	1.54	.387	.122			

Note. [a]*n* = 10 for each group.
*$p < .05$.

Weighted frequency means graphs were also completed in order to illustrate the relationship between high and low frequencies under each condition. In each case the magnitude of change score in relaxation and anger (from the manipulation check) were multiplied by the group mean frequencies.

Figure 1 Weighted Frequency Means

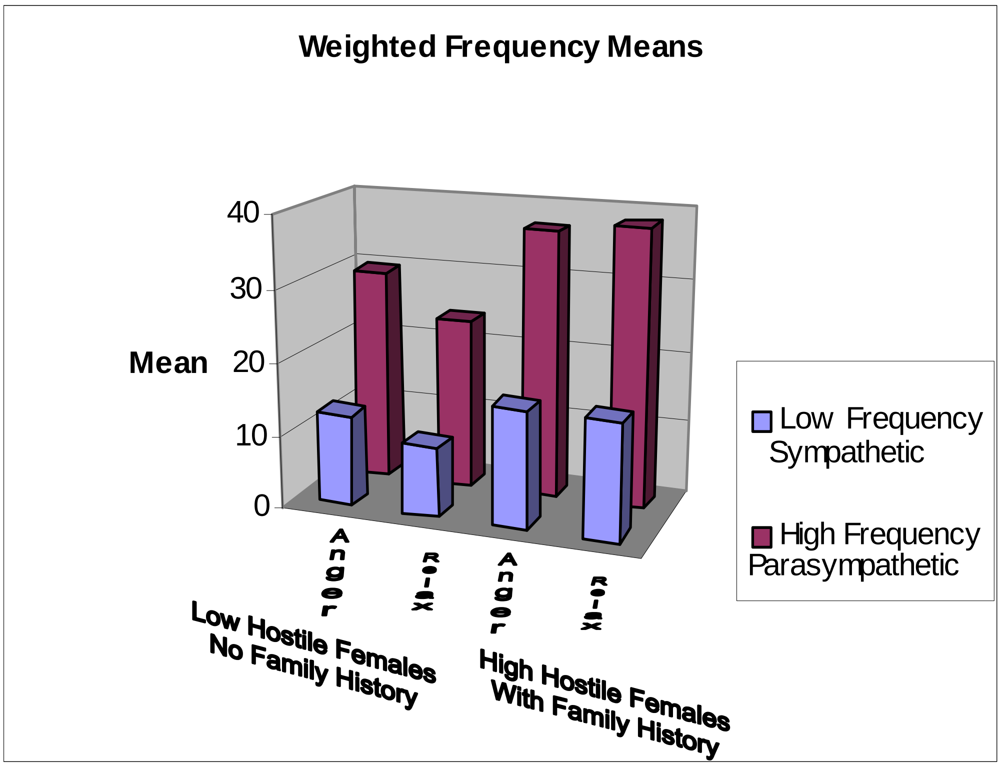
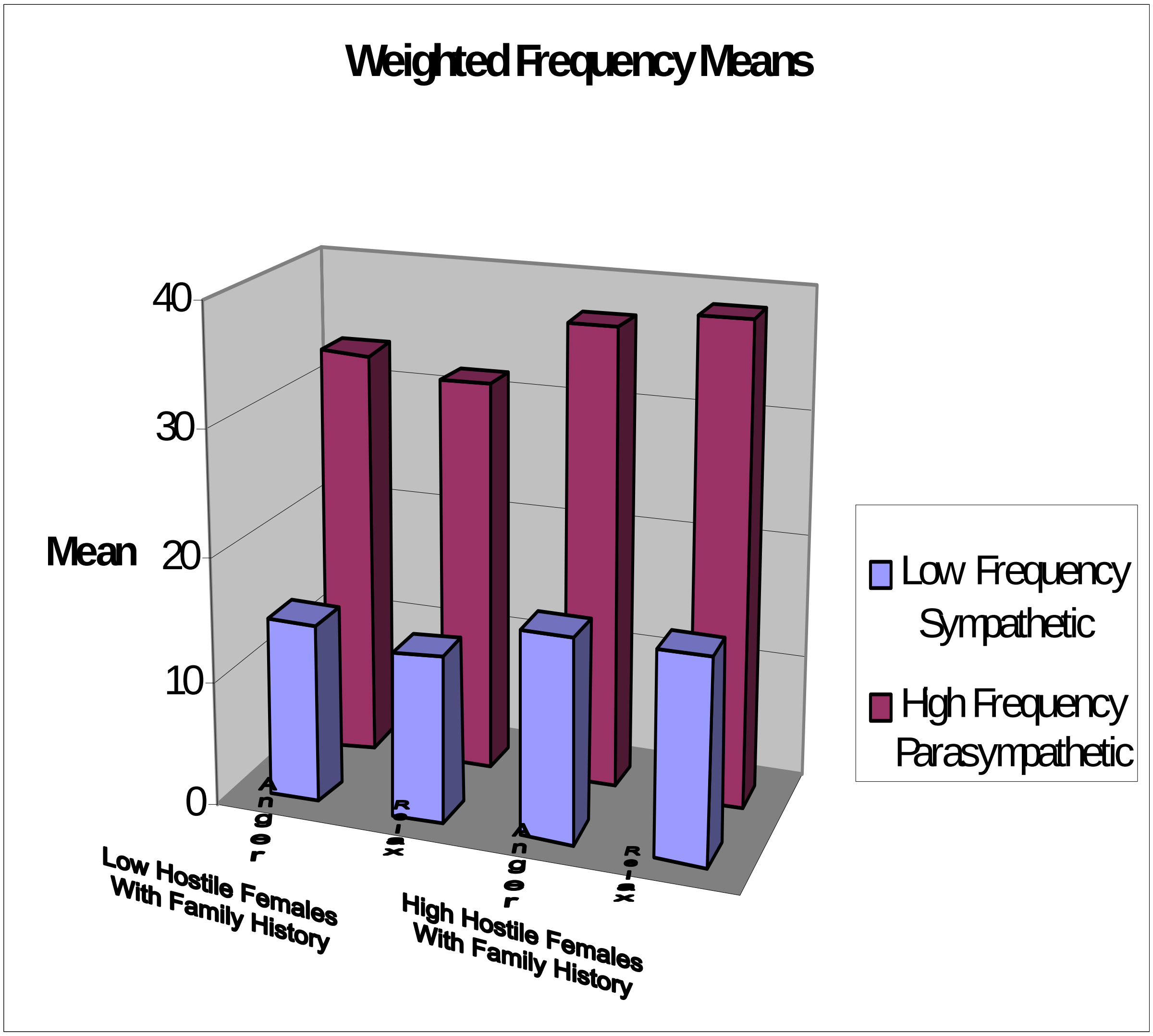


Figure 2 Weighted Frequency Means



The magnitude of change score (manipulation check) was considered in order to examine if significant differences existed between groups per experimental condition. A one-way ANOVA was applied, and when significant differences were found, post hoc tests using LSD were conducted. Accordingly, significant differences were found for the relaxation magnitude. Specifically, during relaxation low hostile females with no history of CVD rated their increase in relaxation significantly lower than high hostile females with a family history of CVD. Low hostile males with a family history of CVD rated their increase in relaxation significantly lower than high hostile males with a family history of CVD. There were no other significant group differences. Table 5 summarizes the ANOVA findings and Table 6 summarizes group means, standard deviations, standard errors, and levels of significance for post hoc analyses.

Table 5

Analysis of Variance for Magnitude of Subjective Arousal per Experimental Condition

Experimental Condition[a]	*df*	*F*	*Mean Square*	*p*
Anger	7	2.082	3.193	.056
Relaxation	7	2.168	3.450	.047[*]
Control	7	1.405	3.441	.2.17

Note. [a]$n = 10$ for each group.
[*]$p < .05$.

Table 6

Least Significant Differences for Relaxation Magnitude

Experimental Condition[a]	*Mean*	*Standard Deviation*	*Standard Error*	*P*
<u>Males</u>				
Lo Hos Fam Hx of CVD	2.10	1.60	.504	.037*
Hi Hos Fam Hx of CVD	3.30	8.23	.260	
<u>Females</u>				
Lo Hos No Fam Hx of CVD	2.50	1.51	.477	.037*
Hi Hos Fam HX of CVD	3.70	1.06	.335	

Note. [a]n = 20 for each group.
[*]$p < .05$.

A one-way ANOVA was conducted in order compare means separately among males and females for parasympathetic (i.e. High Frequency) and sympathetic (i.e. Low Frequency) regulation during the anger, relaxation, and control conditions. Comparisons revealed significant between group differences for the anger, control and no control conditions for females, and for the anger, relaxation, and no control conditions for males.

Table 7 summarizes the significant ANOVA findings:

Table 7

Analysis of Variance Comparisons of Autonomic Regulation per Experimental Condition

Experimental Condition[a]	df	F	Mean Square	p
Females: Anger Parasympathetic	3	3.129	58.329	.038*
Females: Control Sympathetic	3	3.440	7.335	.027*
Females: No Control Sympathetic	3	3.139	8.343	.037*
Females: Anger Sympathetic	3	3.250	10.527	.033*
Males: Anger Parasympathetic	3	3.468	58.479	.026*
Males: Relaxation Parasympathetic	3	4.047	62.911	.014*
Males: No Control Sympathetic	3	4.314	8.331	.011**
Males: Anger Sympathetic	3	4.754	8.908	.007**
Males: Relaxation Sympathetic	3	8.516	17.324	.000**

Note. [a]*n* = 10 for each group.
*$p < .05$. **$p < .01$.

A Bonferroni post hoc test for multiple comparison of means was applied in order to specify group differences. The Bonferroni treatment was selected because of it's conservative estimate of significance useful with small samples. Significant mean differences are summarized in Table 8 including group means, standard deviations, standard errors, and levels of significance for these groups:

Table 8 - Bonferroni Multiple Comparisons per Experimental Condition

Experimental Condition[a]	*Mean*	*Standard Deviation*	*Standard Error*	*p*
Anger -- Parasympathetic				
Low Hostile Female -Family Hx of CVD	26.35	4.38	1.39	
				.039*
High Hostile Female –Family Hx of CVD	20.77	6.37	2.02	
Control -- Sympathetic				
Low Hostile Female -Family Hx of CVD	11.38	1.83	.58	
				.018*
High Hostile Female –Family Hx of CVD	9.31	1.73	.55	
No Control -- Sympathetic				
Low Hostile Female -Family Hx of CVD	11.11	1.78	.56	
				.046*
High Hostile Female –Family Hx of CVD	9.05	2.09	.66	
Anger -- Sympathetic				
Low Hostile Female -Family Hx of CVD	11.44	1.70	.54	
				.031*
High Hostile Female –Family Hx of CVD	9.04	2.80	.89	
Anger -- Parasympathetic				
High Hostile Male – No Family Hx of CVD	27.75	4.86	1.54	
				.030*
High Hostile Male – Family Hx of CVD	22.26	1.79	.56	
Relaxation -- Parasympathetic				
Low Hostile Male – No Family Hx of CVD	29.47	3.78	1.20	
				.023*
High Hostile Male – Family Hx of CVD	24.02	2.91	.92	
No Control -- Sympathetic				
High Hostile Male – No Family Hx of CVD	11.39	1.59	.50	
				.007**
High Hostile Male – Family Hx of CVD	9.22	.74	.23	
Anger -- Sympathetic				
High Hostile Male – No Family Hx of CVD	11.75	1.30	.411	
				.006**
High Hostile Male – Family Hx of CVD	9.55	.87	.28	
Relaxation -- Sympathetic				
Low Hostile Male – No Family Hx of CVD	12.38	1.68	.53	.000**
Low Hostile Male – Family Hx of CVD	11.57	1.37	.43	.013*
High Hostile Male – No Family Hx of CVD	12.05	1.61	.51	.001**
High Hostile Male – Family Hx of CVD	9.46	.91	.29	

Note. [a]*n* = 10 for each group.
*$p < .05$. **$p < .01$.

CHAPTER 4

DISCUSSION

The first hypothesis that predicted that individuals scoring high on trait hostility will have lower autonomic balance (i.e. a higher autonomic balance index) than individuals scoring low on trait hostility was supported by the data among female but not male participants during anger and relaxation induction.   Researchers have found that females benefit differentially from males when given the chance to make some behavioral response including positive responding and/or adaptive coping to hostile situations (Brosschot & Thayer, 1998; Saab, et al., 1997). The present findings suggest that there is a clear difference between arousal patterns for females that is not seen among males. High trait hostility females demonstrated significantly lower autonomic balance than low trait hostility females during both anger induction and relaxation imagery. As the tasks were identical and both males and females were not allowed to make any overt behavioral responses, the reason for these differences is likely attributable some other internal coping and/or physiological mechanism.

It was also anticipated that situations in which there is no control over mental stressors will show less autonomic balance than situations where individuals have control. This was not supported by the present data for males or females. These results may reflect participants' insight into the nature of the task and their own degree of perceived control. On average, all groups rated their perceived sense of control as being much higher when they controlled the rate of stimulus presentation than when they could not. This obviates an increase in vigilance to the task that is unnecessary when the stimulus is under participant control. All groups being equally aware of this experimental expectation were likely to adjust their responding accordingly. On the other hand, the anger and relaxation induction phases were largely unknown quantities for all participants. In essence, changes in autonomic balance for female groups during these tasks may reflect differences in task demand. Specifically, becoming more involved in anger and imagery tasks as the demands were unknown and more engaging. This possibility has been suggested in similar research in which stressors involving interpersonal antagonism or mistrust were required to elicit differences in reactivity between persons measuring high versus low on trait hostility (Smith & Allred, 1989; Suarez & Williams, 1989).

Additional hypotheses predicted that high hostile participants with a family history of cardiovascular disease would show decreased autonomic balance in response to anger as compared to low hostile participants with or without a family history of CVD. It was predicted that the reverse pattern would emerge during relaxation. Levels of hostility and family history of CVD across experimental conditions resulted in significant differences only between female groups. Specifically, low hostile females with no family history of CVD demonstrated significantly greater autonomic balance than high hostile females with a family history of CVD during anger and relaxation conditions. Low hostile females with a family history of CVD also demonstrated significantly greater autonomic balance than high hostile females with a family history of CVD during anger and relaxation conditions.

In both anger and relaxation conditions, high hostile females with a family history of CVD showed greater physiological reactivity (i.e. lower autonomic balance) than low hostile females in either family history condition. The high hostile group was able to show increases in autonomic balance when relaxing as compared to when they became angry. However, they also demonstrated lower autonomic balance during relaxation than did the either low hostile group during anger induction. This finding is suggestive of an overall cardio protective feature of low trait hostility among females. Family history of CVD appears to be a risk factor marked by autonomic disregulation for high hostile and not low hostile females.

The pattern of autonomic activation for the high hostile females with a family history of CVD was marked by relatively larger increases in parasympathetic over sympathetic activation than low hostile females with no family history of CVD (see Figure 1). In general, high hostile females with a family history of CVD showed greater parasympathetic arousal than other low hostile females without a history of CVD during both anger induction and relaxation. The spread of sympathetic versus parasympathetic activation was far smaller when a positive family history of CVD was indicative of both high and low hostile groups (see Figure 2). Sympathetic regulation showed much less variation across all groups. The primary cardiac arousal pattern is one of parasympathetic regulation among females to both anger and relaxation induction. Interestingly, parasympathetic regulation was higher for high hostile females with a family history of CVD during relaxation than anger induction, although not statistically significant. Low hostile females with no family history of CVD demonstrated approximately 1/3 less parasympathetic activation than the high hostile group (see Appendix I for complete comparison of Weighted Frequency Means).

While females demonstrated greater divergence in autonomic balance, their subjective perception of the magnitude of change from start of relaxation to the end of relaxation was somewhat similar to males. In particular, during relaxation low hostile females with no history of CVD rated their increase in relaxation significantly lower than high hostile females with a family history of CVD. Low hostile males with a family history of CVD rated their increase in relaxation significantly lower than high hostile males with a family history of CVD. No differences emerged in ratings of anger change during anger induction. Interestingly, high hostile females with a family history of CVD rated their perception of how relaxed they became as higher than low hostile females without a family history of CVD when in fact they were not benefiting from the same increase in autonomic balance. These findings may represent a poorer self-appraisal of the subjective aspects of relaxation that are in fact incongruent with a decline in physiological arousal for high hostile females with a family history of CVD. On the other hand, male groups compared separately showed greater perceptions of relaxation among high hostile males with a family history of CVD than low hostiles without a family history of CVD. In this case however, the difference in autonomic balance is relatively static.

The lack of evidence in the present study pointing to significant group differences in autonomic balance between high versus low males, with or without a family history of CVD, is curious. A mediating factor not considered in the present design may be the rate of cardiac recovery and general cardiovascular fitness. Brosshot and Thayer (1988) found that anger inhibition and slow cardiovascular recovery were associated with persistently low vagal tone. They attributed this finding to a belief that in the social reality, incidences of anger inhibition outnumber incidences of anger expression. Slow cardiac recovery rather than high reactivity may be the mechanism underlying CVD risk associated with anger inhibition. Future research considering the role of autonomic balance would benefit by a consideration of return to baseline latencies that would serve to identify the role of cardiac recovery for hostile individuals.

Comparisons of sympathetic and parasympathetic regulation unrelated to subjective perception of arousal support anticipated patterns in autonomic regulation. Specifically, among both female and male populations, parasympathetic regulation was diminished during anger induction for individuals with high levels of trait hostility and having a family history of cardiovascular disease. Similar results were obtained for men during relaxation imagery induction. These findings support a central role for parasympathetic under-activation in critical periods of arousal in both anger and relaxation situations for high hostile individuals with a family history of CVD. Sympathetic regulation was typically higher for low hostile individuals regardless of family history of CVD than for high hostile individuals. The lack of a reliable pattern between groups for sympathetic regulation implicate a predominate role of parasympathetic variation accountable for differences observed in presence or absence of family history of CVD. These findings bear important implications for the role of parasympathetic under-regulation in high hostile individuals in the development of CVD. Further controlled studies are necessary to elucidate the relationship between parasympathetic activation to environmental demands and the genesis and maintenance of CVD. Studies that consider blood pressure variability as it co-occurs with autonomic regulation would serve to map psychophysiological correlates to CVD.

APPENDIX A

Sign up Sheet for Participation in Research Investigation

Sign up Sheet for Participation in Research Investigation

Research Statement: The purpose of this study is to examine the relationship between participants identified as high or low hostile and the regulation of cardiovascular responses to stress. The information obtained from this study will be used to promote a better understanding of factors contributing to cardiovascular disease. Students are under no obligation to participate in the study; students not participating will have the opportunity to earn extra class credit by means other than their participation in this study.

Name:	Phone Number:	Code: (Not to be completed by student)

This project has been reviewed and approved by the UNT Committee for the Protection of Human Subjects 940/565-3940.

APPENDIX B

Buss-Durkee Hostility Inventory Irritability Scale

BDHI **Participant Code: ________**

Please circle T - True or F - False for the following statements as they apply to yourself.

1. T F I lose my temper easily but get over it quickly.
2. T F I am always patient with others.
3. T F I am irritated a great deal more than people are aware of.
4. T F It makes my blood boil to have someone make fun of me.
5. T F If someone doesn't treat me right, I don't let it annoy me.
6. T F Sometimes people bother me just by being around.
7. T F I often feel like a powder keg ready to explode.
8. T F I sometimes carry a chip on my shoulder.
9. T F I can't help being a little rude to people I don't like.
10. T F I don't let a lot of unimportant things irritate me.
11. T F Lately, I have been kind of grouchy.

APPENDIX C

Cook-Medley Hostility Inventory (Ho)

CMHI **Participant Code: ________**

Please circle either **T for True** or **F for False** to the following questions:

1. T F When I take a new job, I like to be tipped off on who should be gotten next to.

2. T F When someone does me wrong I feel I should pay him back if I can, just for the principle of the thing.

3. T F I prefer to pass by school friends, or people I know but have not seen for a long time, unless they speak to me first.

4. T F I have often had to take orders from someone who did not know as much as I did.

5. T F I think a great many people exaggerate their misfortunes in order to gain the sympathy and help of others.

6. T F It takes a lot of argument to convince most people of the truth.

7. T F I think most people would lie to get ahead.

8. T F Someone has it in for me.

9. T F Most people are honest chiefly through fear of being caught.

10. T F Most people will use somewhat unfair means to gain profit or an advantage rather than to lose it.

11. T F I commonly wonder what hidden reason another person may have for doing something nice for me.

12. T F It makes me impatient to have people ask my advice or otherwise interrupt me when I am working on something important.

13. T F I feel that I have often been punished without cause.

14. T F I am against giving money to beggars.

15. T F Some of my family have habits that bother and annoy me very much.

16. T F My relatives are nearly all in sympathy with me.

17. T F My way of doing things is apt to be misunderstood by others.

18. T F I don't blame anyone for trying to grab everything he can get in this world.

19. T F No one cares much what happens to you.

20. T F I can be friendly with people who do things which I consider wrong.

21. T F It is safer to trust nobody.

22. T F I do not blame a person for taking advantage of someone who lays himself open to it.

23. T F I have often felt that strangers were looking at me critically.

24. T F Most people make friends because friends are likely to be useful to them.

25. T F I am sure I am being talked about.

26. T F I am likely not to speak to people until they speak to me.

27. T F Most people inwardly dislike putting themselves out to help other people.

28. T F I tend to be on my guard with people who are somewhat more friendly than I had expected.

29. T F At periods my mind seems to work more slowly than usual.

30. T F I enjoy the excitement of a crowd.

31. T F I find it hard to set aside a task that I have undertaken, even for a short time.

32. T F I like to let people know where I stand on things.

33. T F I am apt to pass up something I want to do when others feel that it isn't worth doing.

34. T F I have sometimes stayed away from another person because I feared doing or saying something.

35. T F I would certainly enjoy beating a crook at his own game.

36. T F Religion gives me no worry.

37. T F I have at times had to be rough with people who were rude or annoying.

38. T F I feel sure that there is only one true religion.

39. T F There are certain people whom I dislike so much that I am inwardly pleased when they are catching it for something they have done.

40. T F I am often inclined to go out of my way to win a point with someone who has opposed me.

41. T F I am often said to be hotheaded.

42. T F The man who had most to do with me when I was a child (such as my father, stepfather, etc.) was very strict with me.

43. T F Lightning is one of my fears.

44. T F When a man is with a woman he is usually thinking about things related to her sex.

45. T F I do not try to cover up my poor opinion or pity of a person so that he won't know how feel.

46. T F I have frequently worked under people who seem to have things arranged so

that they get credit for good work but are able to pass off mistakes onto those under them.

47. T F I strongly defend my own opinions as a rule.

48. T F People can pretty easily change me even though I thought that my mind was already made up on a subject.

49. T F Sometimes I am sure that other people can tell what I am thinking.

50. T F A large number of people are guilty of bad sexual conduct.

APPENDIX D

Family History Questionnaire

Family History Questionnaire

Instructions for Student:

Participant # _______

Has your mother/father or any of your grandparents (where applicable), ever had a stroke or heart attack, or died as a result of that cardiac event before the age of 50: (CHECK WHERE APPROPRIATE)

	Mother	Father	Maternal Grandmother	Maternal Grandmother	Paternal Grandmother	Paternal Grandmother
Stroke						
Heart Attack						
Other (specify)						

APPENDIX E

Progressive Mental Relaxation Script

Progressive Mental Relaxation Script

I would like you to settle back, and if you wish, close your eyes. Take this time for yourself and relax… Begin letting go of all thoughts of things you have done today and take this time for yourself… Now let go of all thoughts of things you are going to do when you get up from here… and relax.

What we are going to do is relax each part of your body progressively. While we are doing this you will hear my voice clearly. You'll be aware of your surroundings, but outside sounds and noises will fade and not interfere with your relaxation…Continue to relax.

While you are relaxing I'd like to direct your attention to your hands and fingers…imagine that the relaxation is beginning in your finger tips, spreading from your finger tips, past each knuckle and into the palms of your hands…concentrate on pure relaxation in your hands without any tension…Allow your fingers to straighten out and relax more and more completely…Become aware of any sensation you may feel in your hands…

You may notice a pleasant warmth or heaviness or perhaps a light tingling and numbness that seems to accompany relaxation…Become aware of the texture of the cloth against the palms of your hands and arms…Your hands are relaxing more and more completely…The relaxation spreads into your wrists…Your hands and your wrists are beginning to relax further…further…deeper and deeper…Allow this pleasant feeling of relaxation to spread into your forearms…Your forearms are relaxing…relaxing…more and more completely. The relaxation spreads to your elbows…into your upper arms…your arms and your hands are relaxing further and further…your arms feel comfortably heavy as you allow them to relax…Let your whole body relax…Now allow this pleasant feeling of relaxation to flow right into your shoulders…Imagine all the muscles in your shoulders smooth and relaxed…Simply by thinking about a body part you are able to relax it…You are able to throw off all tension, all fatigue and irritation.

The relaxation flows across your shoulders and deep into your neck muscles…Allow your neck and your shoulders to relax further and further…deeper…deeper. The relaxation spreads from your neck to your scalp…Become aware of the support of the chair against your body…Feel how gently yet firmly the chair supports you. Imagine a gentle shower of relaxation falling over your scalp…Allow even the top of your head to relax…Now focus on your facial muscles. Think of your forehead. Picture your forehead muscles smooth and relaxing…All the muscles in your forehead are relaxing…relaxing completely…Allow the relaxation to spread to your eyes…relax all the tiny muscles around your eyes…your eyelids…even the muscles behind your eyes…relax, relax completely. Feel the relaxation move down your face to your jaws…Relax your lips, tongue, and throat…All the muscles within your face are relaxing…relaxing…relaxing further and further…

Relax the muscles of your chest…focus on your breathing a moment…breathe easily and freely…in and out…Notice how the relaxation increases as you exhale…As you breathe out just feel the relaxation increase…the further you relax, the more your breathing becomes free and easy… and regular…All the muscles with your chest relax…Allow the relaxation to proceed from your chest to your stomach…Let the muscles deep within your stomach loosen and permit them to relax…Relax the muscles deep within your stomach…Allow every organ, every fiber of your being to relax…from deep within your stomach all the way to the surface of your skin…Relax.

The relaxation then flows into the lower part of your body…Relax your hips. Allow this part of your body to relax completely…The relaxation flows down into your legs..Relax your thighs…Let all the muscles deep, deep within your thighs relax. The relaxation flows to your knees…your knees relax…the relaxation flows to your calves, deep within your calves…and then down into your ankles, and deep into your feet and toes…You feel very relaxed and comfortable…A warm, pleasant soothing feeling of relaxation beginning at the base of your heels…spreading across the bottom of your feet into your toes…A very comfortable, warm, pleasant feeling of relaxation…goes from your toes to the tops of your feet to your ankles…This comfortable, warm, pleasant feeling of relaxation flows from your ankles, to your calves…knees…thighs…and hips. Notice a pleasant, comfortable heaviness in the lower part of your body as you relax still further…

APPENDIX F

Manipulation Check Scales

Please circle the number that corresponds to how you felt during each part of the experiment.

1. During the subtraction phase where I had did not have control over the speed of each number I felt mostly:

1	2	3	4	5	6	7

Not at all In control — Mostly in Control

2. During the subtraction phase where I controlled the speed of each number I felt mostly:

1	2	3	4	5	6	7

Not at all In control — Mostly in Control

3. During the anger imagery phase I felt mostly:

1	2	3	4	5	6	7

Not at all Angry — Mostly Angry

4. During the relaxation phase I felt mostly:

1	2	3	4	5	6	7

Not at all Relaxed — Mostly Relaxed

For questions 3 and 4, go back and circle how angry or relaxed you were prior to the start of each imagery sequence.

APPENDIX G

Consent to Participate in Research Investigation

University of North Texas (Denton)
University of North Texas Health Science Center at Fort Worth

COMBINED LAY SUMMARY AND INFORMED CONSENT

Title of Project: Vagal tone influence on controllable and non-controllable stress for participants identified as high or low hostile and having a positive or no family history of cardiovascular disease

Principal Investigators: Charles Nelson, M. A.
Susan F. Franks, Ph.D.

Participant Name (please print): ____

Description and Purpose of the Study: You have been asked to take part in a research study to find out information about stress, hostility, and cardiovascular disease. The purpose of this study is to examine the relationship between participants identified as high or low hostile and the regulation of cardiovascular responses to stress. The information obtained from this study will be used to promote a better understanding of factors contributing to cardiovascular disease.

Risks and Discomforts of the Study: There are minimal risks associated with participation in this study. Some participants may be uncomfortable sitting for the anticipated 45 minutes – 1 ½ hours, however, you may choose to withdraw from the study. Physiological recording devices are well-known for their safety to human subjects; by their passive and relatively noninvasive nature, they pose little risk of harm.

The electrocardiogram procedure and blood pressure monitor procedures pose no known risks to participants other than the mild discomforts associated with sitting for long periods of time. There is a risk of residual agitation or irritation from the experiment. In such case, the investigator (Charles Nelson) is available to assist you in reducing this discomfort either directly, or with your permission, by a referral to The Education and Testing Counseling Center for additional assistance.

Study Procedures: As a participant, I understand that I will be expected to participate in a number of information gathering tasks including the completion of forms, and questionnaires related to my family medical history (health and demographics), as well as the recording of physiological functions. A two lead electrocardiogram (ECG) and blood pressure monitor will be placed on the hand, arm, upper chest, and abdomen locations with a nontoxic adhesive. The recording procedure poses no known risks to participants other than the mild discomfort associated with sitting still for periods of time. During the course of this investigation, I may be asked to think about anger inducing or frustrating personal experiences. Guided imagery and a cognitive task will also be required of each participant. Participants will perform an arithmetic task involving the mental subtraction of 13 from a random four digit number. For each presentation, participants will respond verbally to the mental arithmetic stimulus item. Total participation time will range between 45 minutes and 1 and ½ hours.

Subject's initials_____
Date_______________

Benefits: You may benefit from increased information about cardiovascular disease and health that you might be able to use to improve your own health. Also, information from studying how relaxation affects hostility will increase our knowledge about how to prevent cardiovascular disease.

Compensation: You will not be reimbursed for your participation in the study. You will however be provided with credit toward your overall grade in Health Psychology.

Confidentiality: Your participation will be kept as confidential as possible under current local, state, and federal laws. Unless required by law, only the researchers and their staff, government regulatory agencies, and the Institutional Review Board may examine any materials that might identify you by name. You will not be identified in any reports or publications resulting from this study.

Contacts: If you have a problem with the study or questions, you may call Dr. Susan Franks at (817) 735-2228. If you have concerns regarding your rights as a subject, you should contact Dr. Jerry C. McGill, Chairman of the Institutional Review Board at the University of North Texas Health Science Center at Fort Worth. Dr. McGill may be reached between the hours of 8:00 am and 5:00 pm at (817) 735-5483. You may also contact Dr. Peter Shillingsburg, Chairman of the Institutional Review Board at the University of North Texas at Denton. Dr. Shillingsburg may be reached between the hours of 8:00 am and 5:00 pm at (940) 565-3940. Please ask questions if you do not fully understand this explanation.

Leaving the Study: Your participation in this study is voluntary. You can refuse to participate or you may withdraw from the study at any time without penalty or loss of benefits that you are otherwise entitled.

Consent: **I voluntarily consent to participate in this study. I have read and understand this statement of informed consent. I understand that I may withdraw my consent or withdraw from this study at any time without losing the benefits I otherwise would have. I have had the chance to ask questions regarding the study.**

I HAVE RECEIVED A COPY OF THIS SIGNED INFORMED CONSENT AGREEMENT.

Signature of Research Subject	Printed Name	Date

Signature of Person Explaining Consent	Printed Name	Date

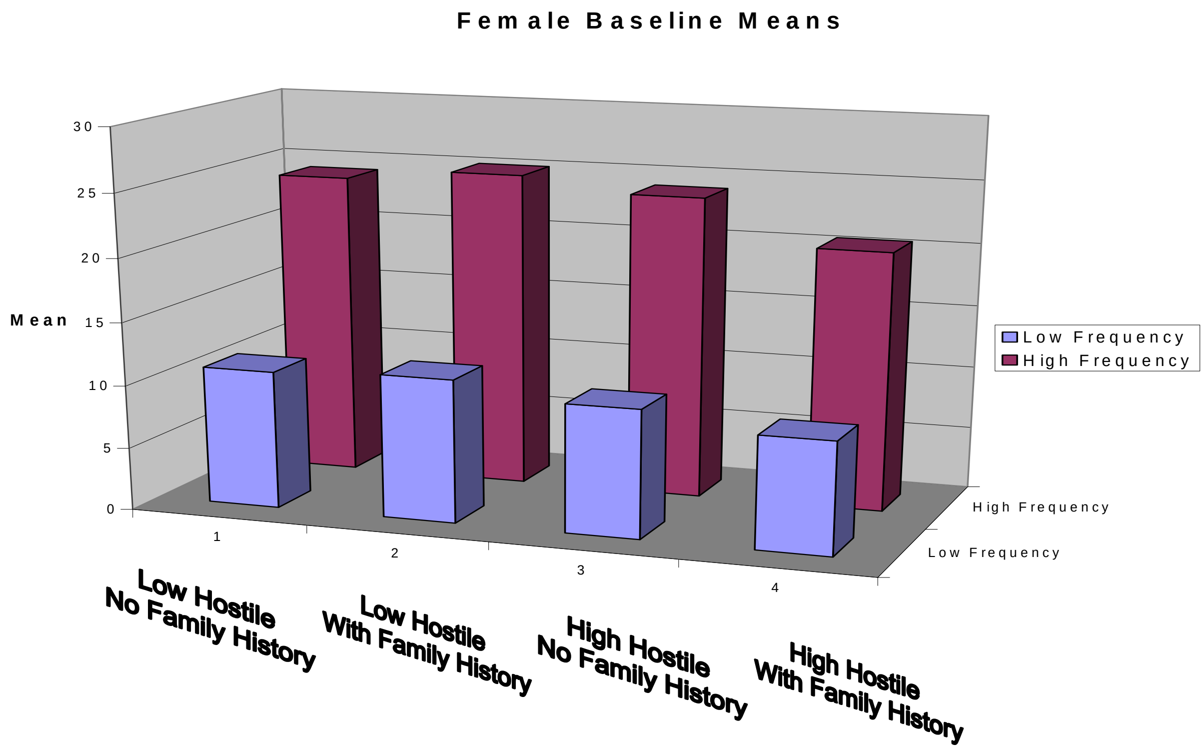
Signature of Witness	Printed Name
Date

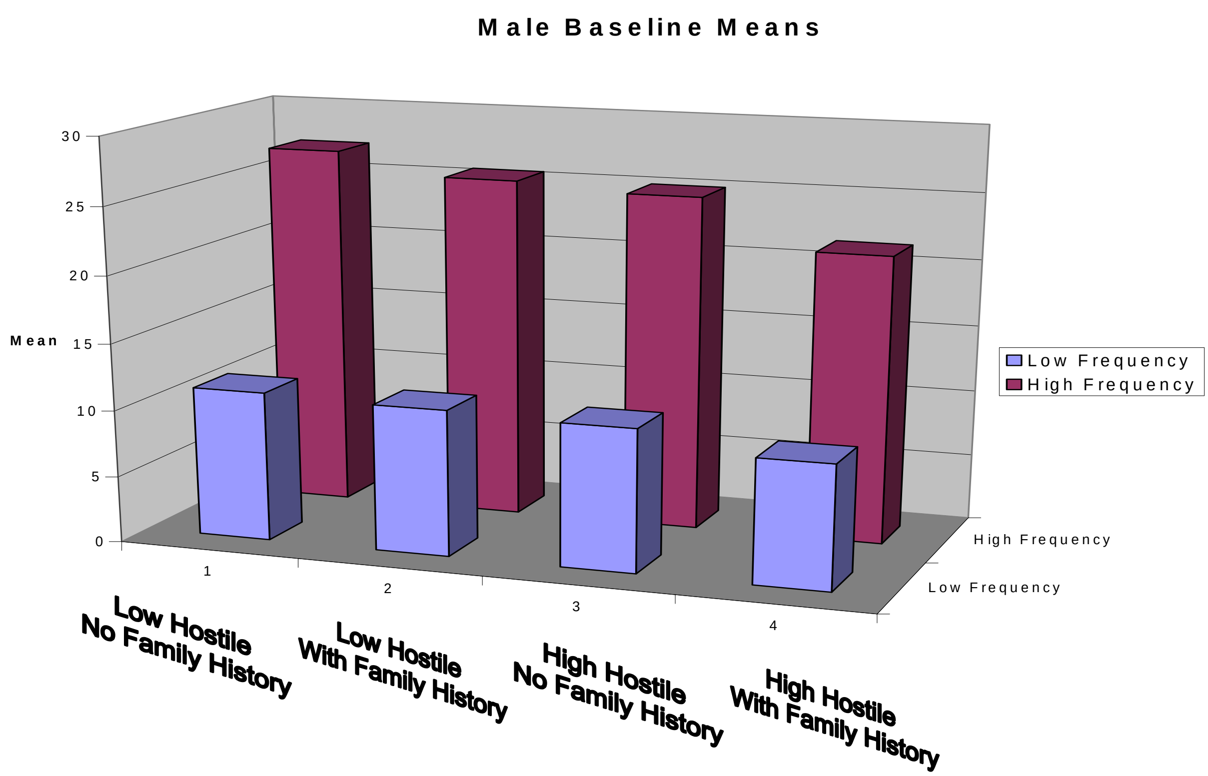
Subject's initials_____
Date_______________

APPENDIX H

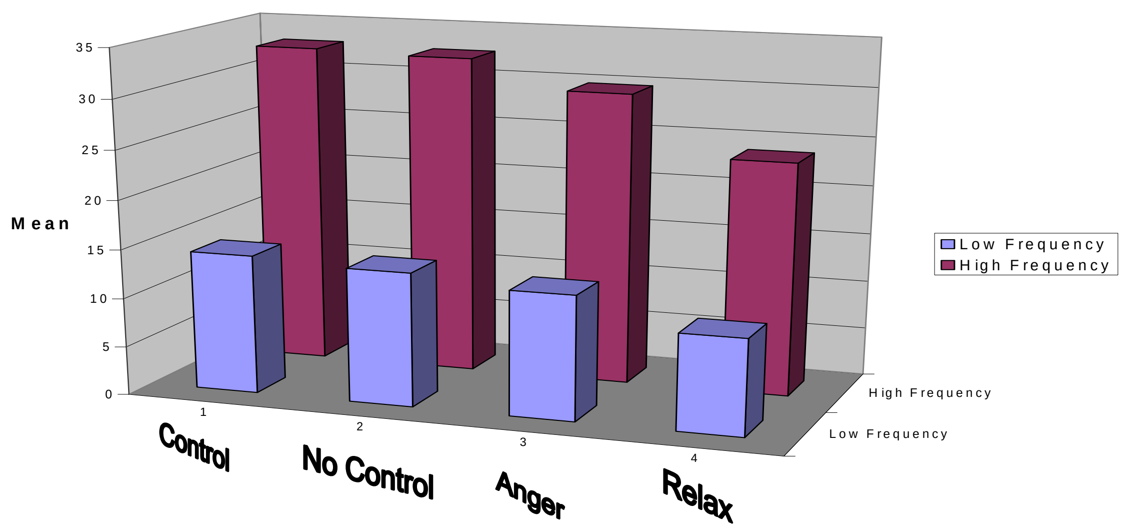
Supplementary Figures – Weighted Frequency Means

(NB. In all figures, Low Frequency represents Sympathetic and High Frequency Represents Parasympathetic)

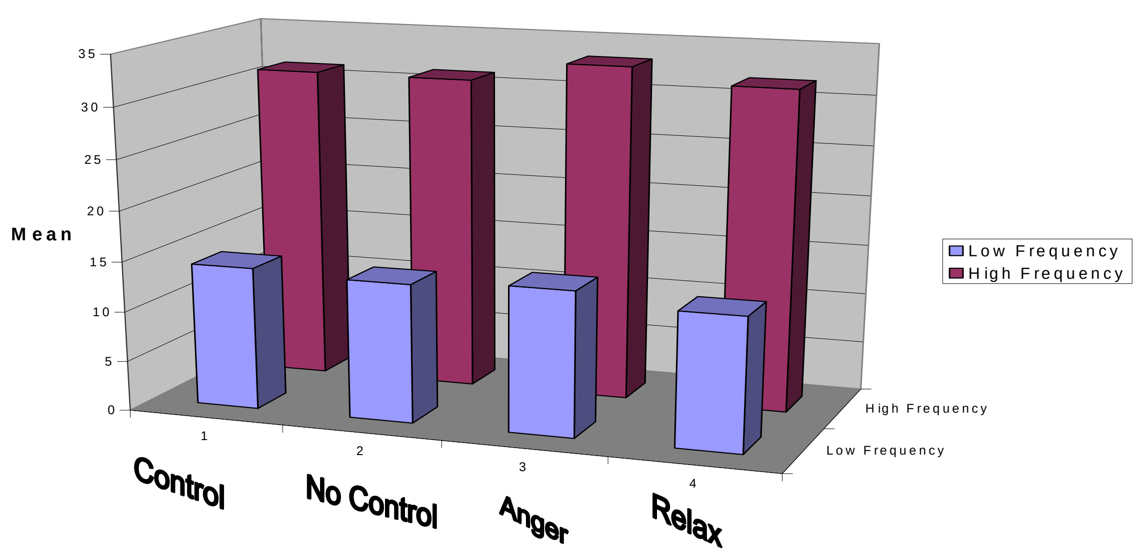


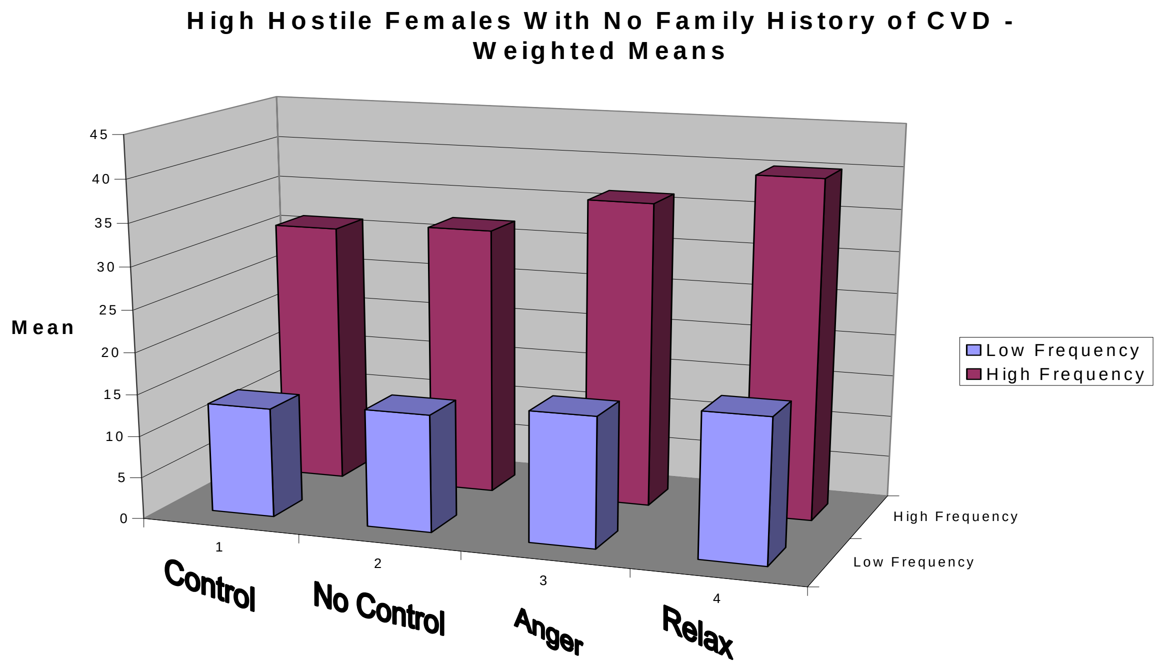


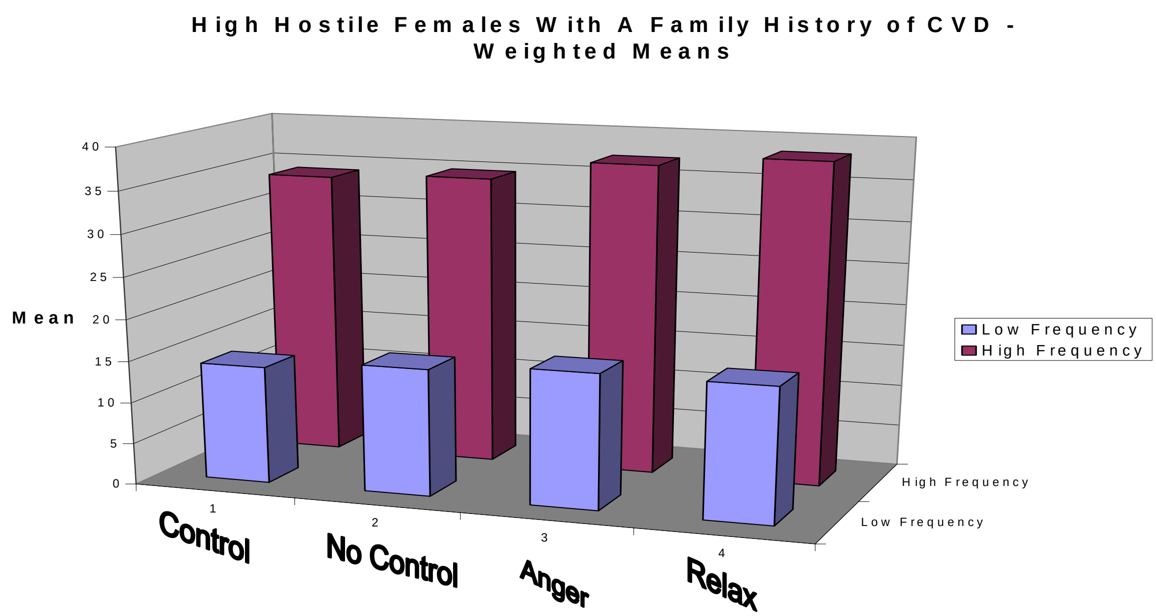
Low Hostile Females With No Family History of CVD - Weighted Frequency Means



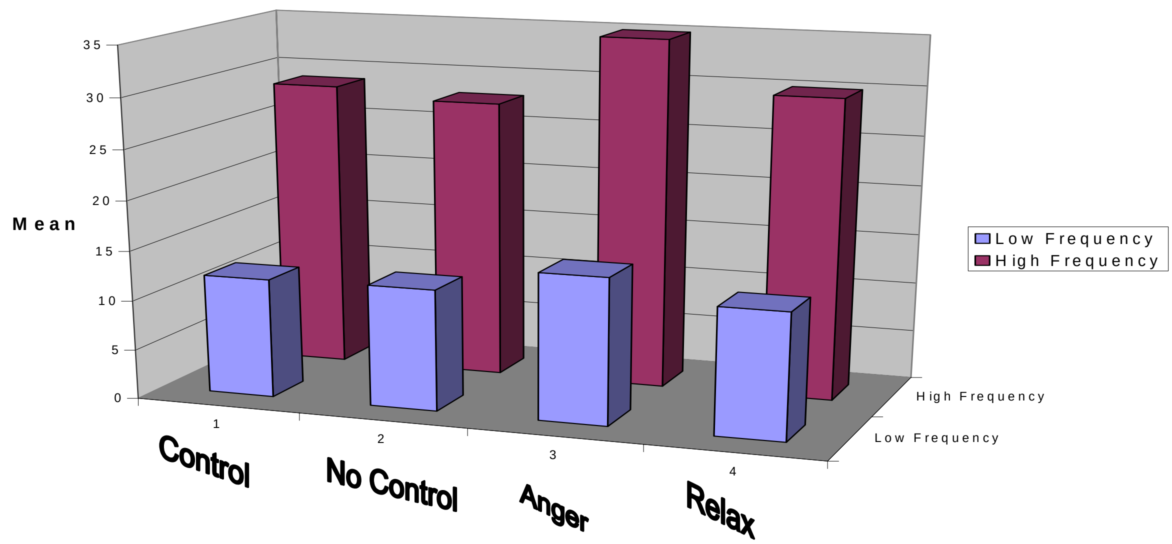
Low Hostile Females With A Family History of CVD - Weighted Frequency Means



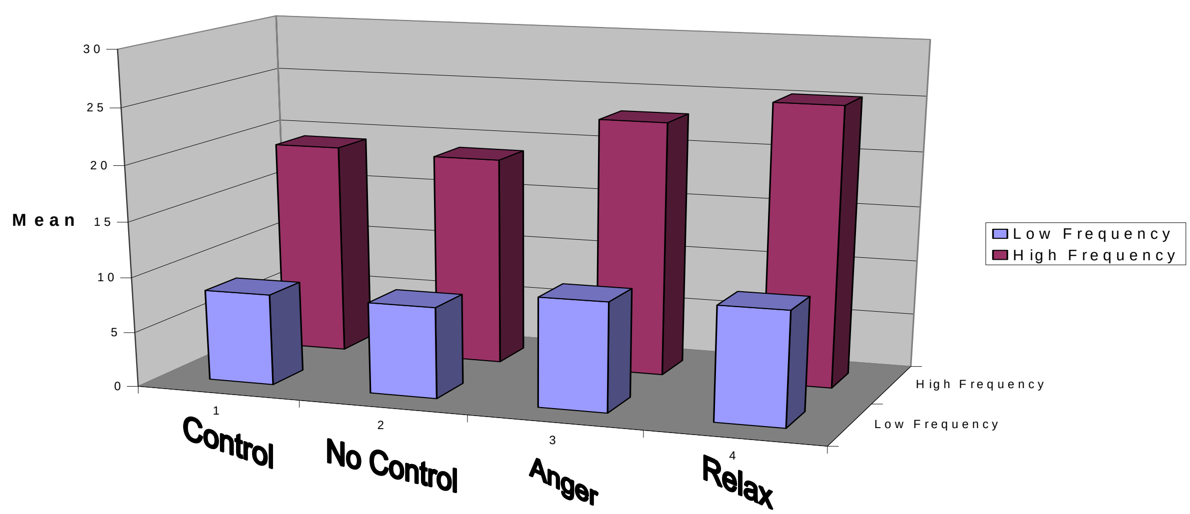

High Hostile Females With No Family History of CVD - Weighted Means
Mean
0
5
10
15
20
25
30
35
40
45
1
2
3
4
Control
No Control
Anger
Relax
High Frequency
Low Frequency
Low Frequency
High Frequency


High Hostile Females With A Family History of CVD - Weighted Means
Mean
0
5
10
15
20
25
30
35
40
1
2
3
4
Control
No Control
Anger
Relax
High Frequency
Low Frequency
Low Frequency
High Frequency

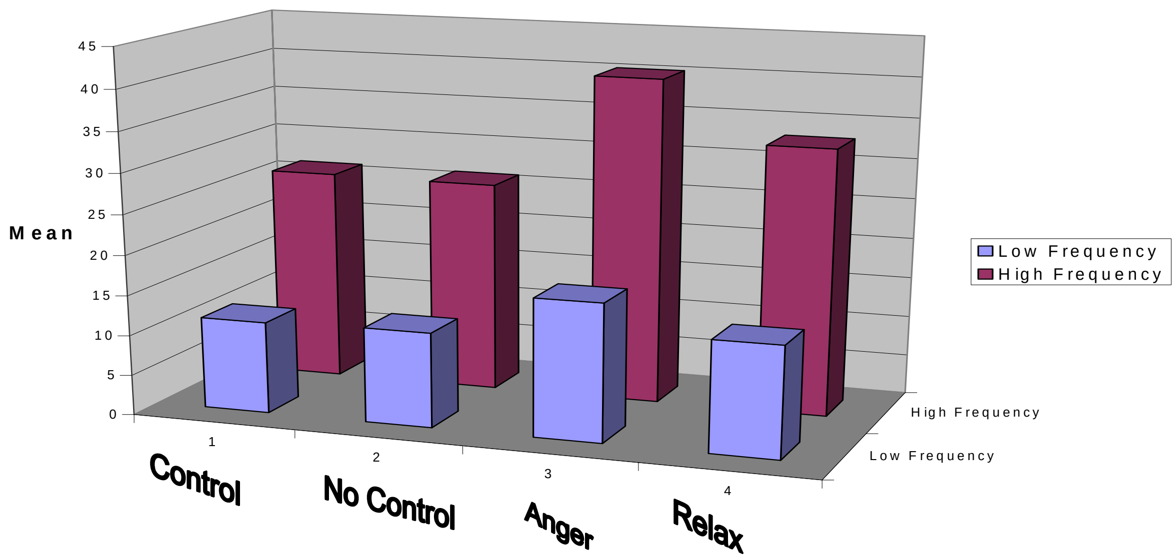
Low Hostile Males With No Family History of CVD - Weighted Means



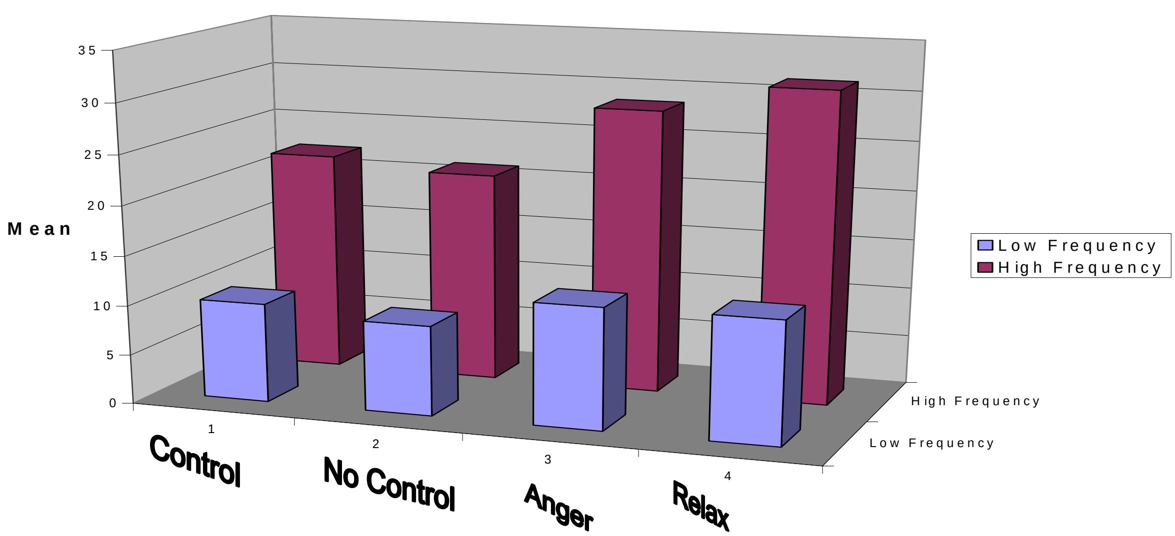
Low Hostile Males With A Family History of CVD - Weighted Means



High Hostile Males With No Family History of CVD - Weighted Means



High Hostile Males With A Family History of CVD - Weighted Means



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